Cognitive Neuroscience Society

23rd Annual Meeting, April 2-5, 2016
New York Hilton Midtown, New York City, New York

2016 Annual Meeting Program

Contents

2016 Committees & Staff 2
Schedule Overview 3
Keynote 5
George A. Miller Prize 6
The Fred Kavli Distinguished Career Contributions Award 7
Young Investigator Award 8
Special Events 9
CNS 2016 Debate 10
Data Blitz 11
General Information 13
Save the Date 15
GSA/PFA Awards 16
Exhibits 16
Invited-Symposium Sessions 17
Symposium Sessions 23
Poster Schedule 37
Poster Session A 38
Poster Session B 75
Poster Session C 112
Poster Session D 149
Poster Session E 187
Poster Session F 224
Poster Topic Index 262
Author Index 264
Advertisements 275
Hotel Floor Plans 278

A Supplement of the Journal of Cognitive Neuroscience

Cognitive Neuroscience Society
c/o Center for the Mind and Brain
267 Cousteau Place, Davis, CA 95616

ISSN 1096-8857 © CNS
www.cogneurosociety.org

2016 Committees & Staff

Governing Board

Roberto Cabeza, Ph.D., Duke University
Marta Kutas, Ph.D., University of California, San Diego
Helen Neville, Ph.D., University of Oregon
Daniel Schacter, Ph.D., Harvard University
Michael S. Gazzaniga, Ph.D.,University of California, Santa Barbara (ex officio)
George R. Mangun, Ph.D., University of California, Davis (ex officio)
Patti Reuter-Lorenz, Ph.D., University of Michigan (ex officio)

Program Committee

Brad Postle, Ph.D., University of Wisconsin-Madison (Chair)
Michael Anderson, Ph.D., University of Cambridge
Roberto Cabeza, Ph.D., Duke University
Manuel Carreiras, Ph.D., Basque Center on Cognition, Brain and Language, Spain
Michael Chee, M.B.B.S., Duke University -NUS Graduate Medical School, Singapore
Kia Nobre, Ph.D., University of Oxford
Sharon Thompson-Schill, Ph.D., University of Pennsylvania

Poster Committee

Tobias Egner, Ph.D., Duke University (Chair)
Marian Berryhill, Ph.D. University of Nevada, Reno Signe Bray, Ph.D., University of Calgary
Evangelia Chrysikou, Ph.D., University of Kansas
Brian Haas, Ph.D., University of Georgia
Matthew Jerram, Ph.D., Suffolk University
Jeffrey Johnson, Ph.D., University of Missouri
Jonas Obleser, Ph.D., University of Lübeck, Germany
Rebecca Spencer, Ph.D., University of Massachusetts-Amherst
Matthias Wieser, Universoty of Wuerzburg, Germany

Symposium Committee

Elizabeth Kensinger, Ph.D., Boston College (Chair)
Michael Cole, Ph.D., Rutgers University
Kelly Giovanello, Ph.D., University of North Carolina, Chapel Hill
Ole Jensen, Ph.D., Radboud University of Birmingham
Uta Noppeneny Ph.D., University of Birmingham
Corianne Rogalsky, Ph.D., Arizona State University
Daphna Shohamy, Ph.D., Columbia University

Young Investigator Award Committee

Kevin LaBar, Ph.D., Duke University (Chair)
Marvin Chun, Ph.D., Yale University
Michael Frank, Ph.D., Brown University
Cindy Lustig, Ph.D., University of Michigan
Cathy Price, Ph.D., University College, London

Founding Committee (1994)

Michael S. Gazzaniga, Ph.D., University of California, Santa Barbara
George R. Mangun, Ph.D., University of California, Davis
Steve Pinker, Ph.D., Harvard University
Patti Reuter-Lorenz, Ph.D., University of Michigan
Daniel Schacter, Ph.D., Harvard University
Art Shimamura, Ph.D., University of California, Berkeley

Administrative Staff

Kate Tretheway, Executive Director
Sangay Wangmo, Administrative Assistant

TM Events, Inc. Meeting Staff

Tara Miller, Event Director
Kerry Bosch, Meeting Planner
Dustin Miller, Event Associate
Becky Gazzaniga, Event Associate
Shawna Lampkin, Event Associate
Joan Carole, Exhibits Manager
Jeff Wilson, Website & Program Manager
Shauney Wilson, Submissions Manager

Schedule Overview

Saturday, April 2, 2016

11:00 am – 1:30 pm	Exhibitor Check-In, *3rd Floor Promenade*
11:00 am – 6:30 pm	Onsite Registration & Pre-Registration Check In, *3rd Floor Promenade*
1:00 – 2:00 pm	Keynote Address **Race and the brain: Insights from the neural systems of emotion and decisions**, Elizabeth Phelps, Open to the public*, Grand Ballroom*
2:00 – 2:30 pm	Coffee Service, *Grand Ballroom Foyer*
2:30 – 3:45 pm	**Data Blitz Session 1**, Tobias Egner, Chair, *Beekman*
	Data Blitz Session 2, Brad Postle, Chair, *Sutton South*
3:00 – 7:00 pm	Exhibits on Display, *Americas Hall I & II*
4:00 – 5:00 pm	22nd Annual George A. Miller Prize in Cognitive Neuroscience Lecture, **Computational neuroimaging: Quantifying brain tissue and modeling activity in the living human brain**, Brian Wandell, *Grand Ballroom East*
5:00 – 7:00 pm	Poster Session A, *Americas Hall I & II*
6:00 – 7:00 pm	Welcome Reception, *Americas Hall I & II*

Sunday, April 3, 2016

7:30 am – 6:30 pm	Onsite Registration & Pre-Registration Check In, *3rd Floor Promenade*
8:00 am – 7:00 pm	Exhibits on Display, *Americas Hall I & II* (Exhibit Halls Closed 11:00 am – 1:30 pm)
8:00 – 8:30 am	Continental Breakfast, *Americas Hall I & II*
8:00 – 10:00 am	Poster Session B, *Americas Hall I & II*
10:00 am – 12:00 pm	Invited Symposium 1 **Computational Psychiatry** Michael Frank, Chair, *Grand Ballroom East*
	Invited Symposium 2 **Memory reactivation contributes to memory consolidation, integration and decision-making** Lila Davachi, Chair, *Sutton Complex*
12:00 – 1:30 pm	Lunch Break (Exhibit Halls Closed)
12:15 – 1:15 pm	**Professional networking using social media** Nicholas J.A. Wan, *Beekman*
1:30 – 3:30 pm	Symposium 1 **20 years of resting-state: contributions to understanding cognition** Bharat Biswal, Chair, Michael Cole, Co-Chair, *Grand Ballroom East*
	Symposium 2 **The role of amplitude, phase, and rhythmicity of neural oscillations in top-down control of cognition** Jason Samaha, Chair, Ali Mazaheri, Co-Chair, *Sutton Center*
	Symposium 3 **Metacognitive neuroscience: How the human brain reflects on cognition, perception and action** Stephen Fleming, Chair, *Grand Ballroom West*
3:30 – 4:00 pm	Coffee Service, *Grand Ballroom Foyer*
4:00 – 5:00 pm	The Fred Kavli distinguished Career Contributions in Cognitive Neuroscience Lecture **Commonality of the fine-grained structure of neural representations across brains**, James Haxby, *Grand Ballroom East*
5:00 – 7:00 pm	Poster Session C, *Americas Hall I & II*

Monday, April 4, 2016

8:00 am – 6:30 pm	Onsite Registration & Pre-Registration Check In, *3rd Floor Promenade*
8:00 – 8:30 am	Continental Breakfast, *Americas Hall I & II*
8:00 am – 5:00 pm	Exhibits on Display
8:00 – 10:00 am	Poster Session D, *Americas Hall I & II*
10:00 am – 12:00 pm	Symposium 4 **From prediction error to control: Neurobiological and computational accounts of Prefrontal Cortex** Eliana Vassena, Chair, *Grand Ballroom East*
	Symposium 5 **Memory retrieval as a guide along the winding road of memory formation** Donna Bridge, Chair, *Sutton Center*
	Symposium 6 **Multisensory integration: neural mechanisms, computational operations and behaviour** Uta Noppeney, Chair, *Grand Ballroom West*
12:00 – 1:30 pm	Lunch Break Exhibit Expo, Americas Hall I & II
12:15 – 1:15 pm	**NIH Funding: Training and Research Grant Opportunities**, Kathy Mann Koepke, *Sutton Center*
	Publishing Workshop for Early Career Researchers, Panel: Cindy Lustig, Micah Murray, Michael Rugg, Rebecca Schwarzlose, Toby Charkin, Adam Fraser, *Grand Ballroom West*
	Federal Funding Opportunities at the National Science Foundation, Alumit Ishai, *Grand Ballroom East*
1:30 – 3:30 pm	Poster Session E, *Americas Hall I & II*
3:00 – 4:00 pm	**CNS Trainee Professional Development Panel**, *Concourse G*
3:30 – 4:00 pm	Coffee Service, *Americas Hall I & II*
4:00 – 5:00 pm	YIA 1 **The Cognitive Neuroscience of Adolescent Behavior** Adriana Galvan, *Grand Ballroom West*
	YIA 2 **Enhancing episodic memory networks using noninvasive brain stimulation** Joel Voss, *Grand Ballroom West*
5:00 – 6:30 pm	Debate, **Connectomics: 'Missing link' for understanding neural computation, or 'minutiae of implementation'?**, Anthony Movshon & Moritz Helmstaedter, Debaters, David Poeppel, Moderator, *Sutton Center*
7:00 – 9:00 pm	CNS Student Trainee Social Night, *McGee's Pub NYC*

Tuesday, April 5, 2016

8:00 am – 3:00 pm	Onsite Registration & Pre-Registration Check In, *3rd Floor Promenade*
8:00 – 8:30 am	Continental Breakfast, *Americas Hall I & II*
8:00 – 10:00 am	Exhibits on Display, *Americas Hall I & II*
	Poster Session F, *Americas Hall I & II*
10:00 am – 12:00 pm	Symposium 7 **Human Intracranial Electrophysiology: A New Era** Josef Parvizi, Chair, *Grand Ballroom West*
	Symposium 8 **Taking stock of cognitive training: theory, neural mechanisms and application** Duncan Astle, Chair, *Beekman*
	Symposium 9 **Affective-motivational salience and attentional sets** Rebecca Todd , Chair, Grace Truong, Co-Chair, *Sutton Center*
12:00 – 1:30 pm	Lunch Break
1:30 – 3:30 pm	Invited Symposium 3 **The Neuroscience of Socioeconomic Status: Setting the Agenda** Martha Farah, Chair, *Grand Ballroom West*
	Invited Symposium 4 **Dynamic Neural Coding for Flexible Cognition** Mark Stokes, Chair, *Sutton Center*

Keynote

Elizabeth A. Phelps, Ph.D.

Julius Silver Professor of Psychology and Neural Science, New York University, Nathan Kline Institute

Keynote Address, Open to the Public

Saturday, April 2, 2016, 1:00 - 2:00pm, Grand Ballroom

Race and the Brain: Insights from the neural systems of emotion and decisions

Investigations of the neural systems mediating the processing of social groups defined by race, specifically Black and White race groups in American participants, reveals significant overlap with brain mechanisms involved in emotion. This talk will provide an overview of research on the neuroscience of race and emotion, focusing on implicit race attitudes. Implicit race attitudes are expressed without conscious effort and control, and contrast with explicit, conscious attitudes. In spite of sharp decline in the expression of explicit, negative attitudes towards outgroup race members over the last half century, negative implicit attitudes persist, even in the face of strong egalitarian goals and beliefs. Early research demonstrated that implicit, but not explicit, negative attitudes towards outgroup race members correlate with blood oxygenation level dependent (BOLD) signal in the amygdala – a region implicated in threat representations, as well as emotion's influence on cognition. Building on this initial finding, we demonstrate how learning and decisions may be modulated by implicit race attitudes and involve neural systems mediating emotion, learning and choice. Finally, we draw on recent research on emotion regulation to suggest potential means to diminish the unintentional expression of negative, implicit race attitudes.

George A. Miller Prize

Congratulations to Dr. Brian Wandell for being awarded this honor!

Dr. Brian Wandell will accept this prestigious award and deliver his lecture on Saturday, April 2, 2016, 4:00 – 5:00 pm, in the Grand Ballroom East at the New York Hilton Midtown Hotel.

Computational neuroimaging: Quantifying brain tissue and modeling activity in the living human brain

Dr. Brian Wandell

Isaac and Madeline Stein Family Professor, Director of Stanford's Center for Cognitive and Neurobiological Imaging (CNI), Psychology Department.

In the last twenty-five years there has been extraordinary progress in our ability to measure and model the tissue properties and activity in the living human brain using magnetic resonance imaging. Reliable measurements can be made at the millimeter scale in individual subjects, significantly enhancing the value of these techniques for both scientific and clinical applications. I will describe examples that combine functional MRI measurements with simple visual models to characterize the position, size and stimulus selectivity within the many different regions of visual cortex. I will also describe how to use diffusion MRI and quantitative MRI to model the connections between brain regions and measure the active, biological wires that carry information across the very large expanse of the human brain. MRI measurements that quantify the molecular properties of brain tissue, and reproducible computational models of brain responses promise a new era in which data and models from around the world can be meaningfully compared and combined. Using the tools of reproducible research for computing and informatics for data sharing, we can develop quantitative profiles of brain responses and tissue properties that help us understand the brain in both health and disease. These measurements and models can provide a strong foundation for a human neuroscience that benefits society.

About the George A. Miller Prize in Cognitive Neuroscience

The George A. Miller Prize in Cognitive Neuroscience was established in 1995 by the Cognitive Neuroscience Society to honor the innovative scholarship of George A. Miller, whose many theoretical advances has so greatly influenced the discipline of cognitive neuroscience. The first ten years of the prize were funded by generous support from the James S. McDonnell Foundation.

The Prize is awarded to the nominee whose career is characterized by distinguished and sustained scholarship and research at the cutting-edge of their discipline and that has in the past, or has the potential in the future, to revolutionize cognitive neuroscience.

Extraordinary innovation and high impact on international scientific thinking should be a hallmark of the recipient's work.

Each year a call for nominations for the George A. Miller Prize is made to the membership of the society. The recipient of the prize attends the annual meeting of the Cognitive Neuroscience Society and delivers the George A. Miller lecture.

Previous Winners of the George A. Miller Lectureship

2015	Patricia Kuhl, Ph.D., University of Washington
2014	Jon Kaas, Ph.D., Vanderbilt University
2013	Fred H. Gage, Ph.D., The Salk Institute
2012	Eve Marder, Ph.D., Brandeis University
2011	Mortimer Mishkin, Ph.D., NIMH
2010	Steven Pinker, Ph.D., Harvard University
2009	Marcus Raichle, Ph.D., Washington University School of Medicine
2008	Anne Treisman, Ph.D., Princeton University
2007	Joaquin M. Fuster, Ph.D., University of California Los Angeles
2006	Steven A. Hillyard, Ph.D., University of California San Diego
2005	Leslie Ungerleider, Ph.D., National Institute of Mental Health
2004	Michael Posner, Ph.D., University of Oregon
2003	Michael Gazzaniga, Ph.D., Dartmouth College
2002	Daniel Kahneman, Ph.D., Princeton University
2001	William Newsome, Ph.D., Stanford University
2000	Patricia Churchland, Ph.D., University of California, San Diego
1999	Giacommo Rizzolatti, Ph.D., University of Parma, Italy
1998	Susan Carey, Ph.D., New York University
1997	Roger Shepard, Ph.D., Stanford University
1996	David Premack, Ph.D., CNRS, France
1995	David H. Hubel, Ph.D., Harvard Medical School

The Fred Kavli Distinguished Career Contributions Award

Congratulations to Dr. James Haxby for being awarded this honor!

Dr. Haxby, will accept this prestigious award and deliver his lecture on Sunday, April 3, 2016, 4:00 –5:00 pm, in the Grand Ballroom East at the New York Hilton Midtown Hotel.

Commonality of the fine-grained structure of neural representations across brains

Dr. James Haxby

Evans Family Distinguished Professor and Director of the Center for Cognitive Neuroscience at Dartmouth, Professor in the Center for Mind/Brain Sciences at the University of Trento

Multivariate pattern analysis affords investigation of fine-grained patterns of neural activity that carry fine-grained distinctions in the information they represent. These patterns of brain activity in different brains can be recast as vectors in a common high-dimensional representational space with basis functions that have tuning profiles and patterns of connectivity that are common across brains. We derive transformation matrices that rotate individual anatomical spaces into the common model space with searchlight-based, whole cortex hyperalignment. This model provides a common structure that captures fine-grained distinctions among cortical patterns of response that are not modeled well by current brain atlases. The model also captures coarse-scale features of cortical topography, such as retinotopy and category-selectivity, and provides a computational account for both coarse-scale and fine-scale topographies with multiplexed topographic basis functions.

About the Distinguished Career Contributions Award

The Distinguished Career Contributions (DCC) award honors senior cognitive neuroscientists for their distinguished career, leadership and mentoring in the field of cognitive neuroscience. The recipient of this prize gives a lecture at our annual meeting.

Previous Winners of the Distinguished Career Contributions Award

2015 Marta Kutas, Ph.D., University of California, San Diego

2014 Marsel Mesulam, M.D., Northwestern University

2013 Robert T. Knight, M.D., University of California, Berkeley

2012 Morris Moscovitch, Ph.D., University of Toronto

THE KAVLI FOUNDATION

Young Investigator Award

Congratulations to the 2016 Young Investigator Award Winners

Adriana Galvan, Associate Professor of Psychology, Jeffrey Wenzel Term Chair in Behavioral Neuroscience, Department of Psychology, UCLA

Joel Voss, Assistant Professor, Northwestern University Feinberg School of Medicine, Departments of Medical Social Sciences, Neurology, and Psychiatry

YIA special lectures take place on Monday, April 4, 2016, 4:00 – 5:00 pm, in the Grand Ballroom West at the New York Hilton Midtown Hotel.

The purpose of the awards is to recognize outstanding contributions by scientists early in their careers. Two awardees, one male and one female, are named by the Awards Committee, and are honored at the CNS annual meeting. Each award includes $500 US to be used by the winners toward travel costs to the meeting, or for any other purpose.

The Cognitive Neuroscience of Adolescent Behavior

Monday, April 4, 4:00 –4:30 pm, Grand Ballroom West

Adriana Galvan
Associate Professor of Psychology

Jeffrey Wenzel Term Chair in Behavioral Neuroscience, UCLA

The human brain undergoes significant maturation during adolescence. Most changes occur in mesolimbic circuitry and frontal cortex. Intriguingly, mesolimbic brain regions exhibit non-linear patterns of neural engagement, showing the greatest activation in adolescents as compared to younger and older individuals. This pattern of development is in contrast to linear patterns of development observed in cortical regions. How does this unique neurodevelopmental phenotype affect commonly observed behavior in adolescents? In which environmental circumstances do these neurobehavioral interactions yield adaptive versus maladaptive behavior? Research in my laboratory is designed to address these questions. In this talk, I will present a line of research testing the hypothesis that the ongoing maturation of mesolimbic circuitry during adolescence confers greater sensitivity to environmental input and flexibility in decision making. These hypotheses are tested with cognitive, neuroimaging, endocrine, and eyeblink studies.

Contrary to historical narratives about the destructive consequences of the unstable adolescent brain, this research is revealing particular ways in which its plasticity bears exciting possibilities for learning, exploration, and ingenuity.

Enhancing Episodic Memory Networks Using Noninvasive Brain Stimulation

Monday, April 4, 4:30 –5:00 pm, Grand Ballroom West

Joel Voss, Assistant Professor

Northwestern University Feinberg School of Medicine

Episodic memory has been associated with interactions among a distributed set of brain regions forming a hippocampal-cortical network. This network is disrupted in a variety of neurological and neuropsychiatric conditions that have memory impairment as a chief symptom. I will describe my laboratory's efforts to target and manipulate portions of this network using noninvasive electromagnetic stimulation. We have shown that multiple-day, network-targeted, repetitive transcranial magnetic stimulation (rTMS) can produce lasting enhancements of network functional MRI connectivity and episodic memory performance. These changes are robust 24 hours after the final rTMS session and persist in weakened form for up to 2 weeks. Furthermore, rTMS-induced changes are highly specific to targeted portions of the hippocampal-cortical network defined a priori on anatomical grounds. Improvements in episodic memory performance also occur with enhanced neural correlates of recollective retrieval, suggesting relative specificity of stimulation effects on the targeted posterior portions of the hippocampal-cortical network that are more heavily implicated in recollective than familiarity-based memory retrieval. Targeted noninvasive stimulation of hippocampal-cortical networks is a promising approach for studying involvement of hippocampal-cortical networks in memory that could have significant impact on impairments of memory in a variety of disorders.

Special Events

Professional Networking Using Social Media

Sunday, April 3, 12:15 - 1:15 pm, Beekman

Social media is a powerful tool for neuroscientists. Speakers will discuss ways to use social media (blogging, Twitter, LinkedIn, etc.) to widen and strengthen your professional network as well as open up new opportunities you may not have been exposed to otherwise (press opportunities, different funding sources, etc). Speakers will also share personal experiences from social media and give tips on what has helped (or not helped) build their own professional network and expand their careers. Discussion time will allow for participants to engage with speakers and others on experiences learned through using social media as a networking tool.

Organizer: Nicholas J.A. Wan (Utah State University)

Speakers: Bradley Voytek, Ph.D. (University of California – San Diego); Richard Prather, Ph.D. (University of Maryland); Sophie Scott, Ph.D. (University College London)

Federal Funding Opportunities at the National Science Foundation

Monday, April 4, 12:15 - 1:15 pm, Grand Ballroom East

Dr. Alumit Ishai, Director of the Cognitive Neuroscience Program, will present an overview of current federal funding opportunities for Cognitive Neuroscientists at NSF, the grant application, review and funding processes, and provide hints for successful grant writing along the way. Come learn how to advance your research with federal support!

Speaker: Alumit Ishai, Director, NSF Cognitive Neuroscience Program

NIH Funding: Training and Research Grant Opportunities

Monday, April 4, 12:15 - 1:15 pm, Sutton Center

NIH Program Directors representing several Institutes will highlight current training, career development, and research funding opportunities; will touch on funding opportunities, grant application types, review, and funding processes, and provide hints for success. Come learn and ask questions about how NIH support can help you!

Speaker: Kathy Mann Koepke, NICHD/NIH

Publishing Workshop for Early Career Researchers

Monday, April 4, 12:15 - 1:15 pm, Grand Ballroom West

This workshop will present a rare opportunity to gain insights into journal publishing from the Editors and Publishers of Elsevier journals (such as Neuropsychologia) on how to write and review a paper, new publishing initiatives and publishing ethics.

Panel: Panel: Cindy Lustig (Editor-in-Chief of Current Opinion in Behavioral Sciences and Senior Editor of NeuroImage), Micah Murray (Editor-in-Chief of Brain Topography, Section Editor of Neuropsychologia, and Handling Editor of NeuroImage), Michael Rugg (Editor-in-Chief of Neuropsychologia), Rebecca Schwarzlose (Editor of Trends in Cognitive Science), Toby Charkin (Executive Publisher at Elsevier), Adam Fraser (Publisher at Elsevier)

CNS Trainee Professional Development Panel

Monday, April 4, 3:00 - 4:00 pm, Concourse G

Join the CNS Trainee Association for the first Trainee Professional Development Panel! Hear some of the foremost experts in the field of cognitive neuroscience detail their career trajectories, discuss factors that influenced their development, and reveal what they wish they had known as Trainees. The second half of the session will be open for Q&A. Appropriate for trainees of all levels!

CNS 2016 Debate

Connectomics: 'Missing link' for understanding neural computation, or 'minutiae of implementation'?

Monday, April 4, 5:00 - 6:30 pm, Sutton Center

A debate between Anthony Movshon, NYU and Moritz Helmstaedter, Max-Planck-Institute.

Moderator: David Poeppel, Max-Planck-Institute & NYU

Limited seating, reservation required.

Anthony Movshon, NYU

Biologists are taught the basic principle that form follows function. The idea of connectomics goes further, to propose that form determines function. From this it would follow that knowing the form of neural circuits in detail would by itself allow us to deduce their function. The reality is different. The form of neural circuits undoubtedly constrains their function, but a knowledge of form alone is neither necessary nor sufficient to understand brain function. Neuroanatomy has always been one of the central tools of neuroscience. But except in very special cases like the retina, where the behavior of a circuit is well understood, anatomy alone tells us little of function. Rather, functional models that try to capture the purpose of neural computation rather than dwelling on the minutiae of its implementation offer a better path to understanding the brain.

Moritz Helmstaedter, Max-Planck-Institute

Since brains drive rich time-varying behaviors, the focus of scientific investigation has always been the dynamics of neurons, synapses, neuronal ensembles. Decades later we have a myriad of theoretical proposals how brains could compute, especially in the cerebral cortex of mammals. But few of these models are unequivocally refutable by functional experiments. Could the lack of knowledge about neuronal circuit structure, connectomes, be the missing link? Connectomic experiments are more efficient than functional ones in finding rare but relevant computations of a neuronal ensemble. Connectomes are required to explain computations in the mammalian retina and fly optical system. The degree to which connectomes shape computations in the mammalian cerebral cortex will remain a matter of scientific debate until finally, cerebral cortex connectomes will be measured.

Data Blitz Sessions

A Data Blitz is a series of 5-minute talks, each covering just a bite-sized bit of research. It will offer a fast-paced overview of some of the most exciting research presented at this year's poster sessions.

Data Blitz Session 1

Saturday, April 2, 2:30 - 3:45 pm, Beekman

Chair: Tobias Egner, Duke University

Speakers: Sophie Scott, Alessandro Tavano, Simon Davis, Jean-Remi King, Radhika Gosavi, Robert Emerson, Ola Ozernov-Palchik, Francesca Carota, Caitlin Hilliard, Jessica Creery, Jean-Baptiste Eichenlaub, Rachel Newsome

Talk 1: LISTENING TO 'WOB WOB' AND 'WAH WAH' - THE EFFECTS OF EXPERTISE IN BEAT BOXING AND GUITAR PLAYING ON PERCEPTION NETWORKS. Sophie Scott[1], Saloni Krishan[1], Cesar Lima[1], Tom Manly[1], Samuel Evans[1], Harry Yeff[2]; [1]Institute of Cognitive Neuroscience, UCL, London, [2]Get Involved LTD

Talk 2: TEMPORAL PROBABILITIES IN THE BETA-BAND Alessandro Tavano[1,2], Erich Schröger[2], Sonja Kotz[3,4]; [1]Max Planck Institute for Empirical Aesthetics, Frankfurt am Main (Germany)., [2]Institute of Psychology, University of Leipzig (Germany)., [3]Maastricht University, Maastricht (The Netherlands), [4]Max Planck Institute for Human Cognitive Brain Sciences, Leipzig (Germany)

Talk 3: THE PSYCHOLOGY OF EVERYDAY THINGS: HOW PERCEPTUAL AND CONCEPTUAL FEATURES INFLUENCE MEMORY FOR OBJECTS. Simon Davis[1], Benjamin Geib[1], Rosalie Cichinelli[1], Marty Woldorff[1], Roberto Cabeza[1]; [1]Duke University

Talk 4: DECODING THE SELECTIVE AND DYNAMIC MAINTENANCE OF UNSEEN SENSORY FEATURES IN THE HUMAN BRAIN Jean-Remi King[1], Niccolo Pescetelli[2], Stanislas Dehaene[3]; [1]New York University, [2]Oxford, [3]College de France, Paris

Talk 5: DECODING GRAPHEME-COLOR SYNESTHESIA USING MULTIVARIATE PATTERN ANALYSIS Radhika Gosavi[1], Emma Meyering[1], Nathan Rose[1], Bradley Postle[1], Edward Hubbard[1]; [1]University of Wisconsin- Madison

Talk 6: LONGITUDINAL STUDY OF THE EMERGING LATERALIZATION OF THE LANGUAGE NETWORK DURING INFANCY Robert Emerson[1], Wei Gao[2], Weili Lin[1]; [1]University of North Carolina at Chapel Hill, [2]Cedars-Sinai Medical Center, Los Angeles, CA

Talk 7: DISTINCT NEURAL ALTERATIONS OF HETEROGENEOUS DYSLEXIA RISK PROFILES Ola Ozernov-Palchik[1,2], Meaghan Mauer[1], Elizabeth S Norton[3], Georgios Sideridis[1,5], Sara Beach[4,5], Maryanne Wolf[2], John D. E. Gabrieli[5], Nadine Gaab[1,5]; [1]Boston Children's Hospital, [2]Tufts University, [3]Northwestern University, [4]Massachusetts Institute of Technology, [5]Harvard University

Talk 8: WORD CO-OCCURRENCE STATISTICS AND CONCEPTUAL TAXONOMIES PREDICT DISSOCIABLE FMRI INFORMATION PATTERNS IN THE BRAIN SEMANTIC SYSTEMS. Francesca Carota[1], Hamed Nili[2], Friedemann Pulvermüller[3], Nikolaus Kriegeskorte[1]; [1]MRC - Cognition and Brain Sciences Unit, Cambridge, UK, [2]Experimental Psychology Department, University of Oxford, UK, [3]Freie Universität, Berlin, Germany

Talk 9: HIPPOCAMPAL DECLARATIVE MEMORY SUPPORTS LANGUAGE AND GESTURE PRODUCTION Caitlin Hilliard[1], Susan Wagner Cook[1], Melissa Duff[1]; [1]University of Iowa

Talk 10: HUMAN HIPPOCAMPAL THETA DURING FEEDBACK ON A SPATIAL LEARNING TASK Jessica Creery[1], David Brang[1,2], Vernon Towle[2], James Tao[2], Sasha Wu[2], Ken Paller[1]; [1]Northwestern University, [2]University of Chicago

Talk 11: REACTIVATION OF MEMORY-RELATED GAMMA ACTIVITY IN HUMAN SLEEP Jean-Baptiste Eichenlaub[1], Nicole Rivilis[1], Siddharth Biswal[1], Brandon Westover[1], Eric Halgren[2], Sydney S. Cash[1]; [1]Massachusetts General Hospital, Harvard Medical School, [2]Kavli Institute for Brain and Mind, UCSD

Talk 12: WHEN A MARSHMALLOW IS MORE LIKE A PILLOW THAN A GRAHAM CRACKER: PARSING PERCEPTUAL AND CONCEPTUAL PROCESSES OF THE MEDIAL TEMPORAL LOBE Rachel Newsome[1,2], Danielle Douglas[1], Louisa Man[1], Morgan Barense[1,2]; [1]University of Toronto, [2]Rotman Research Institute

Data Blitz Session 2

Saturday, April 2, 2:30 - 3:45 pm, Sutton South

Chair: Brad Postle, University of Wisconsin - Madison

Speakers: Kendra Seaman, Vyoma D Shah, Lisa Alexandria Velenosi, Wayne Mackey, Anne Martin, MaryAnn P Noonan, Tommy Wilson, Alessandra Finisguerra, Katherine Rice, Suzanne Dikker, Moranne Eidelman-Rothman, Charlotte Grosse Wiesmann

Talk 1: ADULT AGE DIFFERENCES IN THE INFLUENCE OF FINANCIAL SKEWNESS ON CHOICE AND NEURAL ACTIVITY Kendra Seaman[1], Josiah Leong[2], Charlene Wu[2], Brian Knutson[2], Gregory Samanez-Larkin[1]; [1]Yale University, [2]Stanford University

Talk 2: INCREASED DOPAMINE SYNTHESIS CAPACITY IS ASSOCIATED WITH A LOWER RATE OF LEARNING IN OLDER ADULTS Vyoma D Shah[1], Anne S Berry[1], Suzanne L Baker[1], Taylor J Mellinger[2], Kaitlin N Swinnerton[2], Jacob W Vogel[2], William J Jagust[1]; [1]Lawrence Berkeley National Laboratory, [2]University of California Berkeley

Talk 3: NEURAL REPRESENTATIONS OF SPATIAL LAYOUT ACROSS MENTAL TRANSFORMATION – A TACTILE FMRI STUDY Lisa Alexandria Velenosi[1,2], Timo Torsten Schmidt[1,2], Felix Blankenburg[1,2]; [1]Freie Universität Berlin, Berlin, Germany, [2]Center for Cognitive Neuroscience Berlin, Berlin, Germany

Talk 4: DISRUPTION OF DELAY-PERIOD ACTIVITY IN HUMAN FRONTAL EYE FIELDS CAUSES SYSTEMATIC IMPAIRMENTS IN SPATIAL COGNITION Wayne Mackey[1], Clayton Curtis[1]; [1]New York University

Talk 5: MEMORY AND ATTENTION FIELDS IN THE HUMAN VISUAL SYSTEM Anne Martin[1], Liang Wang[1,2], Yuri Saalmann[1,3], Avgusta Shestyuk[4], Nathan Crone[5], Josef Parvisi[6], Robert Knight[4], Sabine Kastner[1]; [1]Princeton University, [2]Chinese Academy of Sciences, [3]University of Wisconsin, Madison, [4]University of California, Berkeley, [5]The Johns Hopkins Hospital, [6]Stanford University

Talk 6: DIFFERENTIAL MODULATION OF VISUAL RESPONSES BY DISTRACTOR OR TARGET PREDICTIONS? MaryAnn P Noonan[1], Yannik Bauer[2], Alex H Von Lautz[3], Chris Summerfield[1], Mark S Stokes[1]; [1]Department of Experimental Psychology, University of Oxford, Oxford, UK, [2]International Max Planck Research School, University of Tübingen, Germany, [3]Bernstein Center for Computational Neuroscience, Berlin, Germany

Talk 7: CROSS-FREQUENCY COUPLING BETWEEN ALPHA OSCILLATIONS AND SELECTIVE ENTRAINMENT: A CORRELATE OF SELECTIVE ATTENTION Tommy Wilson[1], Sophie Molholm[1], John J Foxe[1,2]; [1]The Sheryl and Daniel R. Tishman Cognitive Neurophysiology Laboratory (CNL) and Children's Evaluation and Rehabilitation Center (CERC), Albert Einstein College of Medicine, Bronx, New York, [2]Ernest J. Del Monte Institute for Neuromedicine, University of Rochester Medical Center, Rochester, New York

Talk 8: DECEPTIVE INTENTION AND KINEMATIC ALTERATION OF AN OBSERVED ACTION AFFECT THE MOTOR SYSTEM VIA DISSOCIABLE PROCESSES Alessandra Finisguerra[1], Lucia Amoruso[1], Stegios Makris[2], Cosimo Urgesi[1,3]; [1]University of Udine, Italy, [2]Edge Hill University, United Kingdom, [3]Bangor University, United Kingdom

Talk 9: LET'S CHAT: DEVELOPMENTAL NEURAL BASES OF SOCIAL MOTIVATION DURING REAL-TIME PEER INTERACTION Katherine Rice[1], Eleonora Sadikova[1], Elizabeth Redcay[1]; [1]University of Maryland

Talk 10: BRAIN-TO-BRAIN SYNCHRONY PREDICTS STUDENT ENGAGEMENT AND SOCIAL DYNAMICS IN THE CLASSROOM: A CROWD-SOURCING NEUROSCIENCE STUDY. Suzanne Dikker[1,2], Lu Wan[3], Ido Davidesco[1], Lisa Kaggen[4], Jess Rowland[1], James McClintock[5], Matthias Oostrik, Jay Van Bavel[1], Mingzhou Ding[3], David Poeppel[1,6]; [1]New York University, [2]Utrecht University, [3]University of Florida, [4]Stanford University, [5]Trevor Day School, [6]Max Planck Institute for Empirical Aesthetics

Talk 11: PRIOR EXPOSURE TO EXTREME PAIN ALTERS THE PERCEPTUAL PROCESSING OF OTHERS' PAIN; THE EFFECT OF OXYTOCIN Moranne Eidelman-Rothman[1], Abraham Goldstein[1], Omri Weisman[1], Inna Schneiderman[1], Orna Zagoory-Sharon[1], Jean Decety[2], Ruth Feldman[1]; [1]Bar-Ilan University, [2]The University of Chicago

Talk 12: WHITE MATTER MATURATION IN TEMPOROPARIETAL JUNCTION AND ITS CONNECTION TO PREFRONTAL CORTEX SUPPORTS THE EMERGENCE OF THEORY OF MIND Charlotte Grosse Wiesmann[1], Jan Schreiber[1], Tania Singer[1], Nikolaus Steinbeis[1,2], Angela D. Friederici[1]; [1]Max Planck Institute for Human Cognitive and Brain Sciences, [2]Universiteit Leiden

General Information

Abstracts

Poster abstracts can be found in the printed program and in the PDF version which is downloadable from www.cogneurosociety.org.

ATM

An ATM is located in the lobby level of the hotel for your convenience.

Audiovisual Equipment for Talks

LCD projectors (e.g., for PowerPoint presentations) will be provided in all rooms where spoken sessions are scheduled; however, computers will NOT be provided. Presenters must bring their own computers and set them up BEFORE the start of the session in which they are presenting. Speakers are requested to bring their own dongle. Facilities will be provided to allow several computers to be connected to the LCD projector in a room. Presenters are strongly encouraged to arrive in their scheduled symposium room a minimum of 30 minutes before their talks so that they know how to set up their equipment.

Baggage Check

The Bell Desk - Assistance with luggage, packages and other carry-on's, is located with the Concierge, next to the front desk in the lobby. Baggage Storage ($3.50 p/bag)

Business Center

The Business Center is located on the 2nd floor of the New York Hilton Midtown Hotel.

Catering

Catering will be available during the conference and is included in the registration fee. Please refer to the table below for the catering times.

Saturday, April 2

Welcome Reception, 6:00 - 7:00 pm, *Americas Hall I & II*
Coffee Service, 2:00 – 2:30 pm, *Grand Ballroom Foyer*

Sunday, April 3

Continental Breakfast, 8:00 – 8:30 am, *Americas Hall I & II*
Coffee Service, 3:30 – 4:00 pm, *Grand Ballroom Foyer*

Monday, April 4

Continental Breakfast, 8:00 – 8:30 am, *Americas Hall I & II*
Coffee Service, 3:30 – 4:00 pm, *Americas Hall I & II*

Tuesday, April 5

Continental Breakfast, 8:00 – 8:30 am, *Americas Hall I & II*

Certificate of Attendance

To receive a Certificate of Attendance please visit the Registration Counter on the 3rd Floor Promenade of the New York Hilton Midtown Hotel at the end of meeting. If you require any changes, we will be happy to email/mail a copy after the meeting. See also Receipts.

Chair People

Please ensure that you are available in your presentation room at least thirty minutes before the start of the session. Persons chairing sessions are asked to keep the talks on time.

Contact Us

To contact us onsite, visit the Registration Counter on the 3rd Floor Promenade of the New York Hilton Midtown Hotel or send an email to meeting@cnsmeeting.org. We will respond to your email at our soonest opportunity.

Code of Conduct

The Cognitive Neuroscience Society is committed to providing a safe and professional environment during our annual meeting. All CNS members are expected to conduct themselves in a business-like and professional manner. It is unlawful to harass a person or employee because of that person's sex or race. Harassment is defined by any situation that creates a hostile or offensive work environment. Any person found to be harassing another during the meeting will be escorted off the premises and barred from attending future meetings.

Disclaimer

The Program Committee reserves the right to change the meeting program at any time without notice. Please note this program is correct at time of print.

Drink Tickets

Each Attendee will receive one drink ticket; it can be redeemed for an alcoholic or non-alcoholic beverage at the Welcome Reception on Saturday. Lost drink tickets will not be replaced.

Exhibits

The conference exhibits are located in Americas Hall I & II of the New York Hilton Midtown Hotel. Located in this room are the posters, exhibit booths, and catering. The Exhibit Hall is open to all attendees at the following times:

Saturday, April 2	3:00 – 7:00 pm
Sunday, April 3	8:00 am – 11:00 am
	1:30 - 7:00 pm
Monday, April 4	8:00 am – 5:00 pm
Tuesday, April 5	8:00 – 10:00 am

Exhibit Halls are closed Sunday, 11:00 am - 1:30 pm. Join us for the Exhibits Expo on Monday from 12:00 - 1:30 pm.

Facebook

Find us on Facebook search for "Cognitive Neuroscience Society" and like us!

Hotel

The New York Hilton Midtown Hotel is our exclusive Hotel for the CNS 2016 Annual Meeting and where all CNS 2016 meeting events will be held. New York Hilton Midtown Hotel located at 1335 Avenue of the Americas, New York, New York, 10019, USA.

Hotel Restaurants

Bridges – Discover the ultimate in sophistication in the fantastic setting of Bridges Bar. Celebrate the romance of Manhattan's Seven Bridges while sipping your favorite cocktail at the spacious bar. Enjoy some of the best martinis in town or choose from our ever-changing selection of fine regional wines in a welcoming atmosphere. Open from 5:30 p.m. to 2:00 a.m. Monday to Saturday.

Herb n' Kitchen - Hilton's new concept restaurant, Herb N' Kitchen, features seasonal salads, artisanal sandwiches and brick oven pizzas. A barista zone offers specialty coffees to enjoy either in the restaurant or on the go. Breakfast buffet served daily from 6:30 a.m. to 11:00 a.m. (last seating 11:00 a.m.). Coffee and light fare items available to take away from 6:00 a.m. to 1:00 a.m.

Lobby Lounge – Overlooking the lobby, the Lobby Lounge is your spot to rendez-vous. Enjoy exceptional wines, cocktails, light fare, as well as terrific people watching. Open from 12 noon to midnight Monday through Saturday and 12 noon Sundays.

Minus5 Ice Bar - Minus5° is an ice bar where you can touch, feel, and explore handcrafted ice sculptures and architecture made from Canadian ice. Everything inside minus5° is made of ice, even the glasses that you enjoy our famous vodka-based cocktails in. No matter what the event, you and your companions will be treated to the coolest experience in town! This is a unique venue for fun and memorable group events or corporate functions.

Internet Access

CNS attendees will receive complimentary wireless internet in their guest room, when reserved within the CNS block and before March 16, 2016.

Free internet terminals are located on the 3rd Floor Promenade. Internet terminals are available during the meeting registration hours on Saturday, Sunday, Monday, and Tuesday when not needed for onsite registration. See *Onsite Meeting Registration*.

LinkedIn

Join our group on LinkedIn search "Cognitive Neuroscience Society (CNS)".

Lost & Found

The meeting Lost and Found is located at the Registration Counter on the 3rd Floor Promenade of the New York Hilton Midtown Hotel.

Member Services

The member services desk is located at the Registration Counter on the 3rd Floor Promenade of the New York Hilton Midtown Hotel. The member services desk will be open at the following times:

Saturday, April 2	11:00 am – 5:00 pm
Sunday, April 3	7:30 am – 4:30 pm
Monday, April 4	8:00 am – 6:30 pm
Tuesday, April 5	8:00 am – 12:00 pm

Message Center

Messages for meeting registrants can be left and retrieved at the Registration Counter on the 3rd Floor Promenade of the New York Hilton Midtown Hotel. A bulletin board will be available for announcements and job postings.

Mobile Phones

Attendees are asked to silence their mobile phones when in sessions.

Name Badges

The New York Hilton Midtown Hotel and Convention Center is open to public access. For security purposes, attendees, speakers and exhibitors are asked to wear their name badges to all sessions and social functions.

Entrance into sessions is restricted to registered attendees only. Entrance to the Exhibition will be limited to badge holders only. If you misplace your name badge, please go to the Registration Counter on the 3rd Floor Promenade of the New York Hilton Midtown Hotel for a replacement.

Parking

The New York Hilton Midtown Hotel offers Valet parking. Parking rates are currently $55.00/24 hour per car or $67.00/24 hour per SUV for hotel guests. (Please note this information was correct at time of print.)

Phone Charging Station

There will be a small phone charging station located at the Registration Counter on the 3rd Floor Promenade of the New York Hilton Midtown Hotel.

Photo Disclaimer

Registration and attendance at, or participation in, the Cognitive Neuroscience Society meetings and other activities constitute an agreement by the registrant/attendee to CNS's use and distribution (both now and in the future) of the registrant's or attendee's image in photographs of such events and activities.

Poster Sessions

Poster sessions are scheduled on Saturday, April 2, Sunday, April 3, Monday, April 4, and Tuesday, April 5. The presenting author must be present during the assigned session and other authors may be present to answer questions. The poster sessions are in Americas Hall I & II of the New York Hilton Midtown Hotel. Badges are required at all times. Do not leave personal items in the poster room.

Printed Program

One copy of the printed program is available to each attendee. If you would like a second copy please check in at the Registration Counter on the 3rd Floor Promenade of the New York Hilton Midtown Hotel on the last day of the event. Every effort has been made to produce an accurate program. If you are presenting at the conference, please confirm your presentation times as listed in this program. Attendees also have the option to view the program by downloading it from our website.

Receipts

You received two receipts via email, one at the time of purchase and a second with your registration confirmation. Please email the registration desk if you require an additional copy. See also Certificate of Attendance.

Reception

The Welcome Reception will be held in Americas Hall I & II, from 6:00-7:00 pm on Saturday, April 2.

Registration

The Registration Counter is located on the 3rd Floor Promenade of the New York Hilton Midtown Hotel. The Registration Counter will be open at the following times:

Saturday, April 2	11:00 am - 6:30 pm
Sunday, April 3	7:30 am – 6:30 pm
Monday, April 4	8:00 am – 6:30 pm
Tuesday, April 5	8:00 am – 3:00 pm

Smoking

Smoking is not permitted in or outside any of the meeting rooms or the exhibition hall.

Speakers

All speakers must register and wear name badge to present. Please ensure that you are available in your presentation room at least thirty minutes before the start of the session. See also Audiovisual equipment for Talks.

Transportation

Taxis at JFK Airport charge a flat fare of $52 for trips between the airport and Manhattan. Taxis impose a $4.50 surcharge during peak hours (4-8 p.m. weekdays, excluding holidays), for a fare of $56.50.

*Fares subject to change without notice.

Twitter

Follow CNS Annual Meeting (@CNSmtg). Our Hashtag this year is #CNS2016

Website

http://www.cogneurosociety.org/annual-meeting/

SAVE THE DATE

CNS 2017 Annual Meeting

Will be held in San Francisco on March 25-28, 2017

Exhibits

Exhibitors

Visit our exhibitors in Americas Hall I (third floor) and Americas Hall II.(fourth floor).

ANT North America
BIOPAC Systems, Inc.
Brain Products GmbH
Brain Vision LLC
Cedrus Corporation
Compumedics Neuroscan
Cortech Solutions, Inc.
EGI
Electrical Geodesics, Inc.
MAG & More
Rogue Research, Inc
Rogue Resolutions Ltd.
Routledge
Society for Neuroscience
Soterix Medical, Inc.
SR Research, Ltd.
The MIT Press

Exhibit Hours

The conference exhibits are located in Americas Hall I & II of the New York Hilton Midtown Hotel. Located in this room are the posters, exhibit booths, and catering. The Exhibit Hall is open to all attendees at the following times:

Saturday, April 2	3:00 – 7:00 pm
Sunday, April 3	8:00 am – 11:00 am
	1:30 - 7:00 pm
Monday, April 4	8:00 am – 5:00 pm
Tuesday, April 5	8:00 – 10:00 am

Exhibit Halls are closed closed Sunday, 11:00 am - 1:30 pm.

Join Us at the Exhibit Expo

Join us Monday for a special Exhibit Expo from 12:00 – 1:30 pm. Explore all that CNS's exhibitors have to offer during this exclusive event dedicated to providing attendees new ideas, innovative technologies, and useful products.

GSA/PFA Awards

Congratulations to the 2016 winners of the Graduate Student Awards and the Post-Doctoral Fellow Awards. Each winner receives a monetary stipend to cover conference travel expenses.

Graduate Student Award Winners

Jessica Robin
Robert Emerson
Austen Smith
Katherine Alfred
Tommy Wilson
Michael Wolff
Tyler Santander
Radhika Gosavi

Post-Doctoral Fellow Award Winners

JB Eichenlaub
Kendra Seaman
Moranne Eidelman-Rothman
Francesca Carota
Anne Martin
Jonathan Fawcett
Jean-Remi King

Invited-Symposium Sessions

#	Title	Date	Time	Location
1	Computational Psychiatry	Sunday, April 3	10:00 am - Noon	Grand Ballroom East
2	Memory reactivation contributes to memory consolidation, integration and decision-making	Sunday, April 3	10:00 am - Noon	Sutton Complex
3	The Neuroscience of Socioeconomic Status: Setting the Agenda	Tuesday, April 5	1:30 - 3:30 pm	Grand Ballroom West
4	Dynamic Neural Coding for Flexible Cognition	Tuesday, April 5	1:30 - 3:30 pm	Sutton Center

Invited Symposium Session 1

COMPUTATIONAL PSYCHIATRY

Sunday, April 3, 10:00 am - Noon, Grand Ballroom East

Chair: Michael Frank, Brown University

Speakers: Michael Breakspear, Anne Collins, Read Montague, Rosalyn Moran

A central challenge in attempting to characterize complex behavioral phenotypes with mechanistic descriptions is that our understanding of neural systems is far from facilitating a complete account of human behaviors. This explanatory gap has impeded progress in refining diagnostics and in development of effective treatments for mental illnesses. By focusing on a wealth of converging theoretical and cognitive neuroscience evidence, the burgeoning field of Computational Psychiatry offers a quantitative and computational interpretation of previously qualitative diagnostic features, investigating how alterations to component neural systems can underlie specific behavioral phenotypes and/or to predict treatment outcomes. Multiple levels of computation and theory are used to understand mechanisms and dynamics at the level of cells, neurotransmitters and circuits, and to characterize higher level principles involved in learning, decision making, executive functions and social behavior. These models are also used to quantitatively fit behavioral and neural data in tandem with machine learning methods to discover structure among high dimensional data-sets (imaging, genetics etc) relevant for classification of mental illness.

TALK 1: BRAIN NETWORK DYSFUNCTION IN PSYCHIATRIC DISORDERS

Michael Breakspear[1]; [1]Queensland Institute of Medical Research, Brisbane Australia

A large body of recent research has now established the central role of brain network activity in action, perception and cognition. Emerging research now positions a number of psychiatric disorders as disturbances in these same networks. For example, schizophrenia appears to disrupt the structural and functional integrity of the core backbone of large-scale cortical networks. Conversely, affective disorders more selectively target the networks underlying interoceptive awareness and cognitive control. I will present a brief didactic prelude of brain network research, a survey of key findings in psychiatric disorders, and a summary of new opportunities for diagnosis and treatment that a brain network approach offers to the study of psychiatric disorders.

TALK 2: EXTRACTING THE PRINCIPAL COMPONENTS OF HUMAN LEARNING

Anne Collins[1,2], Michael Frank[1]; [1]Brown University, Brown Institute for Brain Science, [2]University of California at Berkeley

Human learning should be compared to a symphony, rather than to a violin solo or even duet: many different neuro-cognitive players contribute to the various aspects of learning for which they are best fitted, and may thus be more or less relied on in different environments, or even dynamically, as learning proceeds. To understand the mechanisms behind impaired learning in patient populations, it is essential to be able to reliably attribute different aspects of their behavior to the relevant player, as well as to understand how dysfunction in one player may impact the others. In this talk, I will show how careful experimental design and computational modeling allow us to pull apart the contributions some of these players, such as the dopamine-dependent habit learning system, and prefrontal-cortex dependent working memory, as well as to investigate their interactions. Results from patients with schizophrenia highlight the importance of carefully separating out these contributions to appropriately interpret learning impairments.

TALK 3: COMPUTATIONAL MEANING OF DOPAMINE AND SEROTONIN INTERACTIONS IN HEALTH AND DISEASE

Read Montague[1,2]; [1]Virginia Tech Carilion Research Institute, [2]Wellcome Trust Centre for Neuroimaging, University College London

The neurotransmitters dopamine and serotonin interact to influence a dramatically wide range of cognitive functions including mood, sleep, reward processing, learning, and decision-making. Such claims are supported by the profound deficits that arise when these systems malfunction such as in Parkinson's Disease, Addiction, Major Depression, and Schizophrenia. The lack of rapid, conjoint measurements of these two transmitters has obstructed the development of coherent computational accounts of their joint function. We

probed sub-second transients of dopamine and serotonin in human striatum using an investment game and a new approach to measuring concentrations of both neurotransmitters. We find that phasic sub-second changes in serotonin and dopamine link sensory outcomes to near-term actions: whether a subject stays with their current position on the next round (stay strategy) or changes their position significantly (switch strategy). Unexpectedly, the transmitters display the same encoding of near-term actions where both show phasic increases to the stay strategy and decreases to the switch strategy. However, these action-encodings differ according to the polarity of prior sensory experience. Dopamine transients encode next actions only following positive outcomes (positive reward prediction errors), while serotonin fluctuations encode next actions only following negative outcomes (negative reward prediction errors). Thus, rapid increases in these transmitters act in concert to inhibit over-reactions to environmental stimuli and open the door for other levels of cognitive control to influence behavior.

TALK 4: IDENTIFYING THE PROMOTERS OF PSYCHIATRIC SYMPTOMS IN ANTI-NMDA RECEPTOR ENCEPHALITIS USING DYNAMIC CAUSAL MODELS

Rosalyn Moran[1]; [1]Virginia Tech Carilion Research Institute

Autoimmune channelopathies, including Anti-N-methyl-d-aspartate (NMDA) receptor antibody encephalitis, are a recently discovered class of neurological disorder where patients can present with a spectrum of severe psychiatric symptoms from abnormal movement patterns to full-blown psychosis. Serum and CSF titres provide diagnostic indicators for NMDAr antibodies but do not explain the heterogeneity of symptom presentation. Here we present a method to functionally assess the neural basis for associated psychiatric illness using a retrospective analysis of electroencephalographic data acquired from two patient cohorts one comprising NMDAr encephalitis and a second with non-autoimmune associated, infectious encephalopathy. Our approach employs a characterization of forward and backward connectivity profiles among sources in the brain as well as a characterization of region specific effects using a dynamic causal model (DCM) of ion-channel signalling. Specifically, we map the cross-spectral characteristic of resting-state EEG to a plausible underlying model of interacting neuronal assemblies. These models have previously been used to characterize the abnormal integration of sensory information with top-down signals in animal models of psychosis and in patients with schizophrenia, where algorithmic properties of pathology have been cast in predictive coding terms. We find that specific patterns of NMDAr breakdown are associated with the diverse symptomology of anti-NMDA receptor encephalitis. We also demonstrate, more broadly, that a methodology developed for cognitive neuroscience can pinpoint key channel pathologies using non-invasive electrophysiological recordings and explain complex features of neuropsychiatric illnesses.

Invited Symposium Session 2

MEMORY REACTIVATION CONTRIBUTES TO MEMORY CONSOLIDATION, INTEGRATION AND DECISION-MAKING

Sunday, April 3, 10:00 am - Noon, Sutton Complex

Chair: Lila Davachi, New York University

Speakers: Daphna Shohamy, Lluís Fuentemilla, Lila Davachi, Ken Paller

Recent advances in behavioral and cognitive neuroscientific methods have led to a better understanding of the role of memory reactivation in cognition. Specifically, it is now becoming clear that memory reactivation likely provides a mechanism underlying the persistence and integration of the past into the present allowing memories to guide future behaviors in various ways. The symposium will highlight recent work demonstrating that memory reactivation contributes to memory persistence and integration at various stages of processing: during encoding, at boundaries between encoding events, during more extended post-encoding periods and, finally, during sleep. Daphna Shohamy will present her work highlighting the role of reactivation during encoding. Specifically, she will discuss her groundbreaking work demonstrating the role of reactivation in integrative encoding. Lluis Fuentmilla will present his recent work demonstrating that reactivation of prior events may be specifically triggered at event boundaries. Lila Davachi will then discuss recent studies showing that reactivation of local hippocampal patterns as well as hippocampal-cortical connectivity occurs during post-encoding periods and this predicts later memory for the preceding representations and can also influence how current information is processed. Finally, Ken Paller will present his elegant work during sleep that suggests a causal link between reactivation during sleep, specifically, and later memory.

TALK 1: REACTIVATING MEMORIES TO GUIDE DECISIONS

Daphna Shohamy[1]; [1]Columbia University

Adaptive decisions are guided by past experience. Yet, decisions must often be made between alternatives that have not been directly experienced before, requiring the integration of memories across multiple past events. I will review findings supporting a role for reactivation in at least two distinct mechanisms: one involves the integration of memories into a network of related experiences, before a decision is ever faced. A complementary mechanism involves reactivation of memories to support inference and prospection at the time a decision is being made. I will discuss evidence supporting each of these mechanisms, their neurobiological underpinnings, and the implications for understanding the role of memory in decision-making.

TALK 2: CONTEXT SHIFTS TRIGGER THE RAPID MEMORY REACTIVATION OF THE JUST ENCODED SEQUENCE OF EVENTS

Lluís Fuentemilla[2]; [1]University of Barcelona-IDIBELL

Experiences unfold over time, but people tend to discretize the continuum into sequences of memory segments. This ability to parcel out the experienced continuum into small event memory episodes is thought to be promoted by the online detection of context shifts or episodic boundaries, thus cueing the rapid transformation of the just encoded events into long-term memory traces. However, in order to preserve a subjective sense of continuity, these memory traces must be linked such that the order of events can be later reconstructed. Here, I will show evidence from scalp electrophysiological recordings (EEG) in humans that context shifts triggered a rapid memory reactivation of the just encoded sequential episode, thereby providing a neural signature of the online formation of a cohesive memory representation of a sequence of events. Instances of memory reactivation were detected very rapidly (at ~400 ms) and were specific to context shifts that were preceded by a sequence of events with episodic content. Importantly, memory reactivation was not observed during the sequential encoding of memory events within an episode, indicating memory reactivation was induced specifically when context shifts were detected. Finally, the degree of memory reactivation predicted participant's ability to later recollect a linked memory trace representation of across sequence of events, suggesting that a very rapid memory reinstatement at episodic boundaries of the just encoded sequence of events may help preserve a subjective sense of continuity of our past experience.

TALK 3: REACTIVATION OF PRIOR MENTAL STATES STRENGTHENS STATE-RELATED MEMORY REPRESENTATIONS AND INFLUENCES HOW NEW INFORMATION IS ENCODED

Lila Davachi[3]; [1]New York University

What is the long-term fate of encoded associative memories? How do these memories stabilize over time? I will present our recent work suggesting that initial memory traces subsequently become reactivated during post-encoding time periods. This reactivation is present both in local hippocampal activation patterns as well as in hippocampal-cortical connectivity patterns. Importantly, the extent of reactivation is related to later memory retrieval success, suggesting that reactivation contributes to memory consolidation. More recently, we have shown that patterns of brain activity can persist not only into immediate rest periods but also into more extended periods of online task performance. We show that this persistence can change the way new material is encoded and remembered, suggesting that cognitive states, more generally, can reactivate and alter how new representations are processed and encoded.

TALK 4: SLEEP AND MEMORY REACTIVATION: HOW YOUR SLEEP INFLUENCES WHO YOU ARE

Ken Paller[4]; [1]Northwestern University

Neuropsychology has provided a foundation for understanding human memory. Standard views of the core defect of amnesia postulate a failure in reactivating recent memories for facts and events (declarative memories). In this case, reactivation involves neocortical-hippocampal interaction as the hippocampus helps to link cortical information components together. Moreover, consolidation cannot progress normally without this reactivation. Memory stabilization and integration depend on repeated reactivation across protracted periods of time. Combining this conceptualization of the neural basis of declarative memory with the commonplace assumption that memories are reactivated during sleep, we postulated that one benefit of sleep arises through reactivation and consolidation (Paller, 1997; Paller & Voss, 2004). Accordingly, a fruitful avenue for the study of consolidation and its failure in disorders of memory is to examine memory reactivation during sleep. Correlations between measures of sleep physiology and retention have implicated slow-wave sleep in consolidation. To experimentally manipulate reactivation, sensory stimulation during sleep has been used to systematically modulate memory processing without causing awakening. For example, we have shown that sounds associated with spatial learning, when presented during slow-wave sleep, can reactivate specific memories formed prior to sleep. Using this method of Targeted Memory Reactivation (TMR), benefits have also been observed for skills and habits, and so are not restricted to declarative memory. A reasonable conclusion is that what we know and remember is partly a function of what happens while we are asleep. Different types of offline memory processing likely transpire during waking and during sleep, ultimately exerting a profound influence on learning. New opportunities for clinical and educational applications can now be explored by using TMR techniques to modify the consolidation of relevant memories during sleep. At the same time, basic research efforts aimed at elucidating the neural mechanisms of memory modification during sleep can help us understand how many types of learning depend on sleep-based memory reactivation.

Invited Symposium Session 3

THE NEUROSCIENCE OF SOCIOECONOMIC STATUS: SETTING THE AGENDA

Tuesday, April 5, 1:30 - 3:30 pm, Grand Ballroom West

Chair: Martha J. Farah, University of Pennsylvania

Speakers: Martha J. Farah, Kimberly G. Noble, Allyson P. Mackey, Bruce S. McEwen

Childhood socioeconomic status (SES) has lifelong effects on cognitive ability, mental health and physical health. In the past decade cognitive neuroscientists have begun to study SES and its neural correlates. The somewhat ambitious aim of this symposium is to push beyond the fascinating

but preliminary research phase of finding SES correlates in brain structure and function, and think about next steps for research in this area. After reviewing what is currently known we will ask: Where are the most critical gaps in our basic science knowledge? How can neuroscience be harnessed to address real-world SES disparities - in cognitive and language development, in school achievement and in health? The final panel discussion will take up the issue of where the field could and should go next, as well as the relevance of SES for cognitive neuroscientists studying development, aging, individual differences, and educational applications.

TALK 1: HOW, AND WHY, DOES BRAIN DEVELOPMENT DIFFER BETWEEN RICH AND POOR CHILDREN?

Martha J. Farah[1]; [1]University of Pennsylvania

A small but rapidly growing literature documents correlations between the SES of children's families and the structural and functional characteristics of children's brains. As an introduction to this symposium, I will review these findings, highlighting the encouraging consistencies among published findings as well as the still poorly understood inconsistencies. I will then turn to the question of mechanism: what causes the brain to develop differently in different socioeconomic environments? SES represents a complex bundle of potentially causal factors including stress, parenting behavior, toxin exposure, nutrition and prenatal influences, as well as inherited characteristics, and multiple SES-linked factors undoubtedly influence brain development. Research concerning these factors will be reviewed. Finally, I will note some of the scientific complexities and social challenges that arise in the neuroscience of socioeconomic status.

TALK 2: PUTTING NEUROSCIENCE TO WORK TO COMBAT THE EFFECTS OF POVERTY ON EARLY CHILDHOOD DEVELOPMENT

Kimberly G. Noble[2]; [1]Columbia University

We are now at an exciting juncture when the basic neuroscience of child poverty can inform the design and evaluation of intervention strategies aimed at improving children's cognitive and emotional development. But what is the right level at which to intervene? And how does neuroscience help answer this question? Three broad interventional approaches will be discussed. First, data will be reviewed on high-quality school-based interventions. Although often moderately effective, interventions that wait until school age are unlikely to reverse SES disparities in child development on their own, given the remarkable neural and psychological disparities that are seen as early as the second year of life. Second, data will be presented on interventions aimed at the "mediators" of SES disparities in early development, designed, for example, to improve responsive parenting or linguistic stimulation in the home. These, too, can be moderately effective, though often suffer from attrition and can be difficult to scale up. Finally, interventions targeting socioeconomic disparities at the most distal level – that is, by reducing poverty itself – will be considered. Data from a pilot study of the first randomized clinical trial of poverty reduction will be presented, demonstrating the feasibility of this approach. While income alone may not be the only or even the most important factor determining children's trajectories, it may be the most manipulable from a policy perspective. The role of neuroscience in suggesting interventions and providing biomarkers for assessing their efficacy will be discussed.

TALK 3: CLOSING THE INCOME ACHIEVEMENT GAP: INSIGHTS FROM COGNITIVE NEUROSCIENCE

Allyson P. Mackey[3]; [1]Massachusetts Institute of Technology

The income gap in academic achievement is a pervasive problem, with broad lifelong consequences. However, very little is understood about how SES shapes brain development, and in turn, how brain structure and function support learning in school. I will present our recent work on relationships between academic achievement and brain structure in socioeconomically diverse samples. These data provide biological correlates of the income achievement gap, and potential biomarkers for academic interventions. Future studies with longitudinal academic and brain data will be necessary to better understand how brain changes support academic changes (and vice versa). While the basic science continues to develop, we are also engaging with school leaders to select research questions of pressing translational importance, and to develop and evaluate interventions based on the current state of the science, even if it is in its infancy.

TALK 4: CENTRAL ROLE OF THE BRAIN IN STRESS AND ADAPTATION: HOW INEQUALITY GETS "UNDER THE SKIN"

Bruce S. McEwen[4]; [1]The Rockefeller University

The brain is the central organ of stress because it interprets what is stressful and determines behavioral and physiological responses. Besides major life events, the aggravations of daily life drive physiological systems, causing "wear and tear" or "allostatic load" and "overload." This reflects the impact of life experiences interacting with genes ("epigenetics") and the epigenetic effects of individual life-style habits such as sleep; diet, exercise and substance abuse; and adverse childhood experiences that set life-long patterns of behavior and physiological reactivity. There are also effects of toxic agents in the environment and social ordering associated with gradients of disease, with an increasing frequency of mortality and morbidity as one descends the scale of socioeconomic status. Hormones associated with stress and allostatic load are adaptive in the short-run but in the long run overuse and dysregulation cause allostatic overload and remodeling of brain architecture. This is particularly evident in the hippocampus, where dendrites shrink, spine synapses are lost and neurogenesis is suppressed. The amygdala and prefrontal cortex, involved in anxiety, fear, mood, cognition and self-regulation, also show structural plasticity. Moreover, adverse early life experience, often associated with low SES, interacting with alleles of certain genes, produces

lasting effects on brain and body via epigenetic mechanisms. Evidence from human brain imaging and animal models will be presented and discussed together with strategies for prevention and amelioration. By revealing mechanisms of health disparities, neuroscience is pointing the way to new biomarkers and new therapeutic targets to protect the health of low SES individuals.

Invited Symposium Session 4

DYNAMIC NEURAL CODING FOR FLEXIBLE COGNITION

Tuesday, April 5, 1:30 - 3:30 pm, Sutton Center

Chair: Mark Stokes, Univ of Oxford

Speakers: Robert Knight, Mark Stokes, Sabine Kastner, Omri Barak

Brain activity is highly dynamic. Although time-variability is often treated as measurement noise, new analytic approaches are starting to provide new insights into how complex neural dynamics contribute to adaptive behaviour. The key challenge at this juncture is to integrate theoretical concepts and empirical insights across various traditions (e.g., human to animal models) and biological scales (synapse to whole-brain networks) for a systems-level understanding of dynamic coding for flexible cognition. Cognitive flexibility presents a particular challenge in neuroscience. The same neural systems must be able to process information in different ways, depending on the myriad contextual contingencies that determine the appropriate input/output mapping in a particular situation. Although it is sometimes tempting to consider the brain like a circuit board, with a set repertoire of input/output behaviours determined by structural pathways; overlaid upon the structural substrate of neuronal connections are the functional dynamics that also influence of information processing. Orchestrated changes in the functional state of a network could be especially important for high level cognitive functions, including task-dependent perception, working memory and flexible decision-making. In this symposium, we will consider potential mechanisms underpinning dynamic coding for flexible cognition. Speakers from complementary perspectives will present their latest research, from computational modelling and population-level analyses in non-human primates to larger-scale network dynamics in the human brain.

TALK 1: FRONTAL CORTEX DEPENDENT NETWORKS SUPPORTING FLEXIBLE BEHAVIOUR

Robert Knight[1]; [1]UC Berkeley

Humans rapidly and flexibly respond to ever-changing environmental demands. Abundant animal electrophysiological and human neuroimaging research points to a central role of prefrontal regions in regulating goal-directed behaviour. Notably, prefrontal dysfunction is central to numerous neurological, psychiatric and developmental disorders. Damage restricted to human lateral prefrontal regions results in profound deficits in cognitive capacity whereas orbital prefrontal damage leads to devastating problems in social discourse. How are these diverse control functions enabled? Intracranial recording of human cortical (electrocorticography; ECoG) and depth (stereoencephalography; SEEG) neural activity provides a unique window into the mechanisms of goal-directed behaviour with unprecedented spatial (sub-centimetre) and temporal (sub-second) resolution. Here we review the key role of high frequency oscillations (high gamma, HG; 7-200 Hz) as an index of local cortical excitability and provides a bridge between human and animal research. This local activity is embedded in distributed neural circuits measured with connectivity metrics including phase locking and graph theoretical approaches. The degree of local HG activity is tuned by the phase of lower frequency oscillations and provides a measure of information flow in rapidly reconfiguring dynamic neural networks. Combing these intracranial approaches provides insights into how neural networks emerge to support both cognitive and social abilities. Evidence will be provided that similar electrophysiological mechanisms support both lateral and orbital frontal capacity in humans. Critically, prefrontal sustained activity measured by intracranial recordings predicts response timing with near perfect accuracy highlighting the central role of prefrontal cortex in linking human perception and action in the sub-second temporal domain.

TALK 2: DYNAMIC CODES AND STABLE REPRESENTATIONS FOR WORKING MEMORY AND FLEXIBLE DECISION-MAKING

Mark Stokes[1]; [1]Oxford University

Brain activity is highly dynamic, yet often it is important to maintain a stable cognitive state. We will consider how complex neural dynamics could be helpful for maintaining stable representations in working memory. First, we examine the basic neurophysiological mechanisms that underpin dynamic coding in primate prefrontal cortex. A combination of single unit statistics, population-level state-space analyses and data-driven simulations highlights the importance of a non-stationary neural subpopulation involved throughout working memory, as well as rapid qualitative changes in neural selectivity during encoding and maintenance. Next, we apply representational similarity analysis to show that these dynamics nevertheless yield stable cognitive representations. Finally, we propose a theoretical model for working memory. From a dynamic coding perspective, task-relevant activity in frontal cortex drives a cascade of neural states that modulate the response profile of the network. History-dependent changes in the underlying neural state result in context-dependent processing of subsequent stimuli, such as a memory probe, thus resulting in a systematic memory-dependent response. We further consider how a similar mechanism could underpin flexible decision-making.

TALK 3: NEURAL NETWORK DYNAMICS FOR ATTENTIONAL SELECTION IN THE PRIMATE BRAIN

Sabine Kastner[1]; [1]Princeton University

Natural scenes are cluttered and contain many objects that cannot all be processed simultaneously due to capacity limitations of the visual system. Selective attention refers to a set of mechanisms that route behaviourally relevant information through large-scale cortical networks. I will discuss studies performed in two primate brain models, the human and the macaque monkey, using a variety of different techniques including fMRI, ECoG and single-cell physiology. First, I will discuss how large-scale networks mediating perception and cognition can be identified using functional brain imaging. Second, I will discuss physiology studies revealing temporal dynamics in a distributed large-scale network that mediates the selection of behaviourally relevant information. And third, I will present results from primate posterior parietal cortex revealing common neural mechanisms for attentional selection that are closely related to behavioural outcome. Together, these comparative electrophysiology studies begin to identify commonalities and differences in attention mechanisms across primate species.

TALK 4: MODELLING NEURAL DYNAMICS UNDERLYING FLEXIBLE RESPONSE CRITERION

Omri Barak[1], Federico Carnevale[2], Victor de Lafuente[3], Ranulfo Romo[3], Nestor Parga[2]; [1]Technion–Israel Institute of Technology, [2]Universidad Autonoma de Madrid, [3]Universidad Nacional Autonoma de Mexico

Under uncertainty, the brain uses previous knowledge to transform sensory inputs into the percepts on which decisions are based. When the uncertainty lies in the timing of sensory evidence, however, the mechanism underlying the use of previously acquired temporal information remains unknown. We study this issue in monkeys performing a detection task with variable stimulation times. We use the neural correlates of false alarms to infer the subject's response criterion and find that it modulates over the course of a trial. Analysis of premotor cortex activity shows that this modulation is represented by the dynamics of population responses. A trained recurrent network model reproduces the experimental findings, and demonstrates a novel neural mechanism to benefit from temporal expectations in perceptual detection. Previous knowledge about the probability of stimulation over time can be intrinsically encoded in the neural population dynamics, allowing a flexible control of the response criterion over time. Omri Barak, Co authors: , , Instituto de Neurobiologia, , Queretaro 76230, Mexico , Instituto de Fisiologia Celular-Neurociencias, Universidad Nacional Autonoma de Mexico, 04510 Mexico DF, Mexico , Departmento de Fisica Teorica, Universidad Autonoma de Madrid, Cantoblanco 28049, Madrid, Spain

Symposium Sessions

#	Title	Date	Time	Location
1	20 years of resting-state: contributions to understanding cognition	Sunday, April 3	1:30 - 3:30 pm	Grand Ballroom East
2	The role of amplitude, phase, and rhythmicity of neural oscillations in top-down control of cognition	Sunday, April 3	1:30 - 3:30 pm	Sutton Center
3	Metacognitive neuroscience: How the human brain reflects on cognition, perception and action	Sunday, April 3	1:30 - 3:30 pm	Grand Ballroom West
4	From prediction error to control: Neurobiological and computational accounts of Prefrontal Cortex	Monday, April 4	10:00 am - Noon	Grand Ballroom East
5	Memory retrieval as a guide along the winding road of memory formation	Monday, April 4	10:00 am - Noon	Sutton Center
6	Multisensory integration: neural mechanisms, computational operations and behaviour	Monday, April 4	10:00 am - Noon	Grand Ballroom West
7	Human Intracranial Electrophysiology: A New Era	Tuesday, April 5	10:00 am - Noon	Grand Ballroom West
8	Taking stock of cognitive training: theory, neural mechanisms and application	Tuesday, April 5	10:00 am - Noon	Beekman
9	Affective-motivational salience and attentional sets	Tuesday, April 5	10:00 am - Noon	Sutton Center

Symposium Session 1

20 YEARS OF RESTING-STATE: CONTRIBUTIONS TO UNDERSTANDING COGNITION

Sunday, April 3, 1:30 - 3:30 pm, Grand Ballroom East

Chair: Bharat Biswal, New Jersey Institute of Technology

Co-Chair: Michael Cole, Rutgers University

Speakers: Bharat Biswal, Michael Cole, Sepideh Sadaghiani, Bart Rypma, Alan Anticevic

Resting state functional connectivity (RSFC) approaches, first developed 20 years ago, encountered significant resistance for almost a decade and have remain a source of controversy to this day. Despite these controversies, recent years have witnessed an exponential increase in studies of functional connectivity. While initial papers focused primarily on the development and refinement of RSFC methodologies, more recent work has focused on applications of resting state approaches to cognitive neuroscience and clinical questions. In this proposal several applications of resting state to cognitive neuroscience are presented. The first talk reviews studies reporting strong relationships between RSFC and task fMRI. We propose that a systematic exploration of the symbiotic relationship between Rest-Task fMRI will offer methods to combine these two modalities to address important questions in clinical and basic neuroscience research corresponding to the brain basis of cognition. In the second talk, we will discuss the authors' recent finding that resting state network architecture is present across a wide variety of tasks, suggesting the general functional relevance of resting state networks. These results shed new light on the relationship between spontaneous and task-relevant brain processes underlying cognition. In the third talk, the authors will report an investigation into the behavioral relevance of dynamic shifts in RSFC, finding that such spontaneous shifts can predict subsequent changes in behavioral performance. The final talk considers clinical applications of RSFC, specifically reviewing work linking cognitive task-based and resting-state approaches via computational modeling and pharmacology with a specific focus on understanding these processes in psychiatric illness.

TALK 1: RESTING STATE AND COGNITION: A BRIEF OVERVIEW

Bharat Biswal[1], Xin Di[1]; [1]New Jersey Institute of Technology

Resting-state fMRI (R-fMRI) has been used as an alternative to the conventional task-based fMRI (T-fMRI) since it requires minimal cognitive or behavioral demand by the subject and can be used in different populations. R-fMRI measures have been thought to reflect the spontaneous or 'baseline' neuronal activity while T-fMRI activations may reflect the dynamic neuronal activities in response to an extrinsic demand. Even though cognitive processes are usually studied using T-fMRI by manipulating different cognitive states, an emerging line of studies have been trying

to map cognitive states with brain regions and connectivity using R-fMRI. Such studies usually correlate individual differences of cognitive performance to regional and connectivity measures in resting-state. We will give an overview of such studies, and discuss the relationships between these studies and T-fMRI results. More importantly, we propose that a systematic exploration of the symbiotic relationship between R-T fMRI will offer methods to combine the two fMRI modalities to address important questions in clinical and neuroscience research corresponding to individuality and variability.

TALK 2: THE COGNITIVE RELEVANCE OF RESTING-STATE FMRI: SPONTANEOUSLY ORGANIZED NETWORKS AND BRAIN STATES ACROSS REST AND TASK

Michael Cole[1], Doug Schultz[1], Richard Chen[1], Kaustabh Kulkarni[1], Takuya Ito[1]; [1]Center for Molecular and Behavioral Neuroscience, Rutgers University, Newark, NJ

Resting state functional connectivity MRI is increasingly used to characterize functional networks in the human brain. We recently found that the resting state network architecture is present across a wide variety of tasks, suggesting the general functional relevance of resting state networks. This illustrates the importance of better understanding the processes underlying the organization of resting state neural activity, as well as how such spontaneous processes affect task-related brain activity. We have taken several approaches to accomplishing these goals. First, we have identified individual difference correlations between the brain's network architecture and cognitive abilities. Second, we have expanded into the realm of multivariate activity patterns, mapping functional connectivity patterns to activity patterns as well as identifying brain state dynamics through time in terms of activity patterns during rest and task. Together these approaches shed new light on the relationship between spontaneous and task-relevant brain processes underlying cognition.

TALK 3: DYNAMIC FUNCTIONAL CONNECTIVITY AND BEHAVIORAL VARIABILITY

Sepideh Sadaghiani[1], Jean-Baptiste Poline[2], Andreas Kleinschmidt[3], Mark D'Esposito[2]; [1]Stanford University, [2]University of California Berkeley, [3]University of Geneva

A large proportion of brain activity is not directly evoked by specific external events. Nevertheless, the role of this ubiquitous ongoing activity in cognition is largely unknown. Ongoing activity is correlated across distant brain regions within large-scale networks and thought to reflect neural communication or functional connectivity. Strength and spatial organization of functional connectivity as measured with fMRI change dynamically over seconds to minutes. We investigated the behavioral relevance of these dynamic shifts by applying MVPA to functional connectivity patterns during long pre-stimulus periods (>30s) unaffected by stimulus-evoked neural responses. The functional connectivity state before presentation of a faint stimulus predicted whether the participant was going to perceive or miss the stimulus on a given trial. Using graph theory, we compared topology of functional connectivity prior to the two perceptual outcomes. Connectivity states preceding missed stimuli showed weakened modular structure, in which connectivity was more random and less conforming to the intrinsic organization of large-scale networks. These findings show that ongoing brain connectivity dynamics can explain variability in behavior. This result supports a view in which ongoing neural activity and connectivity play an active role in cognition. In this view ongoing functional connectivity represents the internal model of the brain to predict regularities in the external world. With sensory information always being limited and often sparse, this internal predictive model enables the brain to construct perception and generate action.

TALK 4: CORTICAL NETWORK EFFICIENCY UNDERLIES INDIVIDUAL DIFFERENCES IN PROCESSING SPEED

Bart Rypma[1]; [1]University of Texas at Dallas

Recent advances in neuroimaging have permitted testing of hypotheses regarding the neural bases of individual differences, but this literature has been characterized by inconsistent results. We hypothesized that one source of between study variability could be between-sample differences in resting and task-based network activity. To test this hypothesis we had participants perform rest and a cognitive task during fMRI scanning. We examined connectivity in frontal and parietal regions during a resting task and a digit--symbol visual search task. Our results showed (1) significant differences in numbers of frontoparietal connections between rest and task, (2) faster participants showed more rest-related activity than slower participants, but less visual-search activity, and (3) connectivity increases in prefrontal, temporal, and parietal nodes were associated with increases in reaction time. These results suggest that relatively low-demand cognitive performance depends on spontaneous fluctuating network activity, whereas high-demand performance depends on a more limited, unidirectional network. The nature of brain-behavior relationships may vary depending on the extent of cognitive demand. Individual differences in cognitive efficiency may vary with the extent of frontoparietal connectivity. High-demand network activity may reflect the extent to which individuals require top-down executive guidance of behavior for successful task performance. Low-demand network activity may reflect task- and performance monitoring that minimizes executive requirements for guidance of behavior.

TALK 5: LINKING COGNITIVE TASK-BASED AND RESTING-STATE APPROACHES VIA COMPUTATIONAL MODELING TO UNDERSTAND PSYCHIATRIC ILLNESS

Alan Anticevic[1], G Yang[1], J Murray[1]; [1]Yale University, Department of Psychiatry, New Haven, CT

Understanding neural mechanisms that produce task-based and resting-state computations presents a fundamental problem for systems neuroscience. Furthermore, there has been a massive proliferation of both task-evoked and resting-state neuroimaging in psychiatry, often treating

these two modalities as separate. Concurrently, psychiatric disorders are not conceptualized as reflecting distinct abnormalities during task versus rest. Put simply, the same mechanistic disruptions should explain both task-based and resting-state abnormalities. This presentation highlights the utility of using biophysically grounded computational modeling to simulate both task-based and resting-state regimes while generating mechanistic predictions across states following parsimonious synaptic-level manipulations. The presentation also highlights novel resting-state and task-based effects in schizophrenia – a severe psychiatric condition that profoundly affects cognitive processing and resting-state connectivity patterns. In turn, the presentation highlights complementary results following NMDA receptor antagonism via acute ketamine administration – a pharmacological manipulation known to affect both cognitive processing and resting-state functional connectivity via a mechanism that can be captured computationally, namely alterations in excitation/inhibition balance. Specifically, results using a delayed working memory task are discussed across both pharmacological and clinical experiments. Collectively, a framework is presented for how to 'unify' observations across task and resting-state using a computational framework that can give rise to both resting- and task-based observations.

Symposium Session 2

THE ROLE OF AMPLITUDE, PHASE, AND RHYTHMICITY OF NEURAL OSCILLATIONS IN TOP-DOWN CONTROL OF COGNITION

Sunday, April 3, 1:30 - 3:30 pm, Sutton Center

Chair: Jason Samaha, University of Wisconsin-Madison

Co-Chair: Ali Mazaheri, University of Birmingham

Speakers: Mathilde Bonnefond, Alexander Sack, Ali Mazaheri, Jason Samaha, Bradley Voytek

Central to cognition is the regulation of information flow across different regions of the brain. The temporal coordination of neural oscillations has been proposed to play a key role in communication between brain regions and in anticipatory and predictive processes. This symposium will present new empirical and theoretic evidence suggesting that 1) various key spectral dynamics (i.e., phase, amplitude, degree of rhythmicity) of oscillations are important for regulating information flow across the cortex and, 2) top-down control over neural oscillations via temporal expectation and attention can bias processing in a goal-directed manner. Bonnefond will begin with evidence that the phase of visuocortical alpha-band oscillations may act as a gating mechanism in the service of anticipatory processing, with a role for left prefrontal cortex as the 'source' of such top-down control. Sack will discuss examples of oscillatory phase biases on perception in the context of temporally predictable cross-modal stimuli. Mazaheri will provide evidence that modulating the rhythmicity of lower frequency oscillations could be a mechanism to reduce maladaptive connectivity across the brain. Samaha will present work suggesting that alpha-band oscillations reflect discreet epochs of visual processing that can be guided by temporal predictions. Finally, Voytek will close with a computational account of oscillatory communication and present invasive and non-invasive electrophysiological recordings in humans demonstrating goal-directed modulated of neural communication in frontal cortex and implications for neuropathology. This survey of the field will cover many recent advances in understanding neural communication, top-down control, and human cognition and will highlight areas of active debate and avenues for further research.

TALK 1: LEFT PREFRONTAL CORTEX CONTROLS ALPHA PHASE ADJUSTMENT IN ANTICIPATION OF PREDICTABLE STIMULI

Mathilde Bonnefond[1], Rodolfo Solis-Vivanco[2], Ole Jensen[1]; [1]Donders Institute for Brain, Cognition and Behaviour, Radboud University, Nijmegen, [2]Instituto Nacional de Neurologia y Neurocirugia, Tlalpan, Mexico

While it is now consensual that alpha power (8-12Hz) can adjust in anticipation of incoming information, it remains unclear whether alpha phase can adjust as well. I will present the results of two magnetoencephalography experiments showing that alpha power and alpha phase, in visual areas, are being adjusted in anticipation of both irrelevant and relevant visual information. These adjustments prevented/optimized the processing of irrelevant/relevant stimuli as assessed by performance and stimulus-induced activity. In addition, we found in both experiments that alpha oscillations in the left prefrontal cortex controlled the adjustment of alpha phase in visual areas. The anticipatory power and phase adjustments add to the computational versatility of the alpha rhythm, since it allows for adjusting the processing capabilities of the visual system on a fine temporal scale.

TALK 2: THE ROLE OF OSCILLATORY PHASE FOR ENCODING CONSISTENT TEMPORAL STATISTICS

Alexander Sack[1,2], Sanne ten Oever[1,2]; [1]Maastricht University, Netherlands, [2]Maastricht Brain Imaging Center

Perception of temporally predictive events is enhanced by aligning high excitable phases of ongoing oscillations to the upcoming event. This mechanism has been shown useful to proactively improve perception in an environment that dynamically changes its temporal statistics. However, some temporal statistics are very consistent. For example in audiovisual speech there is a consistent relationship between the onset of lip movements and the onset of speech sounds such that different syllables have distinct visual-to-auditory onset delays. We show that these consistent delays bias participants' perception. Moreover, ongoing oscillatory phase biases the perception of these syllables in the absence of visual input. This data show that consistent temporal information gets wired on oscillatory properties and provide a unique way to categorize information.

TALK 3: THE "RHYTHMICITY" OF OSCILLATIONS IN NEURONAL COMMUNICATION AND TEMPORAL EXPECTATION

Ali Mazaheri[1]; [1]University of Birmingham, Birmingham, UK

Cognition and behaviour are believed to emerge from widespread, often transient, neuronal interactions in the brain. Some of these interactions are captured in the oscillatory activity present in EEG and MEG measurements. The phase-angle of these oscillations has been suggested to reflect the transient inhibitory and excitatory state of the underlying networks producing them. Furthermore, neuronal communication between networks has been suggested to be subserved by the phase-coupling of oscillations in sending and receiving regions. Using this framework, the first part of my talk will focus on new evidence that the disruption in the rhythmicity of an oscillation through external neuro-modulation such as deep-brain stimulation could lead to a reduction in pathological network 'over-connectivity' and translate to therapeutic improvements in disorders such as Parkinson's and treatment of refractory obsessive compulsive disorder. The second part of my talk will focus on whether the phase of ongoing oscillations could be modulated by endogenous factors such as temporal expectation. Here, in contradiction to some of the other findings that will be presented by my colleagues in this symposium I will be providing evidence against the hypothesis that the phase of alpha activity could be modulated by top-down expectation. I will attempt to address some of the possible theoretical and methodological issues underlying this discrepancy.

TALK 4: THE ROLE OF ALPHA-BAND OSCILLATIONS IN TEMPORAL PREDICTION AND PERCEPTION.

Jason Samaha[1], Bradley Postle[1]; [1]University of Wisconsin-Madison

The phase of ongoing posterior alpha-band oscillations has been shown to predict the perception of near-threshold visual stimuli and subsequent cortical information flow. These observations have motivated the hypothesis that alpha-band rhythms reflect discreet "windows" of visual processing. In two studies, we investigated, 1) whether alpha-band phase can be guided by top-down control according to temporal predictions and 2), whether the frequency of alpha rhythms is related to the temporal resolution of visual perception. We found that when subjects were provided with cues predictive of the moment of visual target onset, discrimination accuracy improved and targets were more frequently reported as consciously seen. This effect was accompanied by a significant shift in the phase of alpha-band oscillations, prior to target onset, toward each individual's optimal phase for stimulus discrimination. If alpha-band oscillations do reflect phasic windows of visual processing, then the frequency of the oscillation should predict the temporal resolution of visual perception. In our second experiment, we measured two-flash fusion thresholds and identified the peak alpha frequency of our observers. We found a high correlation between the measures, such that individuals with higher alpha frequencies showed lower fusion thresholds, indicating a finer-grained temporal resolution of visual perception. Additionally, trial-to-trial variation in prestimulus alpha frequency predicted two-flash discrimination accuracy. Taken together, our results suggest that neural activity in the alpha-band may reflect discreet visual computations, the timing of which can be guided by temporal predictions so as to optimally process predicted visual information.

TALK 5: NOISY OSCILLATORY NETWORKS IN COGNITION

Bradley Voytek[1], Erik Peterson[1]; [1]University of California, San Diego, USA

Humans have an interesting capacity for maintaining multiple behavioral goals at different timescales--from the control of immediate actions to holding more abstract long-term goals in mind. This process requires the coordination of many partially overlapping functional brain networks. Neural oscillations are often modeled as a major driver in the formation of such networks, acting under the assumption that information flow is enhanced when low frequency oscillations synchronize neural firing. Surprisingly, the biological feasibility of this assumption is largely untested. Here I introduce a novel computational model for oscillatory neural communication. I show that it is the kind of excitatory-inhibitory coupling that matters most, not the degree of coupling as has been previously suggested. When the coupling between a low frequency oscillation and neural spiking is driven by a model of balanced excitatory-inhibitory inputs, information flow is enhanced. In contrast, when coupling is unbalanced, driven either by excessive excitation or inhibition, information flow is obstructed. Additionally, using a combination of invasive and non-invasive human electrophysiology, I provide evidence that interregional oscillatory coupling coordinates brief windows of spiking activity between frontal subregions. This interregional communication occurs in a noisy neuronal environment, and I show how age-related changes in neuronal noise diminish neural communication and mediate age-related working memory impairments. Numerous neuropathologies, including Parkinson's disease, schizophrenia, and autism, are associated with oscillatory disruptions and excitation-inhibition imbalances. Understanding the distinction between balanced and unbalanced oscillatory coupling offers a unifying mechanistic framework for understanding effective neural communication and its disruption in neuropathology.

Symposium Session 3

METACOGNITIVE NEUROSCIENCE: HOW THE HUMAN BRAIN REFLECTS ON COGNITION, PERCEPTION AND ACTION

Sunday, April 3, 1:30 - 3:30 pm, Grand Ballroom West

Chair: Stephen Fleming, University College London

Speakers: Biyu He, Hakwan Lau, Steve Fleming, Louise Goupil, Lisa Son

Metacognition refers to the ability to self-evaluate and control one's performance on a task in the absence of external feedback. Recently metacognition has become a focus of study in the cognitive neurosciences, spurred by the development of simple psychophysics paradigms and computational models to study the building blocks of self-evaluation including confidence, error detection and judgments of learning. This symposium will showcase emerging metacognitive neuroscience research on how various forms of self-evaluation are instantiated in the human brain. Biyu He will demonstrate the use of visual psychophysics to decorrelate objective performance, subjective awareness and metacognitive confidence, and show how these behavioural measures map onto distinct spatiotemporal signatures of brain activity. Hakwan Lau will harness the power of multivoxel neurofeedback to selectively manipulate confidence levels, thereby isolating the neural substrates of metacognitive computation. Steve Fleming will explore the role of action outputs in the construction of metacognitive confidence through experiments applying transcranial magnetic stimulation to the motor system during perceptual judgments. Louise Goupil will show that metacognitive mechanisms are intact early in development, harnessing non-verbal measures and electroencephalography to show correlates of confidence and error detection in 12-18 month old infants. Together these talks will illuminate our emerging understanding of the neural basis of metacognition, and demonstrate experimental techniques for its study in a variety of domains.

TALK 1: SPATIOTEMPORAL DISSOCIATION OF BRAIN ACTIVITY UNDERLYING SUBJECTIVE AWARENESS, OBJECTIVE PERFORMANCE AND CONFIDENCE

Biyu He[1]; [1]National Institutes of Health

Despite intense recent research, the neural correlates of conscious visual perception remain elusive. The most established paradigm for studying brain mechanisms underlying conscious perception is to keep the physical sensory inputs constant and identify brain activities that correlate with the changing content of conscious awareness. However, a contrast based on conscious content alone would not only reveal brain activities directly contributing to conscious perception, but also include brain activities that precede or follow it. To address this issue, we adopted a paradigm whereby we collected, trial-by-trial, measures of objective performance, subjective awareness and the confidence level of subjective awareness. Using magnetoencephalography (MEG) recordings in healthy human volunteers, we dissociated brain activities underlying these different cognitive phenomena. Our results provide strong evidence that widely distributed slow cortical potentials (SCPs) correlate with subjective awareness, even after the effects of objective performance and confidence were both removed. The SCP correlate of conscious perception manifests strongly in its waveform, phase and power. By contrast, objective performance and confidence were both contributed by relatively transient brain activity. Source activity correlated with confidence first appeared in the dorsal parietal cortex at around 200 ms. It then moved anteriorly and had widespread frontoparietal distribution at ~500 ms. The activity was restricted to posterior brain regions at ~750 ms and dissipated thereafter. It reappeared around central and frontal cortices at 2 ~ 2.5 sec, possibly in anticipation of the upcoming responses to questions. These results shed new light on the brain mechanisms of conscious, unconscious and metacognitive processing.

TALK 2: MULTIVOXEL NEUROFEEDBACK SELECTIVELY MODULATES CONFIDENCE WITHOUT CHANGING PERCEPTUAL PERFORMANCE

Hakwan Lau[1]; [1]UCLA

A central controversy in current studies of metacognition concerns whether confidence directly reflects the reliability of a perceptual (or cognitive) process, as suggested by normative models. The affirmative view enjoys popularity in both the computational and animal literatures, but it has also been suggested that confidence may depend on a late-stage estimation process dissociable from actual reliability. Yet, at least in humans, experimental tools have lacked the precision to resolve these issues convincingly. Here we overcome this challenge by employing the recently-developed method of decoded neurofeedback (DecNef), in order to systematically manipulate multivoxel correlates of confidence in a fronto-parietal network. Our results provide clear evidence that confidence can be dissociated from perceptual performance; we selectively manipulated the former without changing the latter. Further psychophysical analysis rules out accounts based on simple shifts in criterion or reporting strategy for confidence. These findings challenge the current dominant views of confidence and metacognition. Using the same technique of decoded neurofeedback, in another study we show that it can be used to partially erase fear memory, demonstrating its potential for a variety of novel applications.

TALK 3: UNPACKING THE INPUTS TO METACOGNITIVE COMPUTATION: THE ROLE OF ACTIONS IN PERCEPTUAL CONFIDENCE

Steve Fleming[1]; [1]University College London

Theoretical models often assume that decision confidence is related to the quality or strength of the inputs to the system, such as the strength of a visual stimulus. Counter to this intuitive view here we show that motor outputs also contribute to judgments of perceptual confidence. In two experiments we used transcranial magnetic stimulation

(TMS) to manipulate response-specific representations in the premotor cortex, selectively disrupting post-decision confidence in visual discrimination judgments. Specifically, stimulation of the motor representation associated with the unchosen response reduced confidence in correct responses, thereby reducing metacognitive capacity without changing visual discrimination performance. Effects of TMS on confidence were observed when stimulation was applied both before and after the response occurred, which suggests that confidence depends on late-stage metacognitive processes. In the second part of my talk I will discuss these findings from the perspective of a novel computational framework in which self-evaluation during decision-making operates as a second-order inference about a coupled but distinct decision system, equivalent to inferring the performance of another actor. This framework explains why action outputs play a causal role in the construction of confidence.

TALK 4: INFANTS MONITOR THEIR CONFIDENCE AND ERRORS DURING DECISION-MAKING

Louise Goupil[1], Sid Kouider[1]; [1]CNRS/EHESS/ENS-DEC, Paris

Humans adapt their behaviour not only by observing the consequences of their actions, but also by internally monitoring their performances. Because these metacognitive abilities are typically assessed through explicit self-reports, they are usually denied to young children, who can hardly verbalise their own cognitive states. Yet, recent research revealed that basic metacognitive mechanisms, such as decision confidence and error monitoring, reduce to simple computational mechanisms, and can be observed in non-verbal organisms such as rats and monkeys. Whether these basic metacognitive abilities are also present in early stages of human development, or emerge later with the capacity to report cognitive states remains unknown. Here, by relying on non-verbal indices, we show that 12 and 18 month-old infants internally monitor the accuracy of their own decisions. At the behavioural level, infants showed increased persistence in their initial choice after making a correct as compared to an incorrect response, evidencing an appropriate evaluation of decision confidence. At the neural level, we found that a well-established electrophysiological signature of error monitoring in adults, the error-related negativity, is similarly elicited when infants make an incorrect choice. Hence, although explicit forms of metacognition mature later during childhood, infants already estimate decision confidence, monitor their errors, and use these implicit metacognitive evaluations to regulate subsequent behaviour.

TALK 5: DISCUSSION

Lisa Son[1]; [1]Barnard College

Lisa Son will act as a discussant for the symposium, drawing together strands of each presentation and setting them into the wider context of research on human and comparative metacognition. We will allow time for Q&A with all presenters.

Symposium Session 4

FROM PREDICTION ERROR TO CONTROL: NEUROBIOLOGICAL AND COMPUTATIONAL ACCOUNTS OF PREFRONTAL CORTEX

Monday, April 4, 10:00 am - Noon, Grand Ballroom East

Chair: Eliana Vassena, Ghent University

Speakers: Benjamin Hayden, Joshua Brown, William Alexander, Eliana Vassena, Anne Collins

Prefrontal cortex (PFC) has long been recognized as the locus of higher-level cognitive processes guiding human behavior, yet the neurophysiological mechanisms underlying such complex computations remain elusive. Two sub-regions of PFC, dorsolateral PFC (DLPFC) and Anterior Cingulate Cortex (ACC, also referred to as medial PFC) have emerged as critical components of the neural network involved in cognitive control and decision-making. ACC has been implicated in error monitoring, conflict processing, and effortful control, while DLPFC is involved in task-set representation and working memory. Beyond the functional characterization of these regions separately, the goal of this symposium is to provide the latest insights on how these regions interact to support cognitive control from the perspective of prediction and prediction error. Benjamin Hayden will discuss data from studies in monkeys showing how ACC prediction and control signals arise from a combination of single-neuron encoded variables. Joshua Brown will present findings from a computational model detailing how prediction and prediction error signals generated in ACC govern value-based strategic behaviors. William Alexander will present evidence from computational modeling showing that the interaction of DLPFC and ACC can be understood in terms of progressively more abstract hierarchies of predictions and prediction errors. Eliana Vassena will demonstrate ACC and DLPFC involvement in both prediction and control, and show how a prediction account can explain neural and behavioral effects in effort-based decision-making and task-preparation. Finally, Anne Collins will discuss computational modeling and EEG results emphasizing the importance of prediction error in structure learning and generalization in complex environments.

TALK 1: DEMAND FOR CONTROL REDUCES CODING SPARSENESS IN DORSAL ANTERIOR CINGULATE CORTEX

Benjamin Hayden[1]; [1]University of Rochester

Factors that elicit control—such as conflict and surprise—enhance BOLD responses in dorsal anterior cingulate cortex (dACC) but do not consistently drive single neurons. Possible explanations for this discrepancy include species differences, anatomical differences, and task and training differences. We hypothesize instead that the discrepancy reflects that way that neural signals are aggregated in creating the BOLD. Specifically, we hypothesize that increases in BOLD activity can reflect broader recruitment of neurons

that represent context and strategy variables. In a new gambling task, we found that decisional conflict and surprising outcomes (both presumed to drive control) weakly and inconsistently affected single neurons, but reliably reduced population sparseness—a measure of neuronal recruitment. Moreover, selectivity for these two factors was highly positively correlated with selectivity for context and strategy on a cell-by-cell basis. These findings endorse the hypothesis that aggregate control signals do not require control-sensitive neurons, and suggest that these signals may be a consequence, not a direct cause, of control. A simple computational model, where cells are more broadly tuned to task variables in control-demanding trials than in easy trials, explains our findings.

TALK 2: HOW DOES THE ANTERIOR CINGULATE CORTEX CONTROL VALUE-BASED DECISION-MAKING?

Joshua Brown[1]; [1]Indiana University

Recent work on the role of the anterior cingulate cortex (ACC) in cognition has focused on choice difficulty, action value, risk avoidance, conflict resolution, and the value of exerting control among other factors. A main underlying question is what are the output signals of the ACC, and relatedly, what is their effect on downstream cognitive processes? Here we propose a model of how ACC influences cognitive processing in other brain regions that choose actions. The model builds on the earlier PRO model and suggests that ACC learns to represent specifically the states in which the potential costs or risks of an action are high, on both short and long time scales. It then uses those cost signals as a basis to bias decisions to minimize losses while maximizing gains. The model simulates both proactive and reactive control signals and accounts for a variety of empirical findings regarding value-based decision-making.

TALK 3: REPRESENTATIONS OF PREDICTION ERROR IN COGNITIVE CONTROL

William Alexander[1]; [1]Ghent University

Prediction error is a critical and pervasive signal observed throughout the brain, from regions involved in low-level sensory processing to those implicated in high-level cognitive behaviors. In most frameworks, prediction error serves as a training signal mediating the strength of associations between two events; associations are augmented by positive prediction errors and attenuated by negative prediction errors. In recent work we have proposed that, in addition to training associations between events, prediction errors themselves may constitute a type of event that can be associated with task-relevant stimuli. The Hierarchical Error Representation (HER) model suggests that hierarchically organized regions of anterior cingulate (ACC) and dorsolateral prefrontal cortex (DLPFC) interact to learn progressively more abstract representations of prediction error. The HER model is able to autonomously learn sophisticated cognitive tasks that require working memory and representations of task structure in a manner similar to humans. The model additionally captures an array of effects observed in ACC and DLPFC from fMRI, EEG, MVPA, single-unit neurophysiology, and lesion studies.

TALK 4: COGNITIVE CONTROL AND PREDICTION IN EFFORT-BASED DECISION-MAKING AND PERFORMANCE: BEHAVIORAL AND NEURAL CORRELATES.

Eliana Vassena[1]; [1]Ghent University

Human behavior is driven by the pursuit of rewards, which in daily life come at a cost, in terms of required cognitive control (or effort). Exerting control implicates Anterior Cingulate Cortex (ACC) and Dorsolateral Prefrontal Cortex (DLPFC). Importantly this network is involved in expectation of effortful control as well, showing increased activity as a function of predicted task difficulty. Such activity partially overlaps with expectation of reward, and it has been observed both during decision-making and during task preparation. In our recent work, we show that this range of effects can be accommodated within the framework of prediction and prediction error. We demonstrate how the Predicted Response Outcome model (PRO model), based on prediction error, reliably explains control-related activity in ACC. An extension to this model -the Hierarchical Error Representation model (HER model)- expands the same principle to DLPFC. Combining experimental and modeling evidence, we propose a novel theoretical account of ACC-DLPFC interactions based on the HER model. We describe how control-related activity in both regions may derive from prediction error computations across prediction and control contexts. Interestingly, the model predicts that order of information processing will influence behavior. In 2 behavioral studies, we demonstrate that imposing an order of processing of information about required control and potential reward affects decision-making and task-performance. In our data, reward was prioritized in decision-making, while control requirements more strongly influenced preparation. Taken together, our findings support a contribution of ACC-DLPFC network in effortful control and prediction, within the framework of the HER model.

TALK 5: EEG MARKERS OF STRUCTURE LEARNING, CLUSTERING AND TRANSFER

Anne Collins[1,2]; [1]Brown University, [2]University of California Berkeley

When we learn from feedback, reward prediction errors allow us to estimate the value of stimulus-action associations. However, in a structured world where different rules may be valid in distinct contexts, or where instead distinct contexts may require the same rule, reward prediction errors may inform us as to when to create new rules, when to transfer known rules to new contexts, and when to generalize newly learned associations to other equivalent contexts. Here, I present computational modeling and experimental results that show that healthy human adults perform this kind of structure learning and generalization in reinforcement learning. Trial-by-trial model-based analysis of EEG signals showed that subjects incorporated the gener-

alized reward expectations from their inferred hierarchical structure; the extent of structure-dependent prediction error representation in the neural signal predicted behavioral transfer. These results further our understanding of how humans learn and generalize flexibly by building abstract, behaviorally relevant representations of the complex, high-dimensional sensory environment.

Symposium Session 5

MEMORY RETRIEVAL AS A GUIDE ALONG THE WINDING ROAD OF MEMORY FORMATION

Monday, April 4, 10:00 am - Noon, Sutton Center

Chair: Donna Bridge, Northwestern University Feinberg School of Medicine

Speakers: Dagmar Zeithamova, Almut Hupbach, Jordan Poppenk, Donna Bridge, Joel Voss

There are longstanding distinctions between putative cognitive and neural processes that support memory encoding versus memory retrieval; encoding happens when new information forms a memory, whereas retrieval happens when stored information is accessed. However, growing evidence suggests that neurocognitive processes supporting encoding and retrieval are highly intertwined and interact at multiple stages of memory formation, re-formation, and decay. These findings challenge the notion that retrieval is the simple expression of information hard-coded as memory representations, suggesting instead that it is a dynamic force throughout the life of a memory, continuously influencing learning of new and related information as well as memory-based decisions. The specific mechanisms whereby retrieval influences memory are under active debate. For instance, in various "testing effect" experiments, retrieval strengthens existing memories, whereas in various "reconsolidation" experiments, retrieval is characterized as a temporary window for memory modification or disruption. Yet other studies show that retrieval shapes new learning by allowing for incorporation of new information into the context of what is already known (retrieval-mediated learning). The talks in this symposium will highlight many facets of retrieval's influence on memory, with the aim of blurring the lines between encoding and retrieval processes in order to forge a better understanding of the processes that build and re-form memories irrespective of the artificial encoding/retrieval divide.

TALK 1: RETRIEVAL-MEDIATED LEARNING AND THE FORMATION OF KNOWLEDGE THAT SPANS EXPERIENCES

Dagmar Zeithamova[1]; [1]University of Oregon

Memory does not only serve as a record of the past. Rather, memory is prospectively oriented, allowing us to use past experience to inform novel decisions and anticipate the future. To be prospectively useful, current events are not encoded in isolation but rather processed on the background of prior knowledge in order to relate information across events. I will discuss a series of studies on retrieval-mediated learning, demonstrating reinstatement of prior experiences during encoding of related events. Via hippocampal interactions with medial prefrontal cortex, the retrieved and current experiences can be then combined into integrated memory representations that transcend direct experience. These findings highlight the constructive nature of memory resulting from encoding/retrieval interactions.

TALK 2: WHAT TRIGGERS MEMORY UPDATING? EXPLORING THE IMPACT OF DIFFERENT REACTIVATION PROCEDURES

Almut Hupbach[1]; [1]Lehigh University

Each time a memory is reactivated, it can re-enter a plastic state in which it can be modified - it can be changed in content, strengthened, weakened, or even erased. In this talk, I will explore the effects of different reactivation procedures for episodic memory updating. Specifically, I will ask which conditions foster the incorporation of new information into reactivated memory. Using a behavioral interference paradigm, we presented new information immediately after reactivation of an episodic memory, and after a time delay assessed the extent to which new information intruded into the reactivated memory. In a first series of studies, we directly compared different types of reminders, such as reminding questions and re-exposure to the spatial learning context. In support of the fundamental role of spatial context for episodic memory organization, we found that re-exposing participants to the original spatial context was both necessary and sufficient for memory updating. However, this effect was moderated by context familiarity. In highly familiar environments, the spatial context itself was no longer important, and other reminders became effective. In a second series of studies, we manipulated the strength of reactivation. Our findings suggest that strength of reactivation and memory updating are related in an inverted U-shape function: no reference to the original memory (no reactivation) as well as explicit testing of the original memory (strong reactivation) prevented memory updating, whereas indirect reminders as well as relearning the old information before learning new information triggered updating. Implications for theory and educational practice will be discussed.

TALK 3: IMPACTS OF STIMULUS FAMILIARITY ON NEW EPISODIC ENCODING

Jordan Poppenk[1]; [1]Queen's University

A variety of experimental paradigms, reported by various labs, have revealed a facilitatory role of prior stimulus experience in the encoding of new events involving those stimuli, whether that stimulus experience was derived from recent repetition or prior knowledge. Recent research has turned to mechanisms: why is this advantage realized? In this talk, I will describe fMRI classifier evidence gathered in the context of a source memory task to address several possibilities: 1) do participants allocate less attentional resources to familiar stimuli, and more to their context? 2) Does con-

textual information better "stick" when there is an existing, relevant memory trace? An assessment of participants' task-related processing appears to favour the latter possibility. In addition, I will discuss the relevance of neural priming, a phenomenon that accompanies processing of familiar information. In particular, repetition of items is known to induce attenuation of cortical responses in perceptual areas, although its relevance to mnemonic benefits to familiarity is unclear. As no reports have examined neural priming beyond a period of several days, it is unknown whether neural priming could accompany retrieval-based memory enhancement where semantic memory is concerned. I will describe new fMRI evidence describing the upper limit of neural priming's persistence.

TALK 4: ACTIVE RETRIEVAL MODULATES THE STRUCTURE OF EPISODIC MEMORIES

Donna Bridge[1]; [1]Northwestern University Feinberg School of Medicine

The hippocampus binds arbitrarily associated pieces of information to support episodic memory. Surprisingly little is known regarding the factors that influence what pieces of information will be bound or whether there is meaningful structural organization of their interrelationships in memory. We propose that active retrieval modulates the relative "dominance" of memory features, by enabling specific memories to become temporarily salient and available for binding with other information encountered during an event. This dominance concept is grounded on the notion that multiple memory traces are always in competition for control of behavior, but it is the dominant trace that ultimately takes control and is most susceptible to modification. Using eye-movement tracking and neuroimaging methods, we have shown that active retrieval modulates what information is currently dominant and therefore available for binding by the hippocampus with either memory content or relevant information in the environment. Specifically, retrieval provides structure to existing and new memories by influencing (1) what information will be susceptible to binding (2) when binding will occur and (3) the strength of binding among memory features. I will present results from a collection of studies that shed light on these robust and specific influences of retrieval on memory formation and modification. These findings demonstrate that episodic memories are not amorphous collections of information, but rather are honed and structured by active retrieval in order to facilitate adaptive use of memory and to promote rapid learning.

TALK 5: Q & A AND PANEL DISCUSSION

Joel Voss[1], Donna Bridge[1], Dagmar Zeithamova[2], Almut Hupbach[3], Jordan Poppenk[4]; [1]Northwestern University Feinberg School of Medicine, [2]University of Oregon, [3]Lehigh University, [4]Queen's University

Joel Voss will moderate the discussion of retrieval's influence on memory. The panel will field questions from the audience.

Symposium Session 6

MULTISENSORY INTEGRATION: NEURAL MECHANISMS, COMPUTATIONAL OPERATIONS AND BEHAVIOUR

Monday, April 4, 10:00 am - Noon, Grand Ballroom West

Chair: Uta Noppeney, Computational Neuroscience and Cognitive Robotics Centre, University of Birmingham, UK

Speakers: Greg DeAngelis, Uta Noppeney, Michael S. Beauchamp, John J. Foxe, Mark Wallace

For effective interactions with our multisensory environment the brain is challenged to integrate signals from multiple senses. Over the past decade accumulating evidence has suggested that multisensory integration is not deferred until later processing stages in association cortices, but emerges already at the primary cortical level. This interdisciplinary symposium will provide a state of the art overview of how the brain integrates sensory information into a coherent percept of the world. We will bring together speakers that employ various methodologies ranging from electrophysiology in non-human primates to human electrocorticography, fMRI, EEG, psychophysics and computational modelling. In particular we aim to bridge the gap between neural mechanisms and responses, computational operations and behavior. We will explore how fundamental computational principles shape multisensory integration across diverse domains such as motion, spatial or speech processing. Further, we will ask how multisensory integration develops during lifespan in individuals with autism spectrum disorders and normal ageing. The symposium should be of substantial interest to the cognitive neuroscience community by providing new insights into the interactions between the sensory systems and bridging between sensory functions and cognition in typical and atypical populations.

TALK 1: MULTISENSORY MECHANISMS FOR DISSOCIATING SELF-MOTION AND OBJECT MOTION

Greg DeAngelis[1]; [1]Center for Visual Science, University of Rochester, USA

Image motion on the retina generally reflects some combination of self-motion and objects that move in the world. Thus, a fundamental task for the brain is to dissociate visual motion into components related to self-motion and object motion. I will demonstrate that vestibular signals play important roles in perceptual estimation of self-motion and object motion. In addition, I will show that decoding the responses of a population of multisensory (visual-vestibular) neurons allows the brain to accurately estimate self-motion (heading) in the presence of object motion, or vice-versa. Moreover, the population decoding scheme that achieves this goal can be derived from a general computational strategy for marginalizing over one variable and estimating another variable. Thus, the brain appears to use multisensory signals to carry out near-optimal probabilistic computations that dissociate variables that may be confounded in the peripheral sensory input.

TALK 2: SEE WHAT YOU HEAR: CONSTRUCTING A REPRESENTATION OF THE WORLD ACROSS THE SENSES

Uta Noppeney[1], Tim Rohe[2]; [1]Computational Neuroscience and Cognitive Robotics Centre, University of Birmingham, UK, [2]University ofTuebingen

Our brains are continuously confronted with the problem of how to understand the sensory signals with which they are bombarded. For example, I can hear a bird and I can see a bird, but is it one bird singing on the branch, or is it two birds: one sitting on the branch and the other singing in the bush? How should the brain combine signals into a veridical percept of the environment without knowing whether they pertain to same or different events? Combining Bayesian Modelling with fMRI and EEG multivariate decoding we investigated how the brain solves this so-called Causal Inference problem. We demonstrate that the human brain integrates sensory signals into spatial representations in line with Bayesian Causal Inference by simultaneously encoding multiple spatial estimates along the cortical hierarchy. Critically, only at the top of the hierarchy, in anterior intraparietal sulcus, the uncertainty about the world's causal structure is taken into account and sensory signals are integrated weighted by their bottom-up sensory reliability and top-down task-relevance into spatial priority maps as predicted by Bayesian Causal Inference. Characterizing the computational operations of multisensory interactions in human neocortex reveals the hierarchical nature of multisensory perception.

TALK 3: MODELS AND MECHANISMS OF MULTISENSORY SPEECH PERCEPTION

Michael S. Beauchamp[1]; [1]Baylor College of Medicine, USA

Speech is the most important mode of human communication and speech perception is multisensory, making use of both auditory information from the talker's voice and visual information from the talker's face. Surprisingly, some individuals make little use of visual speech information, while others are strongly influenced by it. I will discuss our attempts to construct Bayesian models, specifically models of causal inference, to understand why this might be. Guided by these models, we have used electrocorticography (ECoG), fMRI and TMS to understand the neural substrates of multisensory speech perception. These studies have revealed that the human superior temporal sulcus (STS) is a key node in the brain network for speech perception and individual differences in speech perception. Surprising new data show that eye movements when viewing talking faces predict perception.

TALK 4: MULTISENSORY INTEGRATION DEFICITS IN AUTISM SPECTRUM DISORDER (ASD)

John J. Foxe[1,2], Lars A. Ross[2], Sophie Molholm[2]; [1]The Ernest J. Del Monte Institute for Neuromedicine, University of Rochester Medical Center, [2]The Sheryl and Daniel R. Tishman Cognitive Neurophysiology Laboratory, Albert Einstein College of Medicine

Observing a speaker's articulations substantially improves speech intelligibility under noisy listening conditions, a crucial component of effective communication. We assessed these abilities in children with an ASD, since multisensory deficits are increasingly recognized as a component of the autism phenotype. Severe speech integration deficits were uncovered in school-aged children with autism (5-12 yearolds), but appeared to resolve in children entering adolescence (>13 years of age). This suggests that these abilities are amenable to intervention during early childhood, with potentially important outcomes for social communication abilities in these ASD children. These multisensory speech deficits have clear implications for educators and clinicians working in autism. In parallel work using more basic audio-visual inputs, high-density electrophysiological recordings also reveal highly immature early sensory integration in neocortical circuits and a lack of behavioral facilitation in ASD participants. It is particularly compelling that deficits in basic electrophysiological measures of audio-visual integration were associated with clinical severity scores in these children. We will discuss the mounting evidence pointing to sensory integration deficits as a major feature of the ASDs.

TALK 5: LINKS BETWEEN SENSORY AND MULTISENSORY FUNCTION AND COGNITION

Mark Wallace[1]; [1]Vanderbilt University, US

Despite an intuitive understanding that sensory and multisensory systems form the building blocks for higher-order perceptual and cognitive representations, surprisingly little work has examined the relationship across these domains. We sought to examine this relationship by comparing performance on a battery of sensory and multisensory tasks with a series of measures of cognitive performance. This work was carried out in a developmental context, looking for links across domains in human subjects ranging in age from 8 to 80. Striking changes were noted in sensory, multisensory and cognitive function in older adults (age 65+), with changes in multisensory function not being readily predicted based on changes in unisensory performance. Correlational analyses and hierarchical clustering across all ages revealed a complex pattern of associations across the various sensory and cognitive indices. One example of one of the strongest relationships was between measures of audiovisual temporal acuity and measures of language and communication. In addition to these behavioral, psychophysical and cognitive measures, ongoing neuroimaging work is examining the relationships between (multi)sensory networks and cognitive networks in an effort to better reveal the interrelationships between them.

Symposium Session 7

HUMAN INTRACRANIAL ELECTROPHYSIOLOGY: A NEW ERA

Tuesday, April 5, 10:00 am - Noon, Grand Ballroom West

Chair: Josef Parvizi, Stanford University

Speakers: Josef Parvizi, György Buzsáki, Xiao-Jing Wang, Dejan Markovic, Sabine Kastner

The purpose of this symposium is to shed light on the basics of neuronal population dynamics and oscillations as well as the new research developments that are taking place in the field of human intracranial electrophysiology. Will invasive recordings and cortical stimulations in human subjects change our view of the functional organization of the human brain?

TALK 1: INTRODUCTION

Josef Parvizi[1]; [1]Stanford University

Functional architecture of the brain is at the core of discussions in the field of system neuroscience. Recent advances in invasive recording and direct cortical stimulation methods have given rise to unique set of information about the functional and causal role of distinct populations of neurons within specific regions of the mammalian brains. These new observations have yielded unprecedented data about the selective functional properties of localized populations of neurons during experimental paradigms as well as daily-life natural settings. This presentation will provide an introductory overview of invasive recording and neuromodulation methods in human subjects and will highlight the unique contribution of such studies throughout the history of neuroscience.

TALK 2: RHYTHMS IN THE MAMMALIAN BRAINS

György Buzsáki[1]; [1]New York University

Brain rhythms are highly preserved throughout the evolution of mammalian brains and have constrained the evolutionary and ontogenetic scaling of brain structures. This presentation will provide an overview of brain rhythms and how they form a system, tied together by cross-frequency phase coupling. This mechanism allows for bidirectional communication across brain structure in a state-dependent manner. The receiver structure initiates the exchange by a slow frequency rhythm and the messages are conveyed back from the sender to receiver in higher frequency packages, typically gamma and ripples oscillations. Oscillations allow for the segmentation of spike trains-carried information into neurons 'letters' (assemblies) and 'words', which can be concatenated into neuronal 'sentences'.

TALK 3: COMPUTATIONAL MODELING OF OSCILLATIONS

Xiao-Jing Wang[1]; [1]New York University

This lecture will cover basic principles of brain oscillations during cognition. First, I will summarize the current status of experimental observations of neural population oscillations and their circuit mechanisms, with a focus on gamma and theta rhythms. These oscillatory phenomena have been associated with not only local processing but also inter-areal communication in the brain. I will present recent studies of frequency-dependent feedforward versus feedback signaling between cortical areas, in particular our new results from a large-scale circuit model of the primate cortex endowed with a laminar structure. I will also discuss controversies on the synchrony analysis as a dominant perspective on inter-areal communication or global brain connectivity. These findings and ideas have important implications for abnormal neural synchronization associated with mental disorders like schizophrenia and autism.

TALK 4: NEUROMODULATION: A FUTURISTIC PERSPECTIVE

Dejan Markovic[1]; [1]UCLA

Much progress has been made in generating brain-machine interface and restoring limb movement. However, it has proven to be more difficult to restore cognitive functions. This presentation will discuss what may be possible in the future for enhancing cognitive functions using implantable neuromodulation devices. Starting from devices for translational animal studies and initial work in body-powered systems, this talk will discuss a minimally invasive battery-less neuromodulation system for human memory restoration. This talk will cover how we are about to break the the grand challenges in neural engineering by introducing reliable low-power miniaturized wireless telemetry systems at rates and channel counts that are needed for major scientific discoveries and therapeutic outcomes in neurospcyhiatric conditions.

TALK 5: DISCUSSION

Sabine Kastner[1]; [1]Princeton University

The main theme of the discussion will be to address the question of intracranial electrophysiology versus scalp EEG or neuroimaging as well as animal versus human studies. Ethical issues as well as methodological limitations and superiorities of invasive monitoring will be discussed with the presenters in a round table format.

Symposium Session 8

TAKING STOCK OF COGNITIVE TRAINING: THEORY, NEURAL MECHANISMS AND APPLICATION

Tuesday, April 5, 10:00 am - Noon, Beekman

Chair: Duncan Astle, MRC Cognition and Brain Sciences Unit, Cambridge

Speakers: Susan Gathercole, Thomas Redick, John Jonides, Duncan Astle, Adam Gazzaley

Cognitive training – sometimes referred to as 'brain training' – is one of the most controversial topics in cognitive science and neuroscience. Strong claims have been made that training can remediate cognitive deficits associated with a variety of conditions, including: neurodevelopmental disor-

ders, acquired brain damage, neurodegeneration and typical ageing. Commercial training programmes, targeting core functions like attention and working memory, promise generalised gains on everyday tasks and school achievement. However there has been growing disquiet among scientists in the area that these claims exceed the current evidence base. The time is right to take stock of the scientific basis of cognitive training, from cognitive theory and underlying neural mechanisms, through to an evaluation of potential applications. That is the purpose of this symposium. Thomas Redick will provide an empirical evaluation of the claims made by proponents of intensive cognitive training. Susan Gathercole will address the current lack of theory in the area, by proposing a framework for transfer following working memory training. Duncan Astle will draw upon magnetoencephalography data to provide a detailed neurophysiological account of cognitive plasticity following training. John Jonides will explore the potential transfer benefits of combining adaptive training with brain stimulation. And finally, Adam Gazzaley will outline recent developments with innovative technologies, and their potential to enhance the application of training interventions.

TALK 1: A FRAMEWORK FOR TRANSFER FOLLOWING WORKING MEMORY TRAINING

Susan Gathercole[1,2]; [1]MRC Cognition and Brain Sciences Unit, Cambridge, [2]University of Cambridge

The past decade has seen the emergence of the new field of research on cognitive training, with the development of many programs targeting abilities including memory, reasoning, and processing speed. A critical step in understanding the cognitive changes induced by training is to track the transfer of training gains to untrained activities. In this presentation I will put forward a new evidence-based framework for transfer following working memory (WM) training, one of the most substantial fields of cognitive training. It is proposed that the transfer to other WM tasks has two principal sources: i) the establishment of new cognitive routines for highly unfamiliar and unpracticed WM activities, and ii) the development of metacognitive strategies satisfying response requirements for the specific mnemonic content. Predictions from this framework are tested against data from a large sample of children who completed either adaptive WM training or a low-dose WM control program. Transfer is greatest when the two conditions of the framework involving learning to do something new are satisfied, and the magnitude of transfer is predicted by general cognitive ability prior to training. A smaller source of transfer may reflect fine-tuning of pre-existing processes within verbal short-term memory (STM) and is independent of IQ.

TALK 2: WHAT'S WORKING IN WORKING MEMORY TRAINING?

Thomas Redick[1]; [1]Purdue University

A growing number of research articles and commercial websites claim evidence that brief, computerized interventions can be used to improve one's cognitive abilities. In particular, working memory training research has bourgeoned in recent years, in virtually every area of psychology. Despite claims that various forms of working memory training can improve memory, attention, and even intelligence, numerous questions remain about the efficacy of such programs. My talk will begin by briefly summarizing the working memory training literature. Then, I will present the results from a series of studies investigating transfer to both 'near' and 'far' cognitive processes. The conclusion from these studies is that working memory training produces limited benefits in terms of specific gains on short-term and working memory tasks that are very similar to the training programs, but no advantage for outcomes that are quite different from the training tasks. I will end with a discussion of issues related to research design, data interpretation, and unresolved questions in working memory training research and application.

TALK 3: ENHANCING WORKING MEMORY TRAINING USING TRANSCRANIAL DIRECT CURRENT STIMULATION

John Jonides[1], Ben Katz[1], Chelsea Zabel[1], Jacky Au[2], Susanne Jaeggi[2], Martin Buschkuehl[3]; [1]University of Michigan, [2]University of California, Irvine, [3]MIND Research Institute, Irvine

Working memory (WM) is a fundamental cognitive ability that is limited in capacity and constrains complex thought. It is highly predictive of academic and professional success, and thus, in this increasingly complex information age, interventions to increase WM ability are highly valued. A promising intervention that has gained traction over the last decade is transcranial direct current stimulation (tDCS), which is a non-invasive form of brain stimulation that can modulate cortical excitability and temporarily increase brain plasticity. As such, it can boost learning or enhance performance on cognitive tasks. We assessed the value of tDCS as a tool to facilitate working memory training and discovered that stimulation over prefrontal cortex enhanced performance over seven days of training and also had selective effects on transfer to non-trained tasks.

TALK 4: ALTERING DEVELOPING NEUROPHYSIOLOGY WITH COGNITIVE TRAINING

Duncan Astle[1]; [1]MRC Cognition and Brain Sciences Unit, Cambridge

Working memory is a basic requirement for many everyday tasks. Poor working memory skills are highly predictive of educational underachievement and developmental disorder. Despite the high level of interest in the application of cognitive training, especially in childhood, very little is known about the neurophysiological mechanisms by which training gains are achieved. I will present data from a double-blind randomised controlled training study, in which we use the dynamic electrical activity recorded using MEG to explore underlying neurophysiological changes following training. We used new methods to explore the spontaneous coordination of electrophysiological signals at rest. Improvements in working memory after training were significantly associated with changes in functional

connectivity between areas in fronto-parietal cortex and inferior-temporal cortex. During task performance we also observed enhanced coupling between the upper alpha rhythm (at 16 Hz), recorded in superior frontal and parietal cortex, and high gamma activity (at ~ 90 Hz) in inferior temporal cortex. This altered neural network activity associated with cognitive skill enhancement is consistent with a framework in which slower cortical rhythms enable the dynamic regulation of higher frequency oscillatory activity related to task-related cognitive processes. This is the first demonstration that this hierarchically organised neuronal coupling can be measured in childhood, is associated with enhanced competence in a cognitive skill, and can be augmented by targeted intervention.

TALK 5: TECHNOLOGY MEETS NEUROSCIENCE - CHANGING THE FUTURE OF HEALTH AND EDUCATION

Adam Gazzaley[1]; [1]University of California, San Francisco

A fundamental challenge of modern society is the development of effective approaches to enhance brain function and cognition in both the healthy and impaired. For the healthy, this should be a core mission of our educational system and for the cognitively impaired this is the primary goal of our medical system. Unfortunately, neither of these systems have effectively met this challenge. I will describe a novel approach out of our lab that uses custom-designed video games to achieve meaningful and sustainable cognitive enhancement via personalized closed-loop systems (Nature 2013; Neuron 2014). I will also share with you the next stage of our research program, which integrates our video games with the latest technological innovations in software (e.g., brain computer interface algorithms, GPU computing, cloud-based analytics) and hardware (e.g., virtual reality, mobile EEG, physiological recording devices (watches), transcranial brain stimulation) to further enhance our brain's information processing systems and ultimately improve quality of life.

Symposium Session 9

AFFECTIVE-MOTIVATIONAL SALIENCE AND ATTENTIONAL SETS

Tuesday, April 5, 10:00 am - Noon, Sutton Center

Chair: Rebecca Todd, University of British Columbia

Co-Chair: Grace Truong, University of British Columbia

Speakers: Andreas Keil, Valentina Rossi, Grace Truong, Leonardo Chelazzi, Rebecca M. Todd

How does affective-motivational relevance tune attention to the world, and how does such affective prioritization fit into current models of selective attention? Recently, the traditional division of selective attention into 'top-down' and 'bottom-up' processes has been challenged on a number of fronts. One challenge has come from research on attentional prioritization of affectively-motivationally salient stimuli. On the one hand, such salience elicits relatively reflexive responses to features of the stimuli, similar to 'bottom-up' processes elicited by low-level visual salience. At the same time, prioritized attention to affective-motivational salience can be modulated by an organism's changing goals in a manner traditionally characterized as 'top-down.' Moreover, such prioritization is subserved by a distinct network of brain regions that selectively tune the visual cortex to affective-motivational salience, much as frontoparietal attentional networks do. Along with other evidence, these findings point to a view in which attention is tuned to multiple sources of salience in relation to a broad range of goals, which can be short or long term, and implicit or explicit. Here we present research probing mechanisms by which affective-motivational salience, based on learned associations with reward, punishment, and self-relevance, creates attentional sets for relevant aspects of the world and influences deployment of explicit attentional sets for task-relevant stimuli. Taken together, this body of research suggests that, to understand attentional processes, we need to take into account ways in which they may be habitually shaped by implicit motivational/affective goals.

TALK 1: THREAT VERSUS SAFETY IN HUMAN VISUAL CORTEX: HOW AFFECTIVE EXPERIENCE IMPACTS PERCEPTION

Andreas Keil[1]; [1]University of Florida, USA

A plethora of studies suggest that the biological relevance of visual stimuli is associated with facilitated sensory processing. Beyond the phenomenological demonstration of this effect however little is known about the neurophysiological mechanisms that mediate selective facilitation of biologically relevant cues. In this presentation, we discuss conceptual and methodological issues regarding the characterization and induction of threat and safety in the laboratory. We then turn to experimental explorations of behavioral and neurophysiological dynamics as observers learn that a novel, initially unengaging, stimulus is behaviorally relevant. Combining the steady-state visual evoked potential and other electrophysiological signals with hemodynamic neuroimaging techniques, we find that activity in lower-tier visual cortex changes as a function of motivational relevance acquired through Pavlovian fear conditioning. The temporal rate of these changes, their extent, and the brain regions involved reflect the specific behavioral and environmental contingencies to which observers adapt. Findings will be discussed in a theoretical framework that views emotions as action dispositions.

TALK 2: INCENTIVE MOTIVATION ALTERS EARLY SENSORY PROCESSING IN VISUAL CORTEX: EVIDENCE FROM ERPS

Valentina Rossi[1], Naomi Vanlessen[1], Marieke Bayer[2], Annika Graß[2], Annekathrin Schacht[2], Gilles Pourtois[1]; [1]Ghent University, Belgium, [2]University of Göttingen, Germany

Previous research has highlighted that motivationally relevant stimuli (e.g., stimuli paired with positive or negative outcomes) receive preferential processing, either through a gain in visual saliency or through strategic reallocation of

attention. Capitalizing on the high temporal resolution of event-related brain potentials (ERPs), we performed a series of studies to investigate the time-course of reward/punishment expectancy, starting from the earliest stages of visual processing (75 ms, C1 component of the Visual Evoked Potentials). First, in a combined ERP/eye-tracking spatial cueing task we tested whether incentive expectancy would modulate early visual responses to semantically neutral visual stimuli, independently or interactively with voluntary spatial attention. Second, removing the predicting cue informing on the incentive value of the trial, we sought to test if the mere repeated association with positive or negative reinforcers would be sufficient to modulate early visual cortex responses to originally neutral stimuli, and whether these modulations would be value-based or saliency-based (thus dependent on the signed value vs. absolute value of the reinforcer). Our results show that motivational relevance (reward, but also punishment expectancy) can increase the earliest visual cortex response at the C1 level, showing saliency-based priority gain. Moreover, we show that this modulation also generalizes to new stimuli sharing perceptual features with the reinforced ones, presented in a new context. These neurophysiological results suggest that the human low-tier visual cortex rapidly encodes motivationally significant signals based on a coarse feature-extraction mechanism, independently from top-down attention allocation.

TALK 3: SELF-RELEVANCE AS A SOURCE OF ATTENTIONAL BIAS

Grace Truong[1], Todd C. Handy[1], Rebecca M. Todd[1]; [1]University of British Columbia, Canada

Recent research has produced growing evidence of affect-biased attention, which we have characterized in terms of habitual attentional sets for categories of stimuli based on affective salience. Affective salience is shaped by associations with positive or negative consequences in relation to both short- and long-term goals. Here we propose that self-relevance is a superordinate framework for affect-biased attention, as things that are prioritized as a result of emotional/motivational history are inherently self-related. We thus predict that self-relevant will be similarly prioritized. In three studies we examined whether people can rapidly generate a pre-stimulus attentional set for objects that are self-relevant because we own them using a temporal order judgment paradigm. Participants viewed pairs of objects (one self-owned, one other-owned) and judged which appeared first. Critically, self-relevance was ascribed online and to everyday objects, thus mimicking real world conditions in which the personal importance of any given object varies as a function of context. Results indicated that self-owned objects were significantly more likely to be perceived first when presented at the same time as an object owned by someone else, revealing a prior entry effect for self-owned objects. This evidence suggests that automatic attention biases are not solely the domain of "hardwired" universally salient stimuli. Rather, they are more flexible and context-dependent than we previously knew, and can accommodate whatever is meaningful to each of us as individuals. The implications of these findings will be discussed along with related neuroimaging and behavioral experiments investigating the post-stimulus (i.e. downstream) effects of self-relevance.

TALK 4: ALTERING VISUAL SELECTIVE ATTENTION WITH REWARD

Leonardo Chelazzi[1], Oscar Ferrante[1], Elisa Santandrea[1], Chiara Della Libera[1]; [1]University of Verona, Italy

In the past we have pioneered research assessing whether reward modifies attentional priorities. In early studies, we demonstrated that the association of reward with specific stimulus features, such as color and shape, alters the attentional priority of those features, both in the short- and long-term. Subsequent work demonstrated that such effects could result from either of two mechanisms: one reflecting sheer stimulus-reward associations, in a Pavlovian fashion, and a second one reflecting the reinforcement of specific attentional operations applied to the given stimulus, in a Skinnerian fashion. More recently, we have explored whether similar effects can be obtained in the spatial domain. Using a reward-based training regimen, we demonstrated that spatial priority maps can be altered in a highly selective manner by virtue of variable reward probabilities associated with different locations. All the evidence above is generally compatible with the notion that reward affects attention in a bottom-up fashion, altering the priority of stimuli and locations. More recently we have begun to explore whether reward can also impact the top-down guidance of attention, changing the strength of the signals that control selection at a more abstract level of representation. The evidence demonstrates that reward can indeed exert a strong influence on the endogenous control of attention, such that a reward-associated attentional set is more readily re-instated, when necessary, but is also less readily abandoned when a switch in attentional set is required. Overall, the reported findings demonstrate a pervasive and multi-faceted influence of reward on attentional guidance.

TALK 5: SUMMARY AND DISCUSSION

Rebecca M. Todd[1]; [1]University of British Columbia, Canada

In this session we will summarize the presentations in relation to emerging models of attentional prioritization and allow time for Q & A.

Poster Schedule

Poster sessions are scheduled for Saturday-Tuesday in Americas Hall I & II of the New York Hilton Midtown hotel. Posters 1-88 are presented in Americas Hall I and posters 89-176 are in Americas Hall II.

All attendees must present their CNS 2016 name badge to enter the exhibit hall. Do not leave personal items in the poster room.

The presenting author must be present during the assigned session. You may post your materials on the board assigned to you at any time after the "Set-up Begins" time (listed below), but before the beginning of the assigned poster session. You must remove your poster promptly no later than the time listed above in "Take-down Complete." Any posters left up after the "Take-down Complete" time may be discarded.

Note that presenters are asked to set up poster in advance of their session and to leave their poster up for a period following their session (see your specific session for hours). This is to allow attendees to view posters outside the formal session times.

Only registered poster presenters, wearing a CNS 2016 meeting badge, for the current session and exhibitors will be allowed in the exhibit hall during set up and take-down hours. All other attendees will be turned away at the door. No attendee or exhibitor will be allowed to enter the exhibit hall after the Closed for the Day- No Entry hours.

Poster Session	Date	Setup Begins	Session Begins	Session Ends	Take-Down Completed
A	Saturday, April 2	3:00 pm*	5:00 pm	7:00 pm	7:15 pm
B	Sunday, April 3	7:30 am*	8:00 am	10:00 am	11:45 am
C	Sunday, April 3	1:30 pm*	5:00 pm	7:00 pm	7:15 pm
D	Monday, April 4	7:30 am*	8:00 am	10:00 am	12:00 pm
E	Monday, April 4	12:30 pm*	1:30 pm	3:30 pm	4:45 pm
F	Tuesday April 5	7:30 am*	8:00 am	10:00 am	10:15 am

* Please note that only scheduled registered poster presenters may enter the exhibit hall during the set-up time. All other attendees may only enter when the exhibit hall opens.

Note: Please remove your poster promptly at take down complete time, so that the next presenter may set up their poster.

People's Choice Poster Award

Vote for your favorite poster during each Poster Session. One winner will be selected per session to receive a $100 Award! Voting will take place at the Exhibit Hall entrance. Winners will be posted each morning at the Member Services Desk.

Sponsored by

Poster Session A

ATTENTION: Auditory

A1

INFANT MISMATCH RESPONSES TO SPEECH: THE INTERPLAY BETWEEN LANGUAGE AND ATTENTION Yan Yu[1], Margaret Kamowski-Shakibai[2], Monica Wagner[1], Valerie Shafer[3]; [1]St. John's University, [2]Marymount Manhattan College, [3]The Graduate Center, City University of New York — The consistent presence of mismatch responses (MMR) to speech contrast in infants suggests that speech processing develops rapidly during infancy. However, the current literature in this area has been discordant primarily due to the polarity and latency variations of MMR across studies on infant speech perception. Furthermore, little is known about how bilingual versus monolingual experience influences early neurodevelopment of speech perception. We hypothesize that early bilingual experience influences infant's attention to speech, and negative MMR is an indication of more attention to speech change. In this study, we tested 6-month-old infants from monolingual English-speaking households and bilingual Spanish-English speaking households, respectively, using English-only vowel contrast. A passive listening oddball paradigm was used. We compared MMR from the first half of the data session with that from the second half of the session within each infant. The results show that between 150 and 300 ms, the change patterns from the first half to the second half of the event-related recordings differ drastically between the two language groups. The responses become more negative for the bilinguals (both the standard and deviant) whereas no difference, or even greater positivity for the monolinguals. These results provide new evidence for the interplay of language and attention in infant speech development, and it supports our earlier findings (Shafer et al. 2012) regarding increased attention allocation to speech in bilingual infants during passive listening context.

A2

THE INFLUENCE OF STIMULUS-REWARD ASSOCIATIONS ON AUDITORY PROCESSING Elise Demeter[1], Brittany Glassberg[1], Marissa L. Gamble[1,2], Marty G. Woldorff[1]; [1]Duke University, [2]Boston University — Recent work demonstrates stimulus-reward associations can enhance the attentional priority of visual stimuli; it is less known, however, how reward influences the processing of auditory stimuli. Here, we leveraged high-temporal-resolution electrical brain recording (EEG) to investigate the influence of stimulus-reward associations in an auditory oddball task. The task consisted of standard tones (1000 Hz) and rare, deviant target tones (30% of stimuli; 900 and 1100 Hz, equally probable). Tones were randomly presented (100 ms duration, 800-1000 ms interstimulus interval). Participants were instructed to buttonpress whenever targets were presented and that they could earn monetary rewards based on their speed and accuracy. In the first half of the session, high-pitched targets were assigned to a high-reward condition and low-pitched targets to low-reward (high-reward pay rate 10 times low). Reward assignments were reversed in the second half of the session, with reward-assignment order counterbalanced across subjects. Behaviorally, high-reward tones had faster reaction times than low-reward ones. Event-related potentials (ERPs) time-locked to the tone onsets revealed that reward enhanced the amplitude of the early N1 sensory component (latency 70 to 130 ms) and the deviance-related mismatch negativity (130-200 ms). Reward also enhanced the amplitude of and decreased the latency of a central-parietal P3 component (240-800 ms). These data demonstrate stimulus-reward associations can enhance the early sensory processing and discrimination of auditory stimuli, as reflected by the N1 and mismatch negativity components, respectively, and that this enhanced processing then ramifies onto later processing stages, as evidenced by the P3.

A3

PHASE-TRACKING OF SPEECH OCCURS WITHOUT BROADBAND ENVELOPE MODULATION Dillon Hambrook[1,2], Matthew Tata[1,2]; [1]University of Lethbridge, [2]Canadian Centre for Behavioural Neuroscience — Speech comprehension itself is a minor miracle of the human brain made more remarkable by the fact that it is surprisingly robust to interference from competing sounds. Neural oscillatory activity that is coherent between brain systems has been hypothesized to be a biological mechanism that enables speech comprehension. Low frequency (2-8 Hz) electroencephalogram (EEG) activity tracks quasi-periodic changes in the acoustic energy of speech. This tracking is enhanced for attended and intelligible speech. One theory suggests that selective entrainment of neural activity to the acoustic dynamics of a speech stream enable the brain to parse speech into semantically meaningful units by aligning periods of increased neural sensitivity to periods of high-information within the speech stream. We test the hypothesis that the broadband acoustic envelope of speech is crucial for the entrainment of neural activity to speech. By cross-correlating the EEG response with signals derived from the dynamics of speech with an intact or a masked acoustic envelope we identify phase-locked activity related to speech processing. We show that masking the broadband acoustic envelope is not sufficient to prevent tracking of the acoustic dynamics of a speech signal, despite a significant degradation in the intelligibility of the speech. Our results suggest that phase-tracking of the acoustic dynamics of speech operates on amplitude modulations in the frequency bands specific to a speaker's voice rather than broadband energy transients.

A4

THE IMPACT OF MUSICIANSHIP ON INDUCED OSCILLATORY ACTIVITY DURING A SPEECH-IN-NOISE TASK Benjamin Rich Zendel[1,2], Olivier Dussault[2], Merwin Olthof[2,3], Sylvie Belleville[2], Isabelle Peretz[2]; [1]Memorial University of Newfoundland, [2]Université de Montréal, [3]University of Amsterdam — Numerous studies have demonstrated that musicians, compared to non-musicians, have an enhanced ability to understand speech in the presence of background noise. Electroencephalographic evidence suggests that this benefit is related to enhanced encoding of speech formants, which leads to more efficient semantic processing of incoming speech information in noisy environments. These studies have focused on evoked brain activity, quantified by averaging brain responses that are time-locked to the onset of a speech signal presented in noise. This approach may miss neural activity that is not time locked to the onset of a speech signal, because the addition of background noise jitters the onset of the neural response to a speech stimulus. Measuring speech-induced change in neural oscillatory activity would reduce the impact of this onset jitter, and may be useful in understanding the musician benefit for understanding speech-in-noise. Accordingly, groups of musicians and non-musicians were presented with a series of words in different levels of multi-talker babble noise. Induced power changes in the theta, alpha and beta bands were quantified as a function of group and noise level. In both groups there was a noise-related increase in alpha power. Moreover, this noise-related increase in alpha power was enhanced in musicians. It is likely that the noise-related increase in alpha power reflects the inhibition of background noise. Thus, the increased noise-related alpha in musicians likely reflects enhanced inhibitory functioning of the auditory system.

A5

DOES ATTENTION TO OBJECTS IN AUDITORY WORKING MEMORY ENHANCE PERCEPTUAL PRECISION? Sung-Joo Lim[1,2], Malte Wöstmann[1,2], Frederik Geweke[1], Jonas Obleser[1,2]; [1]Max Planck Institute for Human Cognitive and Brain Sciences, [2]University of Lübeck — Selective attention directed towards objects in working memory (i.e., retrospective attention) is known to facilitate recall of an attended object, but how this benefit arises is unknown, especially in the auditory modality. We recently found that retrospective attention to one of two syllables in auditory working memory facilitates performance via enhancing perceptual precision of the attended

syllable. Here, we set out to test whether attention-related perceptual precision enhancement generalizes to different degrees of spare memory capacity. We examined the effect of object-based retrospective attention with a varying number of to-be-encoded items (i.e., memory load). During memory retention in a syllable pitch-discrimination task, we presented retroactive cues. On each trial, listeners (n=12; 20–30 years) sequentially encoded two, four, or six syllables. A valid or a neutral visual retro-cue was then provided to direct listeners' attention to one, to-be-probed syllable. Directing attention to a specific syllable object in memory led to faster pitch change judgments ($\eta 2p = 0.17$) regardless of memory load. Importantly, psychophysical modeling results revealed that retrospective attention improved perceptual precision of the attended syllable object (expressed by steeper slopes of a psychometric curve; $\eta 2p = 0.085$). Notably, this precision benefit was most pronounced for low memory load (Cohen's $d = 0.55$), and this change in precision benefit was predicted by inter-individual differences in memory capacity benefit across memory load (37% variance explained). Our results suggest that retrospective attention enhances perceptual precision of attended objects in auditory memory, but such enhancement depends on the amount of spare memory capacity.

A6

THE BEHAVIOURAL AND NEURAL FATE OF IGNORED SPEECH

Malte Wöstmann[1,2], Lorenz Fiedler[1,2], Sung-Joo Lim[1,2], Jonas Obleser[1,2]; [1]Department of Psychology, University of Lübeck, Germany, [2]Max Planck Institute for Human Cognitive and Brain Sciences, Leipzig, Germany — Attention is epitomized in the improvement of behavioural responses and enhancement of neural responses to task-relevant stimuli. But in how far does interference resulting from task-irrelevant, ignored stimuli depend on stimulus features (e.g., signal intelligibility) and on characteristics of the human observer (e.g., cognitive aging)? In two experiments using an irrelevant-speech paradigm, participants heard to-be-ignored speech while remaining focussed on previously-encoded digits in memory. In a first behavioural experiment, younger (23–33 years) and older participants (61–78 years) listened to nine single digits ("1" to "9") in random order and were instructed to ignore three subsequent spoken sentences that varied in acoustic detail (i.e., intelligibility) and in each sentence's final word (i.e., semantic) predictability. The serial recall accuracy of digits was lower in older compared with younger listeners, supporting the expected age-related decline in attention performance. Across age, performance was only affected by the manipulation of acoustic detail, indicating that not higher semantic predictability (Bayes Factor < 0.2 favouring the null) but only higher intelligibility (Bayes Factor > 10e7 favouring an effect of intelligibility) of ignored speech predicts behavioural interference. In a follow-up electroencephalography (EEG) study employing cross-correlation with the stimulus envelope, auditory 1–8 Hz phase-locked responses showed that listeners' neural encoding of the ignored speech stimulus depends on its acoustic detail, while simultaneous alpha (8–12 Hz) power modulation suggested deployment of inhibitory attentional control. Our findings suggest that non-attentive neural responses to ignored yet intelligible speech compromise the processing of attended, task-relevant stimuli.

A7

TIMESCALES OF COGNITIVE CONTROL DURING AN AUDITORY SIMON TASK

Lisa Chinn[1], Carolyn Pauker[1], Edward Golob[1]; [1]Tulane University — Cognitive control is a context-dependent skill that enables one to ignore distractions and accomplish goals. It operates at timescales of seconds-to-minutes, however, the degree that control at shorter timescales drives effects at longer timescales is currently unclear. We hypothesized that cognitive control would be dynamic across individual trials (seconds), but not fully account for effects at longer timescales (minutes). A Simon task quantified the impact of distracting spatial information on behavior and EEG. Subjects (n=47) listened to amplitude-modulated noise (25,75 Hz) presented laterally, and pressed left/right buttons according to modulation rate. Subjects responded faster with matching (compatible) vs. conflicting (incompatible) trial types (stimulus/response laterality), termed the "Simon effect". The base rate of compatible trials varied across blocks (25, 50, 75%), which also affected the proportion of pairs of trial-types ("sequences"). Different base rates manipulate control demand because rare distractors are more likely to capture attention. Independent component analysis identified base rate effects in frontal and central cortical components using ERP and time-frequency power measures. The Simon effect increased with base rate for reaction time and accuracy (p's<.001), frontal theta-alpha (p<.001), central ERPs (p<.001) and ERSP power (theta p<.001; alpha p<.05). For two-trial sequences the Simon effect was larger after compatible trials (behavior p's<.001, frontal 400-500 ms ERPs p<.01; frontal theta-alpha ERSPs p<.001; central theta p<.001, alpha p<.05 ERSPs). Predictive quantitative models using sequence effects data suggest base rate effects are not fully accounted for by sequence effects. Results indicate behavioral and neural measures tuned to contextual changes on different timescales.

A8

THETA BAND PHASE-TRACKING IN CROSS-MODAL SPEECH

Shweta Soni[1], Matthew S. Tata[1]; [1]University of Lethbridge — In multisensory environment, our brain gathers information from multiple sensory sources and integrates into relevant form to guide our attention. In such environments, congruent and incongruent audio-visual stimuli have been known to have great impact on processing speech signals. While the facial articulation cues have been widely studied as visual cues for auditory processing, the role of reading text as visual information is still unclear. It is well known that speech perception is indexed by the degree at which low frequency neural oscillations track speech acoustics. We predicted that reading congruent text would modulate speech-locked EEG by aligning visual and auditory attention to the same dynamic stimulus. We recorded brain's electrophysiological activity as subjects performed a perception task where they received congruent and incongruent audio-visual information. Using cross-correlation method of quantifying phase-locked activity, we found that congruent visual inputs improved the auditory cortex's responses, especially in the Theta band (4-8 Hz) to the envelope of speech as compared to incongruent visual inputs. Our data corroborates the complementary role of visual inputs for auditory perception in cross modal senario. It also provides further insights to investigate the situations where brain is perceptually disconnected to stimuli (auditory), like mind-wandering.

PERCEPTION & ACTION: Motor control

A9

EEG EVIDENCE OF COMMAND FOLLOWING IN PATIENTS WITH SEVERE BRAIN INJURY

William H. Curley[1,2], Peter B. Forgacs[2,3,4], Tanya N. Nauvel[2], Mary M. Conte[2], Nicholas D. Schiff[2,3,4]; [1]Bates College, ME, [2]Brain and Mind Research Institute, Weill Cornell Medical College, NY, [3]Department of Neurology and Neuroscience, Weill Cornell Medical College, NY, [4]The Rockefeller University, NY — Patients with disorders of consciousness (DOCs) following severe brain injury often have severe motor deficits, limiting their capacity for behavioral output and often leading to misdiagnosis (Schnakers et al., 2009). Electroencephalographic (EEG) assessment of mental imagery is a strategy to assess the level of conscious awareness (Goldfine et al., 2011) that bypasses the motor system. The EEG elicited to motor commands is interpreted as the neural signature of awareness and motor planning in the absence of overt, purposeful movements (Forgacs et al., 2014). In an ongoing study of DOCs, multichannel video-EEG was recorded in 40 severely brain-injured patient subjects (PSs), and 15 healthy controls (HCs) while they were asked to perform four different motor imagery tasks (tennis, swimming, open/close hand, and visuospatial navigation). The EEG was segmented into 3-s epochs and only artifact-free epochs were analyzed. Power spectral estimates in the alpha and beta frequency ranges were then compared during task and rest conditions. For each channel, a Two Group Test was used to determine whether there was a significant ($p \leq 0.05$) difference in power between conditions (Goldfine et al., 2011). We found changes in spectral power in the alpha and/or beta frequency bands in all HCs and 13 of 25 PSs. For both groups, EEG positive response profiles occurred consistently within channels in centro-parietal regions immediately superior to the motor cortex, suggestive of motor planning. Our findings have important implications for the use of EEG motor imagery in the assessment of cognitive reserves in severe brain injury.

ATTENTION: Auditory

A10

THE ROLE OF BETA OSCILLATION IN SENSORY PREDICTION AND ATTENTION

Andrew Chang[1], Dan Bosnyak[1], Laurel J. Trainor[1]; [1]McMaster University — Neural activities of cortical perceptual systems reflect the interactions between sensory prediction and attention. Studies showed that power fluctuations of beta (15 – 25 Hz) oscillatory activity in auditory cortex entrain to the rhythmic tone sequences, such that power decreases following the onset of a tone, and increases again predictive of the onset of the next tone. The current study aimed to investigate whether beta oscillations also predict "what" in addition to "when", and how beta oscillations affect subsequent attentional responses. We recorded EEG while participants passively listened to isochronous auditory oddball sequences, in which occasional tones are in a deviant pitch. We analyzed the oscillations from primary auditory cortices. In Experiment 1, the results showed that the unpredictable deviances induced stronger power than standards in the low-beta band (15 – 20 Hz), and the effect was larger when the deviances had a lower occurrence rate (10 vs. 20 %), suggesting that beta oscillations reflect prediction violations of "what". In Experiment 2, the two oddball sequences were at the same occurrence rate (20%), but the deviances were either predictable or not in the sequence. The results showed enhanced beta power entrainment prior to the deviances only in the predictable oddball sequence, and it was negatively associated with amplitude of P3a, a late event-related potential reflecting less exogenous attentional orienting to deviances. Together, we suggest that beta oscillations reflect sensory prediction of both "what" and "when", and such predictive activities decrease subsequent exogenous attentional responses to deviant pitch.

A11

NO AGE-DIFFERENCES IN RECOVERING FROM THE SENSORY CONSEQUENCES OF AUDITORY DISTRACTION

Marta Volosin[1,2], Zsofia Anna Gaal[1], Janos Horvath[1]; [1]Institute of Cognitive Neuroscience and Psychology, RCNS-HAS, Budapest, Hungary, [2]Eotvos Lorand University, Budapest, Hungary — Numerous studies suggest that elderly are more susceptible to distraction than young adults, but the temporal characteristics of distraction and recovery from a distracted state are still not well researched. The present study utilized the N1 event-related potential (ERP) to investigate how long the distracted state persists in young (19-26 years) and in old (62-74 years) adults. N1 reflects the sensory registration of auditory events, but it also influenced by the focus of attention: sound events in the focus of attention elicit enhanced N1s in comparison to auditory events outside of it. Previous studies showed that when a distracter precedes a target event by 150 ms, the target-related N1 is significantly reduced in comparison to the N1 elicited by a target following the distracter by 650 ms. In the present study, a continuous stimulation paradigm was administered, in which participants listened to a continuous tone occasionally changing its pitch in brief glides (distracters). The tone also contained short gaps (targets). The temporal separation between glides and gaps was 150, 250, 650 ms or longer and the participants' task was to respond to gaps while ignoring glides. We found that target-related N1s were significantly reduced for 150 and 250 ms glide-gap separations compared to 650 ms or longer glide-gap separations. Although elderly exhibited significantly lower gap-related N1 amplitudes than young adults, the relative (proportional) magnitude of N1 modulation did not differ between the two age groups. This suggests that aging does not affect the time needed to recover from auditory distraction.

ATTENTION: Nonspatial

A12

MEASURING COGNITIVE FATIGUE IN MULTIPLE SCLEROSIS USING AN ATTENTION TASK

Sarah Wood[1], Starla Weaver[3], Glenn Wylie[1,2], Brian Yao[1,2], Yu He[1], Tony Jiang[1,2], Guang Yue[1,2], Nancy Chiaravalloti[1,2], Helen Genova[1,2], John DeLuca[1,2], Ekaterina Dobryakova[1,2]; [1]Kessler Foundation, [2]Rutgers New Jersey Medical School, [3]Oklahoma City University — Fatigue affects 90% of individuals with Multiple Sclerosis (MS). To develop effective treatments, we must understand the neural mechanisms underlying fatigue. To elucidate the neural mechanisms associated with fatigue, subjects with relapsing-remitting MS and high fatigue completed two Functional Magnetic Resonance Imaging (fMRI) scans. During the first scan, subjects completed a non-fatiguing task (nFT) consisting of a single letter memory cue and single position cue. Rapid presentation of random letters followed, and subjects had to respond whenever the cued letter was in the cued position. During the second scan, subjects did a fatiguing task (FT), in which the memory cue contained two letters and the position cue contained two positions to remember. Participants had to respond whenever either letter was in either position. Between blocks, subjects reported their fatigue level on a 1-10 scale. The behavioral data shows that task accuracy was significantly lower ($p<0.01$) and response time was significantly slower ($p<0.01$) for the FT. A significant increase in self-reported fatigue ($p<0.01$) was noted during the FT as compared with the nFT. Analysis of fMRI data showed greater activation in sensory areas of the brain during the FT. The nFT resulted in widespread activation of regions in the default mode network (DMN). The behavioral and self-report results suggest that the difficult attention task is more fatiguing than the nFT. DMN activation during the nFT suggests that this task is less cognitively taxing than the FT, during which less activation was observed.

A13

TEMPORAL EXPECTANCIES DRIVEN BY SELF- AND EXTERNALLY GENERATED RHYTHMS

Alexander Jones[1], Yi-Fang Hsu[2], Lionel Granjon[3,4], Florian Waszak[3,4]; [1]Middlesex University London, [2]National Taiwan Normal University, [3]Université Paris Descartes, [4]CNRS — The dynamic attending theory proposes that rhythms create periodic fluctuations of attention which modulate the gain of sensory input. However, temporal expectancies can also be driven by the mere passage of time (foreperiod effect). It is currently unknown how these two types of temporal expectancy relate to each other, i.e., whether they work in parallel and have distinguishable neural signatures. The current research addresses this issue. Participants either tapped a 1Hz rhythm (active task) or were passively presented with the same rhythm using tactile stimulators (passive task). Based on this rhythm an auditory target was then presented early, in synchrony or late. Behavioural results were in line with the dynamic attending theory as RTs were faster for in- compared to out-of-synchrony targets. Electrophysiological results showed self-generated and externally induced rhythms to entrain neural oscillations in the delta frequency band. Auditory ERPs showed evidence of two distinct temporal expectancy processes. Both tasks demonstrated a patterned which followed a linear foreperiod effect. In the active task, however, we also observed an ERP effect consistent with the dynamic attending theory. This study showed that temporal expectancies generated by a rhythm and expectation generated by the mere passage of time are dissociable mechanisms.

A14

STATES OF MIND: CHARACTERIZING THE NEURAL BASES OF FOCUS AND MIND-WANDERING THROUGH DYNAMIC FUNCTIONAL CONNECTIVITY

Benjamin Mooneyham[1], Michael Mrazek[1], Alissa Mrazek[2], Kaita Mrazek[1], Dawa Phillips[1], Jonathan Schooler[1]; [1]University of California, Santa Barbara, [2]Northwestern University — Neuroscientific approaches toward understanding the impact of mindfulness training on brain function have demonstrated differences in activity and functional connectivity within and between intrinsic brain systems, particularly the "central executive," "salience," and "default" networks, based on mindfulness training and experience. Assessments of functional connectivity during meditation tasks have previously only examined "static" functional connectivity values across entire tasks, and therefore have not disentangled the functional connectivity relationships between key brain networks as the mind fluctuates between states of focused attention and mind-wandering. Using a dynamic functional connectivity approach within a sustained attention task, we identified states of functional connectivity between key regions of the central executive, salience, and default networks that were positively and negatively associated with dispositional mindfulness levels, indicating states of focus and mind-wandering. We then assessed the impact of a multifaceted mindfulness intervention program on the frequency of these states' occurrence, and demonstrated a relationship between improve-

ments in mindfulness and state occurrence. We consider the implications of the functional connectivity state characteristics within a discussion of network dynamics underlying focused attention and mind-wandering.

A15

FEATURE-SPECIFIC AND CATEGORY-SPECIFIC ATTENTIONAL CONTROL SETTINGS ARE DIFFERENTIALLY AFFECTED BY ATTENTIONAL RESOURCE ENGAGEMENT IN CONTINGENT ATTENTIONAL CAPTURE

Wu Xia[1], Fu Shimin[1]; [1]Tsinghua University, Beijing, 100084, China — Contingent attentional capture proposed that attentional control settings (ACS) can guide involuntary attentional capture to distractors sharing target relevant property. Although feature-specific ACS and category-specific ACS were reported in single-dimensional search task, it is still unclear whether these two ACSs operate simultaneously in conjunction search task and how they relate to each other. Three experiments were conducted to investigate and compare feature-specific and category-specific ACS under different search strategies. The matching level between peripheral distractors and central target on feature and category dimensions was manipulated in a rapid serial visual presentation task. The influence of attentional resource engagement was also manipulated by the temporal lags between target and distractor. N2pc component, as well as the deficit of target accuracy, was measured to be indicative of attentional capture. Results consistently showed both category-specific and feature-specific ACS. Moreover, relative to category-specific ACS, the feature-specific ACS seems having more weights. Importantly, feature-specific ACS operated regardless of attentional resource engagement, whereas category-specific ACS was prevented by insufficient attentional engagement. It is concluded that feature-specific ACS and category-specific ACS are differentially monitored by attentional resource engagement and have different weights in conjunction search.

A16

PRIORITIZATION IN WORKING MEMORY BY TEMPORAL AND FEATURE-BASED EXPECTATIONS

Freek van Ede[1], Marcel Niklaus[2,3], Nick Myers[1,2], Anna C. Nobre[1,2]; [1]Oxford Centre for Human Brain Activity, Department of Psychiatry, University of Oxford, UK, [2]Department of Experimental Psychology, University of Oxford, UK, [3]Department of Psychology, University of Zurich, Switzerland — Adaptive behavior relies on various sources of top-down biases that enable the prioritization of information that is most relevant to ongoing task demands. In recent years, it has become clear that such top-down biases continue to operate in working memory, as evidenced by enhanced performance for items that are retro-cued during the retention interval. We investigated whether two other potent sources of top-down biases – temporal and feature-based expectations – can also prioritize information in working memory. In experiment 1, retro-cues informed participants about the feature-dimension (color or orientation) on which they were most likely to be probed. We demonstrate that, compared with neutral cues, working memory is improved for the cued feature-dimension at the expense of the uncued dimension. Thus, even within integrated items in working memory, features can be dynamically up- and down-regulated based on current task demands. In experiment 2, differently colored items were most likely to be probed at different working memory delays (1250 or 2500 ms). We demonstrate that such temporal expectations also influence working memory performance. Most strikingly, even for those items that show reduced performance when invalidly probed early, we observed enhanced performance when validly probed late, revealing dynamic "recovery" of their representational fidelity. Thus, multiple sources of top-down biases continue to operate during working memory and reveal novel insights into the dynamic nature of retained representations.

A17

GOAL-DIRECTED ATTENTION SUPPRESSES MULTIVOXEL PATTERN REPRESENTATION AND REDUCES INTER-REGIONAL COUPLING DURING DISTRACTOR INHIBITION

Kai Hwang[1], Akshay Jagadeesh[1], Ruoying Yang[1], Mark D'Esposito[1]; [1]Helen Wills Neuroscience Institute, UC Berkeley — Goal-directed attention prioritizes the processing of task-relevant stimuli. Recent evidence suggests that attention increases the coupling between goal-relevant regions, and enhances the representation of goal-relevant information coded in spatially distributed patterns of brain activity. Although it is often important to inhibit task-irrelevant stimuli, how attention modulates the neural representation and inter-regional coupling during distractor processing is less understood. To address this question, 29 healthy adult participants were recruited for an fMRI study. Sequences of superimposed images of faces and buildings were presented centrally to the participants, and participants were required to detect occasional back-to-back repetitions of a target category (face or building), while ignoring repetitions in the opposite distractor category. A passive viewing baseline was included to quantify attention enhancement versus distractor suppression effects in the fusiform face area (FFA) and parahippocampal place area (PPA). Replicating previous findings, we found that attention reduced evoked responses for distractors in FFA and PPA. Further, using a psychophysiological interaction model, we found that independent of stimulus-driven activity, coupling between early visual areas and higher visual areas encoding the distractor information was decreased when compared to the baseline. Independent of univariate analyses, we further developed a multivoxel pattern-matching method to quantify information representation under different attention conditions. We found that attention suppressed multivoxel patterns of activity for distractors relative to baseline. Our results suggest that multiple neural mechanisms for inhibiting visual distractors likely exist, including reducing response gain, decreasing coupling along the visual processing hierarchy, and suppresses the representation of distracting information.

EMOTION & SOCIAL: Emotion-cognition interactions

A18

A COLLECTION OF UNFAMILIAR EMOTIONAL MOVIE CLIPS

Annick Tanguay[1], Kylee Ramdeen[1], Lydia Muyingo[1], Christine Beaudoin[1], Patrick S. R. Davidson[1]; [1]University of Ottawa — Sets of static emotional images have proven invaluable for research in psychology and neuroscience. Here we present a collection of emotional movie clips, which can be used in ways similar to the static image collections. We provide 300 realistic, brief movie clips from fictional and non-fictional sources. Each emotional clip has a non-emotional one available from the same source, to facilitate matching. We include ratings of valence and arousal (using the same scales as the International Affective Picture System) and estimates of visual complexity. Clips are low in familiarity (to avoid unduly influencing participants' emotional responses, attention, and memory). This set should prove useful for a wide range of work on emotion and behavior.

A19

MIDFRONTAL THETA EEG REFLECTS COMPETITION BETWEEN PAVLOVIAN AND INSTRUMENTAL SYSTEMS DURING SOCIAL REINFORCEMENT LEARNING

James Thompson[1], Margaret Westwater-Wozniak[2], Zena Kirby[1]; [1]George Mason University, [2]University of Cambridge — Emotional expressions are social signals that send information to other people in order to influence their behavior. As a receiver, facial expressions can be a) a guide to appropriate actions; and b) reward or punishment eliciting approach or withdrawal, respectively. In the present study, we examined how Pavlovian responses to facial expressions interact with instrumental learning, and the role of midfrontal theta EEG in this interaction. Action and outcome valence were orthogonalized in our task as participants (N=13) learned to use abstract cue shapes to guide whether they should respond to an upcoming target ("Go" trials) or withhold a response to the target ("NoGo" trials) to receive a social reward (photo of smiling face) or avoid a social punishment (photo of angry face). EEG was recorded from 124 electrodes as participants performed the task. While participants successfully demonstrated instrumental learning, we found evidence of Pavlovian bias: significant social reward-related invigoration ($p<0.01$) and social punishment-related suppression ($p<0.05$) of responses. Time-frequency analysis of EEG responses to the cue shapes revealed a significant increase ($p<0.001$) in power in the 4-8Hz range at midfrontal sites around 500ms after cue onset in conditions that conflicted with Pavlovian biases (Go-to-avoid punishment; NoGo-to-win reward) relative to those consistent with these biases (Go-to-win reward; NoGo-to-avoid punish-

ment). These findings are consistent with midfrontal theta EEG responses reflecting the competition between Pavlovian learning in response to the rewarding or punishing nature of the facial expressions, and an instrumental system capable of using the facial expressions to guide behavior.

A20

CONVERGING EVIDENCE FOR THE NEURAL CORRELATES OF AVERSIVE ANTICIPATION

Josh Carlson[1], Tsafrir Greenberg[2], Lilianne Mujica-Parodi[3]; [1]Northern Michigan University, [2]University of Pittsburgh, [3]Stony Brook University — Anticipation of aversive events is an adaptive preparatory response to negative future outcomes. The anterior insula has consistently been linked to anxious anticipation, while other structures such as the amygdala and anterior cingulate cortex have also been implicated albeit less consistently. Many neuroimaging studies of aversive anticipation have used modest sample sizes, region of interest analyses, and a variety of methodological approaches of inducing anxious anticipation. The aim of the current investigation was to generate a more robust and complete understanding of the neural correlates of anxious anticipation by measuring anticipatory activity across multiple datasets. Two approaches were used to test this aim. First, we performed a voxel-wise analysis across three fMRI datasets to test for common, and distinct, activity in anticipation of aversive sounds, static visual images, and dynamic visual images. Second, Neurosynth was used to perform a meta-analysis based on activation coordinates from 40 fMRI studies of aversive anticipation. Results from the voxel-wise analysis of combined datasets revealed a widespread preparatory response in the anterior insula, dorsolateral prefrontal cortex, dorsal anterior cingulate, medial supplementary motor area, premotor area, visual cortex, auditory cortex, somatosensory cortex, amygdala, and a striatal region consistent with the bed nucleus of the stria terminalis. The results from Neurosynth revealed similar, but more restricted, activity in the anterior insula, perigenual anterior cingulate, dorsal anterior cingulate, medial supplementary motor area, amygdala, and striatum/bed nucleus of the stria terminalis. Thus, the results provide converging evidence for a widespread neural system associated with anticipatory anxiety.

A21

IMPLICIT TENDENCIES TO APPROACH AND AVOID ALCOHOL PREDICT FUTURE DRINKING

Laura Martin Braunstein[1], Alexis Kuerbis[2], Peter Gollwitzer[3], Gabriele Oettingen[3], Kevin Ochsner[1], Jon Morgenstern[4]; [1]Columbia University, [2]Hunter College, CUNY, [3]New York University, [4]North Shore Long Island Jewish Health System — Addiction is characterized by compulsive drug-seeking and substance use, yet many individuals break free of these patterns and change their behavior. Traditional predictors of behavior change/persistence rely on self-reports of factors like readiness to change. However, these explicit measures only characterize top-down influences on behavior. The incentive sensitization model of addition suggests that more implicit, automatic processes, like the tendency to approach substance cues, play a major role in behavior. We tested whether implicit approach and avoidance tendencies for alcohol would predict drinking behavior in a sample of heavy drinkers undergoing treatment to moderate their drinking. We examined implicit approach and avoidance tendencies for alcohol using a modified version of the relevant stimulus response compatibility (SRC) task. In the SRC task, approach and avoidance tendencies were assessed incidentally using reaction times to categorize alcohol/control images by making certain movements, which include approach and avoidance responses. We measured alcohol approach and avoidance tendencies at baseline and post-treatment (12 weeks later) and found that the speed to approach and avoid pictures of alcohol at baseline predicted drinking at post. Specifically, faster alcohol approach at baseline was associated with greater overall drinking at post, and faster alcohol avoidance at baseline predicted fewer drinking days per week at post. Interestingly, readiness to change at baseline did not predict drinking at post. Further, implicit approach tendencies were largely distinct from explicit measures, and approach and avoidance tendencies explained unique variance in post drinking behavior.

A22

THE RELATIONSHIP BETWEEN WHITE MATTER MICROSTRUCTURE AND ATTENTIONAL IMPULSIVITY IN ADOLESCENTS WITH AFFECTIVE MENTAL HEALTH DISORDERS

Andrea T. Shafer[1], James Benoit[2], Andy Greenshaw[2], Sunita Vohra[2], Florin Dolcos[3], Anthony Singhal[2]; [1]Wayne State University, [2]University of Alberta, [3]University of Illinois Urbana-Champaign — Extant literature on microstructural white matter (WM) changes in adolescents with psychopathology is sparse. While the majority of studies show decreases in fractional anisotropy (FA) compared to non-clinical adolescents, a few studies identified increases in FA in certain WM tracts for specific subsets of clinical adolescents (ADHD, alcohol-use disorders and conduct disorder). Only a handful of studies have examined differences in structure-function relationships between clinical and non-clinical adolescents. Most of these show decrements in attentional performance linked to decreases in FA, but some show decrements linked to increases in FA. Therefore, alterations in FA associated with adolescent psychopathology in general and those related to functional differences in attentional processing remain unclear. To address these issues, the current study used diffusion tensor imaging in combination with a continuous performance test in 40 adolescents (20 clinical with affective mental health disorders, 20 non-clinical). The main purpose was to examine group differences in FA, and differences in the relationship between FA and attentional impulsivity in the two samples. A customized preprocessing pipeline using FMRIB tools was implemented, and voxel-based analyses were performed. Analyses identified two main findings. First, FA decreases were observed for clinical relative to non-clinical adolescents in 13 WM structures (i.e., lobar WM, commissural, projection and association fibers). Second, differences in structure-function relationships were found between groups. Whereas clinical adolescents showed a positive relationship between FA and impulsivity in commissural, projection and association fibers, non-clinical adolescents had a negative relationship between FA and impulsivity that was largely localized to association fibers.

A23

VISUOCORTICAL CORRELATES OF ATTENTION DURING PREDICTABLE AND UNPREDICTABLE THREAT - A FREQUENCY-TAGGING SSVEP APPROACH

Matthias J Wieser[1], Philipp Reicherts[1], Georgiana Juravle[2], Andreas von Leupoldt[3]; [1]University of Würzburg, Germany, [2]UKE Hamburg-Eppendorf, Germany, [3]University of Leuven, Belgium — Fear and anxiety are functionally different defense states mediated by distinct brain structures. Whereas fear is elicited by imminent threat and leads to a phasic fear reaction, anxiety is characterized by a sustained state of heightened vigilance due to temporally uncertain danger. In the present study we investigated whether fear and anxiety are associated with different states of attentional vigilance as measured by visuocortical facilitation. To this end, we employed a NPU-paradigm together with ssVEPs and frequency-tagging methodology. We investigated ssVEPs across three context conditions (30 sec): no aversive events (N), predictable aversive events (P), and unpredictable aversive events (U) signaled by a grid of four peripheral objects. Short-duration cues (Gabor patches) were presented for 3 seconds several times in each condition. Aversive events were signaled by the cues in the P condition but were presented randomly in the U condition. Importantly, cues and context events were flickered at different frequencies (15 Hz vs. 20 Hz) in order to disentangle electrocortical responses to contexts and cues. As expected, the onset of the context elicited larger electrocortical responses for the U compared to the P context in the first 1000 ms. Conversely, P cues elicited larger electrocortical responses compared to the N and U cues. Interestingly, during the presence of the P cue, visuocortical processing of the concurrent context was also enhanced. The results support the notion of enhanced hypervigilance to unpredictable threat, while predictable cues show electrocortical enhancement of the cues themselves but additionally a boost of context processing.

A24

DIFFERENTIAL IMPACT OF VMPFC DAMAGE ON RISK TAKING IN 'HOT' AND 'COLD' DECISIONS

Julia Spaniol[1], Francesco Di Muro[2], Elisa Ciaramelli[2]; [1]Ryerson University, [2]University of Bologna — The ventromedial prefrontal cortex (vmPFC) has been implicated in valuation and decision

making, but its precise role in risky choice is not fully understood. In particular, it is unclear how vmPFC contributes to affect-charged ('hot') versus deliberative ('cold') decision making. In the current study, we compared 3 groups matched on demographic characteristics: patients with focal lesions in vmPFC, patient controls with damage outside of the frontal cortex, and healthy controls. Over two sessions, participants completed hot and cold versions of a risky choice task, the Columbia Card Task (CCT; Figner et al., 2009). In the CCT, risk is manipulated parametrically, along with gain magnitude and loss magnitude, allowing an assessment of how these factors influence risk taking. In the 'hot' version of the task, affect is triggered by asking participants to make incremental decisions with immediate feedback. In this version, vmPFC patients showed normal risk sensitivity, but a strong overall increase in risk appetite relative to the other groups. In the cold CCT, decisions are made in a single step and without feedback. Here, vmPFC patients showed no overall difference in risk appetite relative to the other groups, although the vmPFC group's sensitivity to variation in risk was reduced. Finally, sensitivity to gain and loss magnitudes did not differ significantly between the groups, in either the hot or the cold CCT. These results indicate that the vmPFC may play a critical role in overriding risky choice in affect-rich, 'hot' decisions, specifically.

A25

THE TIME-COURSE OF MORAL PERCEPTION: AN ERP INVESTIGATION OF THE MORAL POP-OUT EFFECT

Peter Mende-Siedlecki[1], Ana P. Gantman[1], Brian Steele[2], Jay J. Van Bavel[1], Kyle E. Mathewson[2]; [1]New York University, [2]University of Alberta — Models of moral psychology have only recently considered the relationship between morality and perception. We propose that due to chronic moral motives, moral (vs. non-moral) content is privileged in perceptual awareness. Supporting this, Gantman and Van Bavel (2014) observed that under perceptually ambiguous conditions (backwards-masked stimulus presentation), moral words (e.g., "kill", "should") were perceived more accurately than non-moral words (e.g., "die", "could"), an effect termed the "moral pop-out effect" (MPE). However, the time-course underlying this effect remains unclear. To examine how quickly moral concerns influence cognitive processing, participants (N=43) underwent electroencephalography recording during a lexical decision task presenting moral and non-moral words matched for valence, arousal, and frequency. A difference in the earliest event-related potential (ERP) components (P1, N1, N2) would suggest a direct influence of moral relevance on visual processing, while a difference in later ERP components (P3) would suggest a difference in attentional processes between moral and non-moral words. Participants correctly identified moral words more frequently than non-moral words, replicating the MPE. Moreover, ERP responses to moral and non-moral words began to differ around 300ms, suggesting that the MPE is supported by differences in perceptual attention, biasing the threshold for detecting moral content. Critically, behavioral and neural indices of MPE were correlated across subjects, such that greater detection of moral (vs. non-moral) words was associated with larger P3 amplitudes in response to moral words. These results suggest that the primacy of moral content may stem from increased attention to morally-relevant information, diminishing the threshold for awareness.

A26

CORTICAL AND SUBCORTICAL RESPONSES TO NEGATIVE IMAGES PROSPECTIVELY PREDICT DECISIONS TO REGULATE EMOTION

Bruce Dore[1], Jochen Weber[1], Yaakov Stern[1], Kevin Ochsner[1]; [1]Columbia University — Deciding to regulate emotion is a fundamental means by which individuals can respond to environmental challenges, but little is known about the neural processes that support such decisions. We used fMRI to test whether brain responses to negative images can be used to prospectively predict emotion regulation choice behavior. We found 1) that activity within a priori regions of interest including the amygdala, ventrolateral prefrontal cortex (vlPFC), dorsolateral prefrontal cortex (dlPFC) and dorsomedial prefrontal cortex (dmPFC) predicted person-level number of choices to regulate, and 2) within-person expression of a meta-analytically derived whole-brain pattern associated with regulating emotion predicted choosing to regulate responses to particular stimuli, beyond the predictive value of stimulus intensity or self-reports of emotion. These data demonstrate that brain responses associated with emotional reactivity and regulation can be used to predict who will choose to control emotion and for which stimuli they will choose to do so, a first step towards a prospectively predictive and neuroscience-informed model of variable behavioral responses to distressing events.

A27

ATTENTIONAL DEPLOYMENT TO FEAR-RELATED CUES

Felix Bacigalupo[1], Steven Luck[1]; [1]University of California - Davis — Introduction: Understanding the basic brain and cognitive mechanisms involved in fear processing is critical to understand the pathophysiology of anxiety related disorders and for developing new treatments. Objective: To study how attention is deployed to stimuli that are associated with fear with rigorous control over sensory properties of the stimuli. Methods: The experiment consisted of two phases: Phase 1) fear conditioning, in which a specific color was associated with a loud noise (conditioned stimulus or CS+), whereas other two colors were neutral (CS-); to assess fear conditioning, we measured the skin conductance response (SCR). Phase 2) attentional task, in which the participants were instructed to attend to a lateralized colored circle (target) and report whether it had a gap on top or bottom. Sometimes, one of the colors in this array matched the CS+ color. Visuo-spatial attention was measured via the N2pc component, whereas emotional processing was evaluated via the late positive potential (LPP) of the event related potential (ERP) waveform. Results: There were greater N2pc and LPP amplitudes (indicating greater allocation of attention and emotional processing) for CS+ targets compared to CS- targets in the attention task. Conclusions: These preliminary results suggest that the deployment of visuo-spatial attention is enhanced by fear-related cues. It is possible that patients suffering from anxiety and trauma-related disorders have a dysregulation of visuo-spatial attention that enhances the allocation of attention to fear-related sensory inputs, thus leading to a paradoxical state of over-processing aversive stimuli.

A28

INDIVIDUAL DIFFERENCES DETERMINE EFFECTS OF ACUTE STRESS ON COGNITIVE FLEXIBILITY

Elizabeth V. Goldfarb[1], Monja I. Frobose[2], Roshan Cools[2,3], Elizabeth A. Phelps[1,4]; [1]New York University, New York, NY, [2]Radboud University, Nijmegen, The Netherlands, [3]Radboud University Medical Centre, Nijmegen, The Netherlands, [4]Nathan Kline Institute, Orangeburg, NY — The ability to ignore irrelevant distraction (i.e., cognitive stability) but flexibly update when the information becomes relevant (i.e., cognitive flexibility) are critical, and functionally opposing, computations. As flexibility in an adapted delayed match-to-sample (DMS) task has been shown to involve the dorsal striatum, and stress enhances dorsal striatal function, we hypothesized that stress would facilitate flexibility. Using a within subjects design (N = 38), we assessed the effects of acute stress on performance in this DMS task. As expected, our stress manipulation (cold pressor task) led to a significant increase in cortisol. Individual differences in factors such as cortisol response, gender, and chronic stress levels explained the effects of acute stress on cognitive flexibility. Overall, participants were more accurate on trials that required flexibility compared to trials that required simple working memory maintenance. Under acute stress, the magnitude of this difference was correlated with increases in cortisol, such that higher levels of cortisol correlated with greater flexibility. This relationship was stronger in female than male participants. Effects of stress also varied based on pre-experimental chronic stress levels (Perceived Stress Scale). Participants with low levels of chronic stress showed improved flexibility and stability under stress, while participants with high levels of chronic stress showed impaired flexibility and stability under stress. These findings provide insight into the variable influence of acute stress on cognitive control and emphasized the relevant role of individual differences in responses to stress.

EMOTION & SOCIAL: Emotional responding

A29

BORDERLINE PERSONALITY DISORDER PATIENTS SHOW LONGITUDINAL AMYGDALA AND ANTERIOR INSULA SENSITIZATION TO EMOTIONAL STIMULI FOLLOWING INITIAL HABITUATION

Bryan T. Denny[1], Jin Fan[1,2], Antonia S. New[1,3], Marianne Goodman[1,3], Mercedes Perez-Rodriguez[1], Samuel Fels[1], Hayley Galitzer[1], Antonia McMaster[1], Heather Alexander[1], Larry J. Siever[1,3], Harold W. Koenigsberg[1,3]; [1]Icahn School of Medicine at Mount Sinai, [2]Queens College, City University of New York, [3]James J. Peters VA Medical Center — Borderline personality disorder (BPD) is the prototypical disorder of emotion regulation, yet there remains limited understanding of its neurocognitive correlates. Impairment in habituation or anomalous sensitization of the salience network during repeated exposure to emotional events could contribute to emotion dysregulation in BPD. The present study examined the effect of repeated exposure to emotional images, both within-session and across two sessions separated by about three days, upon nodes of the salience network in BPD patients, avoidant personality disorder patients (AvPD), and healthy controls (HC). 26 BPD, 25 AvPD, and 24 HC participants viewed 5 presentations of the same set of 10 negative and 10 neutral images in each of two sessions spaced approximately three days apart as fMRI data were acquired. Activation in anatomically-defined salience network regions-of-interest (amygdala; anterior insula; and dorsal anterior cingulate cortex, dACC) was compared across groups for each presentation on each of the two study days. Right amygdala activity showed a main effect of within-session habituation across groups ($F(4,1368)=12.45$, $p<0.001$). However, only BPD patients showed increased right amygdala activation to the images re-encountered on Day 2 (Group X Session interaction, $F(2,1368)=23.38$, $p<0.001$). A similar pattern was observed in right anterior insula, but not in left amygdala, left anterior insula, or dACC. BPD patients are distinguished from AvPDs and HCs by right amygdala and right anterior insula sensitization upon delayed re-exposure to negative images for which responses had previously shown habituation. These results suggest dissociable processes of acute habituation and delayed sensitization in BPD patients.

A30

THE EMOTIONAL HOMUNCULUS: EVIDENCE FOR SOMATOTOPIC EMPATHY

Bettina Forster[1], Alejandra Sel[2], Manos Tsakiris[3], Beatriz Calvo-Merino[1]; [1]City University London, UK, [2]University of Oxford, UK, [3]Royal Holloway University of London, UK — Recent research has shown independent contribution of somatosensory cortex (SCx) to facial emotion processing (Pitcher et al., 2008; Sel et al., 2014). In addition, research showed that emotions are felt in different body parts and represented by different patterns of brain responses (Nummenmaa et al., 2014; Saarimaki et al., 2015). We tested whether the empathetic response triggered by observing others emotional face expressions leads to distinct activations of SCx. Participants performed a visual facial emotion discrimination task. On half of the trials SCx activity was probed by task irrelevant touch to different body parts. By subtracting neural activity elicited on visual-only facial emotion expression trials from tactually probed trials we isolated pure SCx emotion responses. Furthermore, by comparing responses to different tactile probe locations (finger versus toe) and different facial emotion expression trials (sad versus anger) we show dissociation in the somatotopic response to different facial emotion expressions. Moreover, participants were asked to indicate where in the body the person expressing the facial emotion felt the emotion. This empathetic inference predicted our participants' cortical activation within SCx when judging facial emotion expressions, at least for anger. Taken together, our result is the first evidence for distinct somatotopic activation patterns of perceiving others' felt emotions. Nummenmaa et al. 2014. PNAS 111: 646-51. Pitcher et al. 2008. J Neurosci 28: 8929-33. Saarimaki et al. 2015. Cereb Cortex: 1-11. Sel et al. 2014. J Neurosci 34: 3263–7

A31

A DOMAIN-GENERAL REPRESENTATION OF VISUAL AESTHETIC APPRECIATION IN THE DEFAULT-MODE NETWORK REVEALED BY MULTI-VOXEL PATTERN ANALYSIS

Edward Vessel[1], Jonathan Stahl[2], Gabrielle Starr[1]; [1]New York University, [2]Ohio State University — Individuals can be aesthetically moved by a diverse array of visual objects, from abstract paintings to mountain vistas. Previous work suggests that the default mode network (DMN), implicated in a variety of internally focused cognitive processes, is differentially engaged by strongly aesthetically moving artwork (vs. non-moving artwork; Vessel, Starr & Rubin 2012). Is the representation of aesthetic appreciation in the DMN specific for artifacts of human culture such as artwork, or does it contain a domain-general representation of aesthetic appreciation? Thirteen observers made aesthetic judgments ("how much does this image move you?") about images of artworks, natural landscapes, or architecture on a continuous scale (in separate runs) while being scanned using fMRI. Classifiers were trained to distinguish most vs. least moving trials using multi-voxel patterns of trialwise BOLD responses. When provided data from the anterior medial prefrontal cortex (aMPFC) portion of DMN (derived from subject-specific "rest" scans), classifiers trained on one category and tested on another performed better than chance for all train/test combinations (57-60%, $p<0.01$), providing strong evidence that this portion of the DMN contains domain-general information about aesthetic appreciation. We also tested classifiers derived from a series of anatomical ROI's tiling medial and orbital PFC. We found across-domain sensitivity between artwork and architecture and between landscapes and architecture. However, there were several ROIs with sensitivity to only single domains, and across-domain sensitivity between art and landscapes did not reach significance in any ROI tested. This suggests that there also exist domain-specific representations of aesthetic appreciation in PFC.

A32

SEARCHING FOR THE PAVLOVIAN TRACE: MULTIVARIATE PATTERN ANALYSIS REVEALS EXPRESSION OF PURELY EXPERIENCE-BASED FEAR MEMORIES IN THE HUMAN RIGHT AMYGDALA

Senne Braem[1], Jan De Houwer[1], Jelle Demanet[1], Kenneth Yuen[2], Raffael Kalisch[2], Marcel Brass[1]; [1]Ghent University, [2]Johannes Gutenberg University Medical Center — Human Pavlovian fear conditioning has long been hypothesized to rely, at least in part, on non-verbal processing of the contingency between the conditioned stimulus (CS) and the aversive unconditioned stimulus (US) that drives the acquisition of conditioned responding (CR). A proposed neural substrate for these purely experience-based learning and memory processes is the amygdala. Demonstrating non-verbal processing by conducting Pavlovian conditioning in the absence of CS awareness has proven methodologically challenging, and these studies have not established a consensus on the existence of non-verbal elements in conditioning, nor on their neural substrates. We here used an alternative strategy. Instead of trying to eliminate conscious CS processing, we created two experimental conditions (CS+1, CS+2) that were equated for CS awareness and all verbally available information on CS-US contingencies. One condition (testing the expression of the CS+1 associated fear memory) was characterized by an additional element of prior experience of the CS-US contingency that was not present in the other condition (testing the CS+2 associated fear memory expression). We observed slightly stronger CRs to the CS+1, reflecting the expression of a purely experience-based, uninstructed fear memory trace, which we here term the Pavlovian trace. We further found that of all fear relevant regions, only the right amygdala showed a CS+1 specific neural activation pattern. Moreover, its strength correlated with the amplitude of the CS+1 > CS+2 fear memory expression difference. This is strong evidence for the existence of a Pavlovian memory trace in the human right amygdala.

A33

DYNAMIC ACTIVITY IN DEFAULT-MODE AND ATTENTION NETWORKS EVOKED BY SUSPENSEFUL NARRATIVES

Matthew Bezdek[1], Shella Keilholz[1], Eric Schumacher[1]; [1]Georgia Institute of Technology — Suspenseful film sequences serve as naturalistic stimuli for investigating moment-by-moment changes in emotional and attentional processes. In previous research, we reported that moments of high suspense evoke a pattern of

brain activation suggesting a narrowing of attention, with increased processing of the central visual field and decreased processing of the periphery (Bezdek et al., 2015). We also reported that suspense produced increased activity in nodes of the ventral attention network and decreased activity in the default-mode network (DMN), consistent with the attention hypothesis. In the current study, we investigated the time course of activity in these brain networks at periods of high and low suspense. We collected fMRI scans on 12 people using a multi-band sequence to achieve near full brain coverage with a fast repetition time of 700 ms. From the resting state run, we used independent component analysis to identify components whose spatial pattern corresponded to the DMN and an attentional network that included regions of the dorsal and ventral attention networks. We then extracted the average signal during the viewing of the suspenseful film excerpts and observe the pattern of activity surrounding suspense peaks and valleys. Consistent with previous research we found that peaks in suspense are associated with increases in attention network activity and decreases in DMN activity. This network separation reaches its peak about three seconds before the moment of highest suspense. These results suggest that brain responses to suspense may build over time in advance of conscious reports of suspense.

A34

EMOTIONAL PROCESSING IN PTSD: AN EVENT-RELATED POTENTIAL STUDY

Robert D. Torrence[1], Jeremy A. Andrzejewski[1], Lucy J. Troup[1]; [1]Colorado State University

— Posttraumatic stress disorder (PTSD) has been characterized by difficulty in emotional processing. Identifying the underlining neurological processes related to emotional facial processing in PTSD may provide important information about the development and maintenance of PTSD symptoms. The aim of this study was to examine event-related potentials (ERPs) during an emotional processing task in individuals with PTSD characteristics and individuals without PTSD. The task measured implicit and explicit emotional expression recognition and empathy in positive (happy), neutral, and negative (angry and fearful) facial expressions. The mean amplitude of the P300 component was compared between the PTSD and non-PTSD groups. Behavioral measures indicated no significant differences in emotion processing between controls and those scoring highly on the PCL-5 measure for PTSD. The ERP results indicated that the mean amplitude for the P300 component was reduced in the PTSD group when compared to non-PTSD. These results suggested individuals with PTSD have a deficit in early discrimination between emotional facial expressions on a neurological level. Previous research has indicated that individuals with anxiety and depression have a similar reduction in the P300 component as this study found in individuals with PTSD.

A35

SUPERIOR TEMPORAL GYRUS STIMULATION MODULATES FACIAL EXPRESSION PERCEPTION IN A MISFORTUNATE SITUATION

Mirella Manfredi[1], Ana Paula Gonçalves Donate[1], Sofia Macarini Gonçalves Vieira[1], Mariana De Araújo Andreoli[1], Paulo sergio Boggio[1]; [1]Social and Cognitive Neuroscience Laboratory, Center of Biological and Health Science, Mackenzie Presbyterian University, Sao Paulo, Brazil

— In a previous ERP study, we suggested that the comic element of a misfortune is the facial expression of the victims. Three situations were considered: people showing a painful/angry expression (Affective), a comic bewilderment expression (Comic) and people with no face visible (No Face). We found an early response specific to the comic stimuli. Since evidences showed that the left superior temporal gyrus (STG) is involved in facial expression perception, we hypothesized that tDCS application on this area would modulate the ability to recognize the facial expression and therefore, the comic element of a misfortune. Twenty university students underwent three bilateral tDCS stimulation sessions (anodal, cathodal, sham) over the left STG. The task consisted in categorizing the stimuli as comic or not. We presented the experimental material used in the previous study. The data revealed an improvement of the reaction times to comic and affective stimuli in the anodal stimulation. Moreover, while we observed longer responses to comic compared to affective stimuli in the sham condition, these differences disappeared in the anodal stimulation. Interestingly, no differences were found between the responses to the No face stimuli across the three tDCS conditions. Overall, this study indicated that the STG activity modulated the responses to comic and affective stimuli only when the facial expression was showed. Moreover, the data confirmed that the anodal stimulation over the left STG improved the ability to detect the facial expressions of the victims in a misfortune, facilitating the categorization of the situation as comic or not.

A36

INSULAR MORPHOMETRY ASYMMETRY- AND AGE-RELATED DIFFERENCES IN AUTISM

Taylor Smith[1], Khalil Thompson[1], Armond Collins[1], Tracey A. Knaus[2], Helen Tager-Flusberg[3], Jeremy D. Cohen[1]; [1]Xavier University of Louisiana, [2]Brain and Behavior Program at Children's Hospital, Louisiana State University Health Sciences Center, [3]Boston University School of Medicine

— Autism spectrum disorder (ASD) is a complex neurobiological developmental disorder, characterized by impaired social communication and social reciprocity, repetitive stereotypic behaviors, and high comorbidity of anxiety disorders. Prevailing theories of ASD suggest malfunction of individual brain regions, including amygdala, superior temporal sulcus (STS), or fusiform gyrus. Insular cortex has bidirectional connections with all of these regions, and has altered structure and function in populations with anxiety disorders, including other genetic developmental disorders. Moreover, age-related brain differences of amygdala were found in ASD at younger ages, but then disappear in adolescence. Using an established insular morphometry method, including a functionally-based anterior-posterior segmentation method, we investigated insular volumetric differences across age (preteen, teen) in ASD (N=26, F=4) and controls (N=17, F=3). It was expected that anterior and posterior insular volumes would be reduced in ASD. While no simple group differences were found for any insular region-of-interest, there was a significant group by hemisphere by age interaction for total insular volume. This indicated left-right total insular asymmetry that differed both between ASD and controls as well as preteen and teenaged groups. There was also a significant group by age interaction for posterior insula but not anterior. When looking at functional subregions, it was the posterior insula, not the anterior as predicted by existing anxiety models, that showed group-related volume differences across age. The current data combined with amygdalo-insular connectivity suggests that altered total insular asymmetry and early reductions in posterior insular volume contributes to the development of heightened anxiety in ASD.

EMOTION & SOCIAL: Person perception

A37

HOLISTIC PROCESSING BUT NOT ATTENTION ALLOCATION CONTRIBUTES TO THE OWN-RACE ADVANTAGE IN FACE RECOGNITION

Grit Herzmann[1], Tim Curran[2]; [1]The College of Wooster, [2]University of Colorado Boulder

— People are better at memorizing own-race than other-race faces. Previous research found lower brain activation for own-race faces during learning which suggested more efficient memory encoding as one of the factors contributing to the processing advantage. We tested this assumption in two experiments with Caucasian subjects and event-related potential (ERP) recording during memory encoding and retrieval. We operationalized more efficient memory encoding as possibly related to focused vs. divided attention (Experiment 1) or intact vs. disrupted holistic processing (Experiment 2). In Experiment 1, Caucasian and Chinese faces were studied under divided and focused attention. In Experiment 2, Caucasian and African-American faces were studied upright or upside-down, which disrupts holistic processing. Own-race faces were accurately recollected more often than other-race faces in both experiments. This advantage was not affected by attention manipulations but interacted with disruptions of holistic processing. ERPs replicated previous results and showed more efficient memory encoding for own-race faces in the focused attention and upright presentation conditions. In these conditions, less brain activation was required to successfully encode and subsequently recollect own-race faces. Whereas divided attention did not affect memory encoding differently for own-race and other-race faces, turning faces upside-down caused significant differences. In the inverted condition, subsequently recollected own-race faces elicited more positive amplitudes as compared to other-race faces. Thus, faces that are not easily processed holistically required more neural activation during memory encoding. Both experiments show that more efficient memory encoding is predominantly based on facilitation in holistic processing but not on the allocation of attention.

A38

TRUST DECISIONS ARE MEDIATED BY ALPHA SUPPRESSION OVER PARIETAL ELECTRODE SITES

Chris Blais[1], Derek M. Ellis[1], Kimberly M. Wingert[1], Adam B. Cohen[1], Gene A. Brewer[1]; [1]Arizona State University

— The ability to render a trust decision is fundamental for civilization, yet surprisingly little is known about the neurophysiology of these decisions. We told subjects they were playing a coin toss game with a trustworthy and an untrustworthy person and measured their neural activity with EEG. Both profiles were computer generated and correctly reported the outcome of a coin toss on 66% of trials. Behaviorally, subjects probability matched and chose to trust the reported coin flips from each profile equally (66.2% vs. 65.9%, respectively, n.s.). Electrophysiologically, there were reliable differences in the pattern of oscillatory activity in the alpha band (8-13Hz) over parietal electrode sites 1-3 s prior to their trust decision. Specifically, for trustworthy profiles there was greater alpha suppression for trust decisions vs. distrust decisions. Conversely, for untrustworthy profiles there was greater alpha suppression for distrust decisions vs. trust decisions. This finding is consistent with the interpretation that subjects are maintaining a "trust" mental set for trustworthy individuals and a "distrust" mental set for untrustworthy individuals. This differential activity (trust minus distrust) also predicts the number of trust decisions made ($r = -.65$, $p < .004$ for trustworthy; $r = .38$, $p = .071$ for untrustworthy). Our results are consistent with the idea subjects form an intention to trust (or distrust) an individual very early in the processing stream, and that this intention manifests as alpha suppression over parietal cortex.

A39

HOW VALID IS FALSE-BELIEF COGNITION TO SOCIAL ABILITY? EXAMINING INDIVIDUAL DIFFERENCES IN MENTALIZING IN ADULTS

Jacqueline Thompson[1], Robin Dunbar[1]; [1]University of Oxford

— Mentalizing (often called Theory of Mind or mindreading) is the ability to interpret and understand the mental states of others. Most mentalizing research has been done in children, but the little that has investigated individual differences in adults has either focused on very simplified false-belief tasks thought to rely on inhibitory mechanisms, or has used more ecologically valid, narrative story tasks whose cognitive underpinnings are less understood. In fMRI studies these tasks have shown differential activation, suggesting that they may only minimally draw upon the same cognitive mechanisms: the simplified tasks have shown selective activation in areas important for executive cognition (anterior cingulated cortex), whereas story tasks have generally found wider activation throughout the 'standard' mentalizing network (including temporoparietal junction and medial prefrontal cortex). However, these two types of mentalizing task have rarely (if ever) been investigated in tandem. We tested 80 young adults on multiple measures relating to social cognition, including a simple false-belief task, a narrative story mentalizing task, executive (impulsivity and response inhibition), working memory, and self-report measures of empathy and extraversion (EQ and IPIP50). As hypothesized, the two types of mentalizing tasks showed only a modest correlation ($r=.20$), reflecting their minimal overlap. Surprisingly, however, cognitive costs of false-belief performance correlated negatively with empathy ($r=-.27$) and extraversion ($r=-.24$), counter to the widely-held expectation that social expertise aids mentalizing ability. These results suggest that cognitive profiles associated with sociability may actually be linked to worse (low-level) mentalizing ability, inviting further research to disentangle this intriguing finding.

A40

THE CONTRIBUTION OF THE HIPPOCAMPUS TO SOCIAL COGNITION DYSFUNCTION

Rita Tavares[1], Temidayo Orederu[1], Avi Mendelsohn[1,2], Daniela Schiller[1]; [1]Icahn School of Medicine at Mount Sinai, [2]University of Haifa

— Efforts to uncover what is the "social brain" have propelled the growth of social neuroscience. Social cognition abilities, however, refuse to neatly map onto anatomically defined brain regions. We investigated how the human brain tracks ongoing changes in social relationships using functional neuroimaging. Participants played the lead role in a "choose-your-own-adventure" game, in which they interacted with cartoon characters. We found that a geometric model of social relationships, in a "social space" framed by power and affiliation, predicted hippocampal activity. Moreover, participants who reported better social skills showed stronger covariance between hippocampal activity and "movement" through "social space." These results suggest that the hippocampus is critical for social cognition, and imply that beyond framing physical locations, the hippocampus computes a more abstract, multidimensional cognitive map. Importantly, these neural representations of social space may be relevant for psychological wellbeing. Here we report new evidence on how this model can be predictive of social behavior and cognition. We found that a number of geometric variables, extracted from participants' behavior in the game, correlated robustly with trait scores: participants with higher social anxiety tended to give less power to the game's characters; and participants who reported less social avoidance and higher self-efficacy showed increased exploration of the social space. Additionally, we found that lower hippocampal volumes predicted lower fidelity tracking of social distance in the posterior cingulate cortex. We propose that geometric modeling of social relationships, and its correlation to hippocampal function, may provide a new diagnostic tool for social cognition dysfunction.

A41

EFFECTS OF STIMULUS ONSET ASYNCHRONY (SOA) ON ODOR-INDUCED MODULATIONS OF HEDONIC EVALUATIONS OF FACES: AN EVENT-RELATED POTENTIAL (ERP) STUDY

Stephanie Cook[1], Nicholas Fallon[1], Anna Thomas[2], Timo Giesbrecht[2], Matt Field[1], Andrej Stancak[1]; [1]University of Liverpool, [2]Unilever Research and Development

— Previous studies show that odors modulate hedonic evaluations of faces. It is not known whether such odor-priming effects vary as a function of temporal lag between odor and visual stimulus. The present study aimed to analyse neural mechanisms underlying effects of odors on evaluations of faces using two SOAs. Participants (N=28) rated faces under pleasant- (jasmine), unpleasant- (methylmercaptan), and no-odor conditions. In half of trials, faces appeared during a 3 s odor pulse. In the other half of trials, faces appeared one-second after odor offset. Participants rated pleasantness of faces and odor intensity after each stimulus using visual analogues scales. EEG was recorded continuously using a 128-channel EGI (Electrical Geodesics, Inc., USA) system. Faces presented in the unpleasant-odor condition were rated significantly less pleasant than faces presented in the pleasant- or no-odor conditions. Faces presented during unpleasant-odor stimulation were rated significantly less pleasant than the same faces presented one-second after offset of the unpleasant-odor. ERP responses to faces showed three prominent components: N170, N400 and the late-positive potential (LPP, >600 ms). There was an interaction effect in the LPP, which was stronger for faces presented simultaneously with the unpleasant-odor compared to the same faces presented after odor offset. Delaying presentation of visual stimulus relative to unpleasant-odor decreased the strength of hedonic evaluations of faces and amplitude of the LPP. A greater cortical and subjective response during simultaneous olfactory and visual stimulation may have adaptive role, allowing for a prompt and focused behavioral reaction if an aversive odor would signal danger.

A42

TESTING DETESTING: THE EFFECT OF TRAUMATIC BRAIN INJURY ON CHARACTER JUDGMENTS

Justin Reber[1], Arianna Rigon[1], Katie Croft, Melissa Duff[1,2]; [1]University of Iowa, [2]University of Iowa College of Medicine

— It is estimated that in the US over 6 million people live with Traumatic Brain Injury (TBI)-related disabilities. Although research has found that individuals with TBI are impaired at recognizing and interpreting social cues, very little work has investigated TBI patients' ability to update and manipulate existing social judgments. The current study used an established paradigm (Croft et al., 2010) to examine how patients with TBI integrate new information into established judgments of moral character. Briefly, TBI patients and demographically-matched comparison patients (NC) were instructed to make baseline moral character judgments based on a person's physical appearance, and later asked to update their judgment based upon an action performed by the person. The action could be morally neutral, positive, or negative. Preliminary results revealed that participants with TBI appear to weight both positive ($p < .05$) and negative ($p < .05$) information significantly differently from NC participants. This suggests that individuals with TBI may have difficulty appropriately updating their opinions of people. For instance, they might have problems crediting people who perform an act of kindness or adequately revising their opinion of individuals who commit a moral violation.

A43

PSYCHOPHYSIOLOGICAL RESPONSES TO EXPRESSIVE AFFECTIVE BODY MOVEMENT (DANCE) AND MUSIC IN INDIVIDUALS WITH AND WITHOUT AUTISM Beatriz Calvo-Merino[1], Julia F Christensen[1], Sebastian B Gaigg[1]; [1]City University London, UK — Impairments in reciprocal social-emotional behaviours constitute a cornerstone of the clinically defining features of Autism Spectrum Disorder (ASD). Individuals with ASD experience difficulties recognising emotional expressions in faces, voices and whole-body movements. Interestingly, they can discriminate different emotions in music and respond typically with psychophysiological arousal. This may suggest that ASD individuals may be more sensitive to emotion when presented in naturalistic affective expression context (i.e. music). Here, we assessed if a similar emotional response can be evoked with other artistic and naturalistic stimuli that include whole body movement (i.e. perception of dance). To test this prediction we compared subjective and physiological emotional responses to dance and music in ASD and typically developing individuals. Participants were asked to classify the emotion they felt (subjective emotional responses; happiness, sadness, excitement, peacefulness, fear) in response to a series of 30 second dance movements or music excerpts (presented in two blocks). Furthermore, participants rated the stimuli in terms of the intensity with which they felt the indicated emotion, while their psychophysiological response was recorded online (galvanic skin response, GSR; heart rate, HR). Results showed that individuals with ASD had difficulties relating to the emotions expressed in dance but not music at the subjective and physiological level. These results suggest that ASD participants are sensitive to the valence depicted in music, but not in dance, supporting that emotion recognition difficulties in ASD may be relatively specific to the domain of bodily expressed emotions.

EXECUTIVE PROCESSES: Monitoring & inhibitory control

A44

STIMULATING SUBTHALAMIC NUCLEUS SUBREGIONS SELECTIVELY MODULATES INHIBITORY ACTION CONTROL Scott Wylie[1], Nelleke van Wouwe[1], Daniel Claassen[1], Joseph Neimat[1], Wery van den Wildenberg[2]; [1]Vanderbilt University Medical Center, [2]University of Amsterdam — Patients with basal ganglia disease, particularly Parkinson's disease, show specific deficits in inhibitory action control. Studies of Parkinson's patients treated with deep brain stimulation (DBS) offer a unique opportunity to establish causal links between inhibitory action control mechanisms and basal ganglia function. We previously studied the effects of subthalamic nucleus (STN) DBS on inhibitory control dynamics in a Simon conflict task, applying the dual-process activation-suppression model (Ridderinkhof, 2002) to measure the strength of response capture by action impulses and the proficiency of reactive inhibition engaged to suppress interference from incorrect action impulses. Results showed that bilateral STN DBS at clinical settings, in dopamine-medicated PD patients improved inhibitory control of incorrect action impulses. Here, in PD patients withdrawn completely from all dopamine medications, we first replicated the finding that bilateral STN DBS at clinical settings improves selective inhibition of interference from incorrect action impulses elicited in a Simon task. Next, we recruited a second group of patients with bilateral electrodes positioned within both dorsal and ventral subregions of the STN. In separate sessions, we counterbalanced focused stimulation with non-clinical settings in bilateral dorsal and ventral STN subregions while PD patients performed the Simon task. Stimulating the dorsal, but not the ventral, STN subregion produced a drastic improvement in selective suppression of action impulses. These findings further confirm the critical involvement of STN circuitry in inhibitory control of action impulses, but more specifically point to circuitry interfacing the dorsal subterritories of the STN as representing a key node in selective inhibition processes.

A45

LONGITUDINAL TRAINING IN MEDITATION IS ASSOCIATED WITH DECREASED PRESTIMULUS ALPHA DURING A SUSTAINED ATTENTION TASK. Clifford Saron[1], Chivon Powers[1], Anthony Zanesco[1], Brandon King[1], Kezia Wineberg[1]; [1]University of California, Davis — Oscillatory activity in the alpha frequency range (8-12 Hz) has been associated with the efficient deployment and maintenance of attention during sustained attention tasks. We examined alpha power in electroencephalography (EEG) recorded from experienced meditators before, during, and after a 12-week intensive Shamatha meditation retreat to explore the electrocortical correlates of previously demonstrated training-related improvements in these participants (MacLean et al 2010). Participants completed a 32-minute continuous performance task (CPT) during which they attended to a stream of long lines (nontargets) and just-noticeably-different short lines (targets), and were asked to respond when a short line (presented at random 10% of the time) was detected. We analyzed longitudinal changes in alpha power 1s immediately prior to stimulus presentations in wait-list control participants tested onsite during an initial meditation retreat, and then again from these same participants when they later underwent training during a second 12-week retreat. We expected prestimulus alpha power would decrease with deeper immersion in the meditation training and that this decline would correspond with longitudinal improvements in discrimination responses. We observed no changes in prestimulus occipital alpha when participants served as wait-list controls. However, prestimulus alpha declined across the duration of the 2nd retreat when these same participants actively participated in the meditation training. These findings suggest that focused attention meditation may support generalized improvements in attentional deployment and maintenance in visual sustained attention tasks. These prestimulus alpha power fluctuations are further discussed in relation to within-task changes in behavioral discrimination performance and post-stimulus visual event-related N1 potentials.

A46

THE NEURAL BASES OF REWARDED "NO ACTION" AND REWARD DEPENDENCY Chiang-shan Li[1,2,3], Sheng Zhang[1], Sien Hu[1]; [1]Department of Psychiatry, Yale University School of Medicine, [2]Department of Neuroscience, Yale University School of Medicine, [3]Interdepartmental Neuroscience Program, Yale University — Numerous studies examined the neural correlates of reward response, focusing on the ventral striatal circuits. Rewarded responses are often contingent upon an overt action. However, in a natural setting, actions are rewarding sometimes only when they are not performed, and few studies have examined the neural bases of rewarded "no-action". Here, 35 young adults performed a reward go-nogo task during fMRI. A trial began with a dollar bill and nickel image framed in a square and shown each to the left or right of fixation (location fixed in each block). After a randomized period of 1 – 5 s, the square turned green (~3/4) prompting a quick button press or red, instructing subjects not to respond. Correct and incorrect trials were each rewarded and penalized with the monetary amount. In a control block, subjects respond to green and red squares in an identical design without win or loss. Compared to control trials, rewarded actions engaged the VS, midbrain, left anterior insula (AI) and medial PFC including the dACC and SMA, with greater responses to dollar than to nickel trials. Compared to control trials, rewarded no actions involved activation of the left AI and dACC/SMA and deactivation of the vmPFC. A direct contrast revealed deactivation of the vmPFC during rewarded no-actions vs. actions. Further, reward dependency as assessed by TPQ was associated with less vmPFC deactivation. These findings describe the neural processes of rewarded no-actions and suggested that reward dependency was associated with cerebral responses to rewarded no-actions rather than actions.

A47

IS THE FRONTOCENTRAL N2 A RELIABLE INDEX OF CONCEALED INFORMATION? Giorgio Ganis[1,2,3], Chun-Wei Hsu[1], David Bridges[1]; [1]University of Plymouth, [2]Massachusetts General Hospital, [3]Harvard Medical School — Event-related potentials (ERPs) employed in concealed information tests (CITs) have focused almost exclusively on the P3b component and have shown that this component is larger for the item of interest (probe) than control items (irrelevants). Recent studies have begun to examine whether

other ERP components are modulated by concealed information. A seminal study (Gamer and Berti, 2010) suggested that visual probes elicit a larger frontocentral N2 than irrelevants in a standard CIT. However, this study did not address the possibility of intrinsic differences among the stimuli because the same probe and irrelevants were used for all participants and there was no control condition with uninformed participants. We addressed this issue by counterbalancing stimuli across participants and by using a control condition with uninformed participants. Results showed that probes did not elicit a larger frontocentral N2 under these controlled conditions. Next, we determined the potential role of stimulus differences in the study by Gamer and Berti, as participants performed onset and target detection tasks on those same stimuli without any information about a nominally defined probe item. Results showed a larger N2 for the probe than the irrelevants, and this effect was indistinguishable from that found in a matched concealed information condition. These findings show that a larger frontocentral N2 is not a reliable index of concealed information in standard CITs. They also indicate that results of CIT studies performed without item counterbalancing and suitable uninformed control conditions may be caused by differential intrinsic properties of the stimuli employed.

A48

IMAGING BIOMARKER OF SMOKING ADDICTION AND EVALUATING TREATMENT EFFICACY

Yi-Yuan Tang[1], Rongxiang Tang[2]; [1]Texas Tech University, [2]Washington University in St. Louis — Previous research conducted by our team and others show that one mechanism for addiction may involve a deficit in self-control network including medial prefrontal cortex (PFC) and anterior cingulate cortex (ACC). Mindfulness meditation has been shown to have the potential to ameliorate negative outcomes resulting from deficits in self-control associated with addiction. However, this approach often requires long-term practice to achieve the benefits. Whether short-term practice could achieve the same goal remains elusive. In our series of randomized studies, one form of mindfulness meditation, the integrative body-mind training (IBMT) has been shown to improve attention, cognitive performance, self-control and neuroplasticity as well as treatment of mental disorders. In this talk I will demonstrate the IBMT effects on smoking addiction and its underlying brain mechanisms using a randomized controlled trial (RCT) in 15 smokers and15 non-smokers. All participants received 2-wk (5 h in total) of IBMT or relaxation training (RT), 30 min per session. Compared to non-smokers, we found a 60% smoking reduction and 30% quitting, and a decrease in craving even in smokers without an intention to quit. Brain imaging has shown that this behavior change is accompanied by greater ACC)/medial PFC activity. Our data suggest the ACC)/medial PFC as biomarker of smoking addiction and short-term mindfulness meditation reduces addiction through self-control network in the brain.

A49

EFFECTS OF CONFLICT-DRIVEN ATTENTION ON HIGH AND LOW LEVEL VISUAL PROCESSING

Kerstin Unger[1], Rebecca Waugh[1], Michael Worden[1]; [1]Brown University — Compatibility effects in selective attention tasks are typically reduced following incompatible trials compared to compatible trials, an observation termed congruency sequence effect (CSE). Relatively little is known about the nature of the attentional mechanisms that are engaged in response to recent conflict between incompatible stimulus and/or response representations. In particular, the existing literature remains controversial as to whether conflict-induced attentional mechanisms operate at early (or only later) stages of visual processing and work preferably through enhancement of target information or also by suppression of distractor information. In this study, we examined the relative contribution of these mechanisms using a modified spatial flanker paradigm with face and house stimuli as targets and distractors. Individually defined regions of interest (ROIs) included Fusiform Face Area (FFA), Parahippocampal Place Area (PPA), and regions within early visual cortex corresponding to the spatial locations of the target vs. the peripheral distractors. Behavioral results showed the expected compatibility effect as well as conflict adaption following incompatible trials. Imaging data indicated that the BOLD response in distractor regions was reduced following incompatible compared to compatible trials, whereas activity was enhanced for the center target. Furthermore, FFA activation to face targets was reduced following incompatible trials with face distractors compared to trials with house distractors. We observed a qualitatively similar albeit weaker effect for the PPA's response to house targets following incompatible trials including houses vs. faces as distractors. These findings suggest that conflict-induced attentional mechanisms modulate processing in early and higher-level visual areas via both suppression and enhancement.

A50

LONG-TERM MAINTENANCE OF MEDITATION-TRAINING RELATED IMPROVEMENTS IN RESPONSE INHIBITION AND VIGILANT ATTENTION

Anthony Zanesco[1], Brandon King[1], Katherine MacLean[1], Stephen Aichele[2], Clifford Saron[1]; [1]University of California, Davis, [2]University of Geneva, Switzerland — The human capacity to maintain vigilant attention is limited. Sustained attention is effortful, and prone to fatigue, lapses, and fluctuations with prolonged engagement. Such attentional deficits are pronounced in numerous psychiatric and brain disorders and are affected by age-related cognitive decline. The deficient and fluctuating nature of attention has historically formed a central motivation for improving sustained attention through dedicated mental training across many contemplative traditions, and several longitudinal studies have now provided evidence that meditation training may facilitate generalized improvements in this domain. However, the extent to which these improvements are maintained following the conclusion of intensive training, their dependence on continued meditation practice, and how they interact with other developmental processes such as aging is poorly understood. Therefore, we examined participants' performance on a sustained response inhibition task, parameterized using a visual discrimination threshold procedure, across six waves of assessment: three waves during three months of full-time Buddhist focused attention meditation training and practice, and the rest over a seven-year follow-up period. We observed improvements in performance measures of response inhibition, vigilance, and reaction time variability during training. These improvements were maintained up to seven years following the intervention. Age-related decrements in response inhibition accuracy and reaction time variability were moderated by time devoted to meditation practice over this seven year-period. The present study is the first to provide evidence that intensive and continued meditation training and practice improves vigilant attention in an enduring manner. Such training may significantly alter trajectories of age-related cognitive decline across the lifespan.

A51

REWARD MODULATES PREPARATORY MOTOR CORTEX INHIBITION

Wim Notebaert[1], Carsten Bundt[1], Elger Abrahamse[1], Senne Braem[1], Marcel Brass[1]; [1]Experimental Psychology, Ghent University, Belgium — Previous studies demonstrated decreased motor cortex excitability in preparation for a target (e.g., Duque & Ivry, 2009). In order to understand the functional characteristics of this inhibition, recent attempts have been made to investigate motivational modulations of this effect. In our study, we presented a cue (+1 or +0) indicating that participants, respectively, could or could not receive reward for fast and correct reaction times. We hypothesized that reward cues would increase anticipatory control processes (Notebaert & Braem, 2015). We measured corticospinal excitability by means of motor transcranial magnetic stimulation (TMS) and electromyography (EMG) during the cue-target interval. We therefore presented a TMS pulse 400, 600 or 800 ms after cue onset (600, 400 or 200 ms before target onset). Participants had to respond to lateralized coloured circles with the left or right index finger (Simon task). Behaviourally, we observed that the reward cue resulted in faster reaction times, but surprisingly, no modulation of the Simon effect was observed. Motor evoked potentials showed that for reward cues (+1), motor excitability gradually decreased in preparation for the target while this was not observed for neutral cues (+0). Most interestingly, this difference in excitability correlated with BIS (Behavioral Inhibition Scale) scores in the sense that participants with higher BIS scores show increased motor cortex inhibition in preparation for the target (relative to neutral trials). Our results therefore indicate that motor cortex inhibition is a functional mechanism that reflects participants' motivation.

EXECUTIVE PROCESSES: Other

A52

ELECTROENCEPHALOGRAPHIC CORRELATES OF CLINICAL FATIGUE

Ashley Howse[1], Ali Walzak[2], Bruce Wright[2], Olave Krigolson[1]; [1]Neuroeconomics Laboratory, University of Victoria, [2]Division of Medical Sciences, University of Victoria — Physician fatigue has a direct impact on the safety of patients in hospitals worldwide. To date, measures for assessing fatigue rely largely on self-report that may or may not be valid depending on the accuracy of the self-report of the physician in question. Here, we report the results from a study in which we used electroencephalographic (EEG) data as a direct measure to assess physician fatigue in a clinical setting. Participants in this study were final year medical students who were taking part in a simulated 12-hour "night on call" following a regular work day. All of the medical students completed a 10 minute EEG protocol at the beginning of their work day (baseline), prior to the night on call (pre), and after the night on call (post). The EEG protocol included two measures of resting state EEG, an oddball paradigm to measure P300 amplitude, and a learning paradigm to measure reward positivity amplitude. Not surprisingly, we found that participants self reported increasing levels of fatigue between the baseline – pre – post assessment points. Importantly, we also observed decreases in the amplitude of all of the EEG components that we measured across the span of measurement points. While our results might appear somewhat obvious in terms of previous laboratory based findings – our data provide ecological validity to prior laboratory findings and provide a basis for the development of an EEG based fatigue assessment protocol which one might hope could one day improve patient safety.

A53

DOPAMINE FACILITATES LEARNING TO STOP IN PARKINSON'S DISEASE

Nelleke C. van Wouwe[1], Daniel O. Claassen[1], Joseph S. Neimat[1], Kristen E. Kanoff[1], Scott A. Wylie[1]; [1]Vanderbilt Medical Center — Disorders associated with altered dopamine function, such as Parkinson's disease (PD), disrupt the ability to learn contingencies between actions and outcomes. However, the mechanisms involved in learning to withhold action to influence reward and punishment avoidance outcomes has received minimal attention. This study investigated the role of dopamine in learning to act and learning to refrain from action based on reward or punishment outcome, in patients with Parkinson's disease 'On' and 'Off' dopaminergic (DA) medication (n=18) versus healthy controls (n=30). Subjects performed a probabilistic learning task that orthogonalized action and valence (action-reward, inaction-reward, action-punishment, inaction-punishment). We tested whether the presence of DA would bias learning towards action, or reward, or whether it would influence conflict monitoring on action-outcome associations that violate inherent 'Pavlovian' learning biases. Inherent learning biases (act to obtain reward and inaction to avoid punishment) were unaffected by PD in comparison to controls. However, DA modulated the ability to shift away from these biases; more specifically, with the presence of DA, PD patients were increasingly biased by action-reward associations, which limited action-punishment learning. Without DA medication, PD patients were more biased by inaction-punishment learning, which hampered inaction-reward learning. Thus, DA influenced the integration between action and valence in a unique way and it suggests that DA modulates the violations between action and valence expectations in reinforcement learning.

A54

INTELLECTUAL ABILITY IS ASSOCIATED WITH THE CAPACITY OF COGNITIVE CONTROL

Yu Chen[1,2], Tingting Wu[1], Tae Hyeong Kim[1], Jin Fan[1,3]; [1]Queens College, The City University of New York, [2]The Graduate Center, The City University of New York, [3]Icahn School of Medicine at Mount Sinai — Cognitive control is a capacity-limited mental operation to coordinate thoughts and actions and to select and prioritize information under the condition of uncertainty, which should be associated with intellectual ability. However, this relationship has not been investigated due to the lack of a precise measurement of the capacity of cognitive control. In this study, we employed a perceptual decision-making task with time constraints to quantitatively estimate the capacity of cognitive control, and also measured the intellectual ability using the Wechsler Adult Intelligence Scale (WAIS) in 30 participants. Correlation analyses revealed that the full-scale intelligence was significantly predicted by the capacity of cognitive control (r = 0.51). For the subscales of the WAIS, only the index of working memory (r = 0.63) was significantly correlated to the capacity of cognitive control, while the indices of verbal comprehension (r = 0.35), perceptual reasoning (r = 0.32), and processing speed (r = 0.13) were not. These findings suggest that capacity of cognitive control is an essential factor confining the intellectual ability, and that the working memory component of the WAIS is closely associated with the psychological construct of cognitive control.

A55

THE ELECTROPHYSIOLOGICAL AND BEHAVIORAL EFFECTS OF COMPUTERIZED TRAINING ON STRUCTURED SEQUENCE PROCESSING

Gretchen N.L. Smith[1], Juan Galvis[1], Gerardo E. Valdez[1], Christopher M. Conway[1]; [1]Georgia State University — Structured sequence processing (SSP) is a domain general mechanism used to learn patterns of stimuli that occur temporally. SSP is vital for the development of social and motor cognition (Cleeremens et al., 1998) and language (Conway et al., 2010; 2011). Recent findings have shown that it may be possible to improve SSP with computerized training (Smith, Conway, Bauernschmidt, & Pisoni, 2015). To further investigate both the neurocognitive and behavioral consequences of SSP training, typically-developing adults (N=34) were quasi-randomly assigned to computerized SSP training, active control, or passive control. SSP training involved reproducing visual-spatial sequences with underlying statistical patterns embedded in them. Following 10 days of training or control, participants were reassessed on non-trained baseline measures of SSP. Event-related potentials (ERPs) were used to examine neural changes elicited during the non-trained SSP task as the result of training. Preliminary ERP findings indicate that the training modulates the P3a and P3b components. In addition, topomaps suggest a different distribution of electrical activity between the training and control groups during the non-trained measure of SSP, especially in frontal regions. Preliminary behavioral results suggest an improvement to accuracy on the non-trained measure of SSP following training [t(1,10)=4.87, p=.001], but not following active or passive control conditions. These findings demonstrate the feasibility of improving SSP with computerized training and, furthermore, suggest that training-related effects may occur via changes to attention, updating, and/or working memory.

A56

THE CAPACITY OF COGNITIVE CONTROL

Tingting Wu[1], Alexander Dufford[1,3], Melissa-Ann Mackie[1,2], Laura Egan[1], Jin Fan[1,2,3]; [1]Queens College, The City University of New York, [2]The Graduate Center, The City University of New York, [3]Icahn School of Medicine at Mount Sinai — Cognitive control refers to the processes that permit selection and prioritization of information processing in different cognitive domains to reach the capacity-limited conscious mind. Although previous studies have suggested that the capacity of cognitive control itself is limited, a direct quantification of this capacity has not been attempted. Additionally, the relationship between cognitive control and other capacity-limited psychological constructs (e.g., working memory) remains elusive due to the lack of precise quantification of the capacity of cognitive control. Here, based on participants' response accuracy in a time-constrained perceptual decision-making task, we quantified the capacity of cognitive control as approximately 3 to 4 bits per second. We also found substantial evidence for null correlations between participants' capacity of cognitive control and their performance on working memory span tasks. These findings demonstrated that cognitive control, as a higher-level function, has a remarkably low capacity and is a distinct psychological construct from working memory.

A57

THE EFFECTS OF A STRESS-RELATED CORTISOL INCREASE ON HIGHER COGNITIVE FUNCTIONS: FALSE MEMORY FORMATION AND ANCHORING AND ADJUSTMENT

Enma Pardilla-Delgado[1], Erik W. Asp[2,3], Tony J. Cunningham[1], Kelsey A. Warner[2], Jessicay D. Payne[1]; [1]University of Notre Dame, [2]University of Iowa, [3]Hamline Universtiy — One function of the PFC, the executive center of the brain, is to affix 'false tags' to cognitive representations. Stress can negatively affect PFC activity, due to a high density of glucocorticoid receptors. In this study we tested the effects of stress-related

cortisol on two higher cognitive functions: anchoring and adjustment, and false memory. When asked to estimate something, individuals often use a certain value as an 'anchor', and 'adjust' away from this value until a reasonable response is reached. The PFC's ability to false tag helps individuals adjust away from anchors in a way that is similar to the way we correctly reject a false memory (i.e., by appropriate source monitoring). In the current study we assessed the effects of a stressor, or a control manipulation, on false memory (DRM) performance and a knowledge estimation task (KET). Saliva was collected before, after, and 40 minutes after the stress manipulation. Cortisol analysis show that our stressor (TSST) was effective, since the change from baseline to post-stressor peak cortisol differed between the groups; t(36)=2.16, p=.04. Stress, when compared to the control task, marginally increased recall of critical lures (i.e., false memories; t (36)=1.9, p=.07). No effects were observed for recall of studied words. There were no significant differences in the KET. These preliminary results suggest that, at least in the DRM task, stress increases false memory, arguably by disrupting monitoring abilities, which are dependent on PFC functioning. However, we found no evidence that stress affects anchoring and adjustment.

A58

CORTICO-CEREBELLAR DYSFUNCTIONS UNDERLYING VERBAL-FLUENCY DEFICITS IN FRIEDREICH'S ATAXIA: A COMBINED STRUCTURAL AND FUNCTIONAL MRI STUDY

Imis Dogan[1,2,3], Eugenie Klöpfer[1], Sandro Romanzetti[1,2,3], Shahram Mirzazade[1,2,3], Cornelius J Werner[1,2,3], Ana S Costa[1,2,4], Stefan Heim[1,3,5], Dagmar Timman-Braun[6], Ilaria A Giordano[7,8], Thomas Klockgether[7,8], Joerg B Schulz[1,2,3], Kathrin Reetz[1,2,3]; [1]Department of Neurology, RWTH Aachen University, Germany, [2]JARA - Translational Brain Medicine, Jülich and Aachen, Germany, [3]Institute of Neuroscience and Medicine (INM 1, 11), Research Center Jülich, Germany, [4]Neurocognition Unit, Department of Neurology, Hospital de Braga, Portugal, [5]Department of Psychiatry, Psychotherapy and Psychosomatics, RWTH Aachen University, Germany, [6]Department of Neurology, University Hospital of Essen, Germany, [7]Department of Neurology, University Hospital of Bonn, Germany, [8]German Center for Neurodegenerative Diseases (DZNE), Bonn, Germany — Friedreich's ataxia (FRDA) is a spinocerebellar-degenerative disorder and the most common of inherited ataxias. Cognitive impairment and underlying cerebro-cerebellar mechanisms in FRDA are barely understood. In order to investigate the neural substrates of verbal-fluency deficits, 15 patients with genetically confirmed FRDA and 15 demographically matched controls underwent neuropsychological testing, structural and functional magnetic resonance imaging (MRI) at 3T. Using a block-design with phonemic and semantic task-conditions, we compared functional activity and cortico-cerebellar connectivity between groups. Structural alterations were assessed by means of voxel-based morphometry (VBM) and diffusion-tensor imaging (DTI). Patients showed deficits in phonemic verbal-fluency, while performances in semantic fluency did not significantly differ from controls. Functional activity differences were particularly observed for phonemic fluency with patients exhibiting higher activity in left Brodmann area [BA] 44, anterior insula and right posterior cerebellum (VI, Crus-I). Functional connectivity was reduced in patients between cerebellar lobule VI-BA44 and VI-insula, and correlated with impaired phonemic fluency performance. VBM showed cerebellar gray matter reductions in FRDA, and white matter degeneration in the superior (SCP) and inferior cerebellar peduncles (ICP). In controls, phonemic fluency was positively correlated with volumes in right Crus-I and SCP, whereas in patients we found a negative association between volumes in Crus-I and activity in BA44. DTI revealed widespread decreases in fractional anisotropy in FRDA, including SCP, ICP and corticospinal tracts. Overall, this pattern of increased neural response in cerebellar and fronto-insular regions and the reduced cortico-cerebellar connectivity underlying phonemic verbal-fluency indicates disruptions in cerebro-cerebellar pathways related to cerebellar damage in FRDA.

A59

GENERAL INTELLIGENCE AND THE EFFICIENCY OF TASK-EVOKED BRAIN NETWORK DYNAMICS

Doug Schultz[1], Michael Cole[1]; [1]Rutgers-Newark — The efficiency of the human brain is remarkable. It is able to exceed modern computers on multiple computational demands (e.g., language, planning) while consuming the wattage of a light bulb. The mystery of how the brain can be so efficient is compounded by recent evidence that all brain regions are constantly active as they interact with each other in so-called resting-state networks (RSNs). In order to investigate the brain's ability to efficiently process complex cognitive demands we compared functional connectivity during rest and several highly distinct tasks. We previously found that RSNs are present during a wide variety of tasks, and that tasks only minimally modify functional connectivity patterns throughout the brain. Here we tested the hypothesis that, while subtle, these task-evoked functional connectivity changes from rest nonetheless strongly contribute to behavioral performance. Surprisingly, we found across three diverse domains (language, reasoning, and working memory tasks) that high performing individuals exhibited more efficient brain connectivity updates – smaller changes in functional network architecture between rest and task. These smaller changes suggest that individuals with more efficient brain connectivity updates have especially effective network configurations for general task performance. Confirming this, network update efficiency correlated with cognitive control abilities and general intelligence. The brain's efficiency therefore appears to be a key feature contributing to both its network dynamics and general cognitive ability.

EXECUTIVE PROCESSES: Working memory

A60

TDCS-LINKED WORKING MEMORY TRAINING IN THE AGING ELICITS FAR TRANSFER

Marian Berryhill[1], Jaclyn Stephens[1,2], Adelle Cerreta[1]; [1]University of Nevada, [2]Kennedy-Krieger Institute — Cognitive training interventions work to counter age-related cognitive decline. Aging generally leads to impaired executive function (EF) in domains including working memory (WM). Recently, advances in methodologies pairing WM training with transcranial direct current stimulation (tDCS) reveal lasting improvement to WM and measurable, significant transfer to untrained EF tasks. One gap in this emerging field, however, is that to date, all interventions have been laboratory based. A second limitation is that the underlying mechanism(s) of durable tDCS-linked cognitive improvement remain unclear. Here, we begin to fill these gaps by reporting a longitudinal tDCS-linked WM training paradigm in the healthy aging that included home-testing, and ecologically valid transfer measures. Collected measures also included neuroimaging (fNIRS) and genotyping (COMT val158met). In a between-groups design, 90 healthy older adults completed 5 sessions of WM training paired with parametric tDCS (Sham, 1 mA tDCS, 2 mA tDCS, 15 min) targeting prefrontal cortex. After training, we measured transfer on laboratory and ecologically valid tasks. The results showed that all participants significantly improved on the WM training tasks. However, those receiving stronger tDCS significantly outperformed the other groups on ecologically valid far transfer tasks. Additionally, group differences on measures of cognitive flexibility and cognitive stability were predicted by COMT genotype, indicating a role of prefrontal dopamine signaling in the underlying mechanism of tDCS-linked EF benefits. No participants dropped out of the study or complained of discomfort. These findings highlight the value and translational potential for tDCS-linked interventions in healthy older adults interested in maintaining cognitive function.

A61

CORTICAL OSCILLATIONS UNDERLYING WORKING MEMORY FOR ORDERED GROUPS.

Jennifer Whitman[1], Tzuhan Cheng[1], Lawrence Ward[1], Rebecca Todd[1]; [1]University of British Columbia — Maintaining multiple items in working memory in an organized fashion requires a flexible neural mechanism. One candidate mechanism involves coupling between fast (40Hz gamma) and slower (5Hz theta) oscillations. Each gamma cycle corresponds to an individual item in the ordered group. The ratio of the faster to slower frequencies is thought to match the capacity for an ordered set (i.e. ~7+/-2 items). Here, we ask whether medium frequency oscillations underlie working memory for serially ordered subgroups. To test this, we recorded EEG while participants remembered either three groups of two letters (e.g. SD-FJ-KL) or two groups of three letters (e.g. SDF—JKL), presented simultaneously for three seconds. After a four second delay, a single digit prompted recall of subgroup 1, 2, or 3. We hypothesized that a medium-frequency oscillation would have a slower peak frequency for

subgroups of three items, by a ratio of 2/3. Preliminary analyses employed time-frequency analysis (Morlet wavelets) to identify frequencies exhibiting task-induced changes in power. These included alpha (8-12Hz), beta, (18-24Hz), and delta (2Hz) oscillations. The involvement of alpha frequency oscillations is consistent with previous studies of visual working memory. Estimates of instantaneous phase within each frequency range were further examined to probe patterns of coupling between frequencies involving a shift in the peak frequency within a middle range (e.g. alpha) as a function of group size. Identification of such shifts can advance understanding of how working memory can be flexibly organized in a task-relevant manner.

A62

CAN TRANSCRANIAL MAGNETIC STIMULATION BRING PASSIVELY RETAINED ITEMS IN SHORT-TERM MEMORY BACK INTO FOCAL ATTENTION?

Nathan Rose[1,2], Joshua LaRocque[2], Adam Riggall[1], Olivia Gosseries[1], Michael Starrett[1,3], Bradley Postle[1]; [1]University of Wisconsin-Madison, [2]ACU, Melbourne, [3]University of California, Davis — To answer this question we had participants perform a short-term memory (STM) task that required maintaining two-items (a face, a word, or coherent dot motion) over two short delay periods on each trial in which they were cued to maintain one of the items in focal attention while still holding the other item in STM. We applied a single pulse of transcranial magnetic stimulation (TMS) to each of the three category selective regions for the three categories of stimuli (Experiment 1, n = 6) or to the superior parietal lobule (Experiment 2, n = 6; Experiment 3, n = 11) during the delay periods. In Experiments 1 and 2 we simultaneously recorded the electroencephalogram (EEG) and measured the TMS-evoked response. In Experiment 3 we measured reaction times to recognition probes presented 100 ms, 500 ms, or 2000 ms after TMS that required recognizing the cued (i.e., actively retained) item (80% of trials) or rejecting the uncued (i.e., passively retained) item (20% of trials). Experiments 1 and 2 showed that the TMS evoked response on the EEG was modulated by both the site of stimulation and the category of the item that was in the active or passive state of representation. Reaction times for rejecting recognition probes for the uncued item were slower at shorter lags between TMS and presentation of the probe. These results suggest that a single pulse of TMS can induce neural and behavioral evidence for the "reactivation" of a passively retained item in STM.

A63

COMPUTERIZED WORKING MEMORY TRAINING INDUCES CHANGES IN INTRINSIC FUNCTIONAL CONNECTIVITY IN CHILDREN WITH NEUROFIBROMATOSIS TYPE 1 (NF1): A PILOT RESTING-STATE STUDY

Yuliya Yoncheva[1], Kristina K. Hardy[2,3], Daniel J. Lurie[4], Krishna Somandepalli[5], Roger J. Packer[2,3], Michael P. Milham[6,7], F. Xavier Castellanos[1,7], Maria T. Acosta[2,3]; [1]NYU Langone Medical Center, Department of Child and Adolescent Psychiatry, New York, NY, [2]Children's National Health System, Washington, DC, [3]George Washington University School of Medicine, Washington, DC, [4]University of California, Berkeley, Department of Psychology, Berkeley, CA, [5]University of Southern California, School of Engineering, Los Angeles, CA, [6]Children Mind Institute, New York, NY, [7]Nathan Kline Institute for Psychiatric Research, Orangeburg, NY — Executive function deficits are common in children with neurofibromatosis type 1 (NF1). Although computerized training programs are increasingly used in other neuropsychiatric disorders, empirically evaluated interventions are lacking for NF1. This pilot study examined training effects on cognition and resting-state intrinsic functional connectivity (iFC) in children with NF1. In an open pre-/post-test design, we provided 25 sessions (6-10 weeks) of computerized visuo-spatial working memory at-home training with phone-based coaching assistance (Cogmed®). Sixteen participants (9 male; 11.1±2.3 years) had analyzable pre-/post-test resting-state fMRI scans and cognitive task data. Standard data preprocessing, including global signal regression, and calculation of iFC indices used the Configurable Pipeline for the Analysis of Connectomes v. 0.3.3. Two voxel-wise iFC measures, fractional amplitude of low frequency fluctuations (fALFF) and regional homogeneity (ReHo), were contrasted pre-/post-test using paired t-tests. Statistically significant ($p<0.05$ corrected) regionally specific differences emerged in both iFC measures. Decreased fALFF with treatment was found in a large cluster spanning thalamus, globus pallidus, lingual and parahippocampal gyri, brainstem and cerebellum; a second cluster encompassed precentral cortex, supplementary motor area, extending into middle and superior frontal gyri. Increased ReHo following training was observed in predominantly visual areas (intra- and supra-calcarine cortex, occipital pole and lingual gyrus). Changes in iFC significantly correlated with facets of behavioral improvement post-Cogmed® and with performance on tasks tapping executive function and visuo-spatial working memory. These findings provide preliminary support that regionally specific iFC changes may capture treatment-related improvements in cognitive dysfunction in NF1 and motivate independent controlled replication.

A64

DISTRIBUTED FRONTAL AND MEDIAL TEMPORAL WORKING MEMORY ACTIVITY: EVIDENCE FROM SEEG

Elizabeth L. Johnson[1], Jack J. Lin[2], Robert T. Knight[1]; [1]University of California, Berkeley, [2]University of California, Irvine — Our ability to hold onto and process information is a hallmark of cognition. This working memory (WM) capacity is linked to activities in the lateral prefrontal cortex (PFC) and medial temporal lobe (MTL). Together with non-invasive human neuroimaging and single-unit animal neurophysiology, intracranial electrocorticography paints a more complete picture of how these network activities support human WM. Six human subjects with stereotaxic (sEEG) implants penetrating the lateral PFC, orbitofrontal cortex (OFC), and MTL encoded pairs of two colored shapes, presented one at a time in specific spatial positions. Each subject had between 1-11 contacts per region. After a 900-1150-ms maintenance period, they were prompted to remember "what", "when", or "where" information, and then given 900-1150 ms to process before indicating their response. We investigated the temporal dynamics of 1-200-Hz spectral power during encoding, maintenance, and processing of subsequently remembered information, standardized to a pre-trial baseline. The results reported are present across all subjects and significant at $p<0.05$, two-tailed, corrected for multiple comparisons using cluster-based permutation statistics. High-frequency activity can be used to track dynamic neuronal flexibility as demonstrated in monkey single-unit research. All sEEG contacts showed transient >70-Hz increases at encoding. Importantly, data implicate the OFC during WM – a process traditionally associated with the lateral PFC and MTL. Encoding, maintenance, and processing were also marked by more sustained 2-25-Hz increases in each region. These patterns of low-frequency activity emerged after presentation of the first shape, suggesting recruitment of a distributed organizational hierarchy to manage pieces of information in WM.

A65

DISCOVERING GATING POLICIES IN THE ABSENCE OF REINFORCEMENT

Apoorva Bhandari[1], David Badre[1,2]; [1]Brown University, Providence, Providence, USA., [2]Brown Institute of Brain Sciences, Providence, USA. — Coordinating behavior during complex, temporally extended tasks requires the use of working memory and internal control policies to guide its use. Computational models have identified 'gating' policies that control the updating of information into working memory (input gate), and its influence on behavior (output gate), and have shown how these might be slowly learnt using reinforcement learning mechanisms. In novel or changed environments, however, we must rapidly discover efficient gating policies that are adapted to the dynamics of the task environment, often in the absence of explicit reinforcement. The cognitive processes and neural systems underlying this process remain poorly understood. Here, we provide evidence from behavioral experiments that efficient gating policies emerge with practice on early trials after a change in the task environment and that practice effects in reaction time data reflect this process. We use functional MRI to examine the neural correlates of this process and identify brain regions in the prefrontal cortex that show distinct patterns of dynamic engagement on early trials. Our results suggest a novel cognitive process that supports the rapid discovery of efficient gating policies in the absence of reinforcement.

A66

CHANGES IN NEURAL ACTIVITY UNDERLYING WORKING MEMORY AFTER COMPUTERIZED COGNITIVE TRAINING IN OLDER ADULTS

Erich Tusch[1], Brittany Alperin[3], Eliza Ryan[1], Phillip Holcomb[4], Abdul Mohammed[2], Kirk Daffner[1]; [1]Brigham and Women's Hospital / Harvard Medical School, [2]Linnaeus University, [3]Oregon Health and Science University,

[4]Tufts University — Computerized cognitive training (CCT) is marketed to older individuals trying to counter the impact of aging on cognition. Both the efficacy and neurocognitive mechanisms underlying CCT remain controversial. In this study, 35 older individuals (age=76, education=18 years, estimated IQ=121) were randomly assigned to Cogmed adaptive working memory (WM) training or an active control condition, 5 sessions/week, ~35 minutes/session for 5 weeks. Under adaptive training, task difficulty is individually adjusted to achieve ~60% accuracy, whereas under the control condition, task difficulty remains the same. Before and after the 5-week intervention, ERPs were measured while subjects participated in a visual n-back task with 3 levels of demand (0-back, 1-back, 2-back). Given the high intellectual capacity of participants, we expected the intervention's impact to be limited to the most difficult level. We hypothesized that the adaptive training would be associated with enhancement of ERP indices of attention and WM. The adaptive training group exhibited an increase in the amplitude of the anterior P3a and posterior P3b under the 2-back condition, a pattern not observed for controls. For 2-back targets, the P3 amplitude change between pre- and post-intervention sessions inversely correlated with RT change: larger increases in P3 amplitude were associated with larger reductions in RT. This relationship was especially robust for the P3b. Our findings suggest that adaptive WM training is associated with increased marshalling of attention, as indexed by the P3a, and the enhancement of categorization/WM updating processes, as indexed by the P3b, which may be linked to improved task performance.

A67

WORKING MEMORY CAPACITY PREDICTS DIFFERENTIAL STIMULATION BENEFITS FROM TDCS AND HIGH-DEFINITION TDCS

Filiz Gozenman[1], Marian Berryhill[1]; [1]University of Nevada, Reno — Non-invasive neuromodulatory approaches such as transcranial direct current stimulation (tDCS) show promise in maintaining or improving working memory (WM). Previous work shows that transcranial direct current stimulation (tDCS) does not affect all individuals in the same way. We previously found that after anodal or cathodal tDCS targeting the right posterior parietal lobe, young adults with higher WM capacity (WMC) benefited more on a visuospatial WM task than those with lower WMC. This raises two issues. First, what mechanism accounts for different behavioral outcomes after identical protocols? And second, for tDCS to become translational, understanding how individual differences predict tDCS-linked benefits is essential. To inform these issues we hypothesized that tDCS benefits high WMC by diffuse cortical effects and that low WMC participants might benefit from focal stimulation enabled by high definition tDCS (HD-tDCS). Across two experiments, two groups of 24 young adults performed visuospatial or verbal retro-cue (RC) WM tasks. Three sessions (tDCS, HD-tDCS, sham; 1.5 mA, 20 min), targeted right or left parietal cortex, respectively. There was an interaction of group and session conditions such that the HD-tDCS selectively improved the RC benefit in the low WMC group and reduced it in the high WMC group. TDCS had little effect on either group in these tasks. Linear regression analyses evaluating WMC continuously show that WMC predicts the performance benefit associated with HD-tDCS. One-size-fits-all protocols fail and WMC needs to be considered in tDCS-based interventions. We provide a speculative attentional account for these data.

LANGUAGE: Development & aging

A68

N400 REGULARITY EFFECTS INCREASE IN SIZE ACROSS EARLY ELEMENTARY SCHOOL

Mallory C. Stites[1], Sarah Laszlo[1]; [1]State University of New York, Binghamton — The N400 component of the event-related potential (ERP) is part of the brain's normal response to words and other potentially meaningful stimuli. In adults, one of its most robust characteristics during single word reading is its strong relationship with orthographic regularity, with larger amplitude N400s being elicited by orthographically regular items (e.g., words, pseudowords) than orthographically illegal items (e.g., consonant strings). Despite the prominence of N400 regularity effects, their developmental timecourse is unclear. It is unknown whether regularity effects are present immediately at the beginning of reading instruction, or require years to develop. In the current investigation, we present ERP findings from a cross-sectional sample of 98 children (grades K-4) to assess when in the course of development N400 regularity effects emerge. Participants viewed a list of regular items (words, pseudowords) and irregular items (acronyms, illegal letter strings) while monitoring for own-name targets. Trial-level data was submitted to linear mixed effects regression (LMER) analyses, to compare the magnitude of regularity effects across successive grades. Results showed that regularity effects have a prolonged developmental timecourse, increasing in size at least until fourth grade. Kindergarteners showed no difference between regular and irregular items; first through third graders showed a robust regularity effect, and fourth graders showed the biggest effect. Findings suggest an initial emergence of N400 regularity effects at the beginning of formal reading instruction that continue to increase in size throughout the grade school years, as the language processing system becomes more tuned to the orthographic characteristics of English words.

A69

LANGUAGE QUALITY IN SCHOOL-AGE CHILDREN WITH PERINATAL STROKE: MORPHOSYNTACTIC ERRORS IN CHILDREN WITH PARIETAL LOBE AND SUBCORTICAL DAMAGE

Philip Lai[1], Judy Reilly[2]; [1]University of Wisconsin-Madison, [2]San Diego State University — Children with Perinatal Stroke (PS) provide a unique opportunity to understand developing brain-behavior relations. This study investigated how early brain damage affect the quality of language produced by investigating errors in morphology during a conversation. Twenty children with PS (9 with Left Hemisphere Injury (LHI) and 11 with Right Hemisphere Injury (RHI)) participated. Five children with PS (3 with LHI and 2 with RHI) had great difficulty with morphology. Within the LHI group, participants #301, #302, and #311 committed 22.2%, 46.1%, and 30.7% errors rates respectively. Error rates were calculated by taking the number of errors over the number of clauses produced. When examining the structures implicated, the only similarity was parietal lobe involvement. The 6 other LHI with lower rates of errors, 5 had no damage to the parietal lobe. A closer examination of subjects #301 and #311 showed subcortical damage as these individuals also produced the least amount of verbal output out of all the PS children. In the RHI group, participants #316 and #327 had 31.5% and 27.2% error rates respectively. Participant #316 had subcortical damage while #327 had both frontal lobe and parietal lobe damage. These results suggest that parietal lobe involvement, especially with subcortical damage, may play a role in the quality of language produced. This is especially true for children with LHI and a lesser degree in children with RHI. Interestingly, 15 individuals with PS had similar scores to the control group, suggesting the power of neuroplasticity in the developing brain for language production.

A70

THE BDNF VAL66MET POLYMORPHISM IS ASSOCIATED WITH STRUCTURE AND FUNCTION IN THE DEVELOPING BRAIN WITH IMPLICATIONS FOR CHILDREN'S COGNITIVE ABILITIES

Kaja Jasinska[1], Peter Molfese[1,2], Sergey Kornilov[1,3,4], Einar Mencl[1], Stephen Frost[1], Maria Lee[3], Kenneth Pugh[1,2,3], Elena Griogorenko[1,3,5], Nicole Landi[1,2,3]; [1]Haskins Laboratories, [2]University of Connecticut, [3]Yale University, [4]Moscow State University, [5]University of Houston — We asked whether a common genetic variant in the BDNF gene (the Val66Met polymorphism) affects brain function and structure in the young brain during a critical period for the emergence and maturation of the neural circuitry for reading. BDNF has been associated with multiple aspects of cognition as well as structural and functional differences in the adult brain. Little is known about the impact of this BDNF polymorphism on the structure and function of the brain in healthy development, here, we examined how the BDNF Val66Met polymorphism influences 6-10 year-old children's reading and cognitive abilities, as well as, brain function during reading, and brain structure (n=78). We found that children homozygous for the Val allele at the SNP rs6265 of the BDNF gene outperformed Met allele carriers on reading comprehension and phonological memory tasks. Further, Met allele carriers had greater activation in reading–related brain regions (left IFG, STG, VWFA) and in the hippocampus during a word reading task suggesting increased engagement of memory and language regions for Met carriers for reading. With respect to structure, children who were Met allele carriers had larger right hippocampi than homozygous Val carriers. Differences in cortical thickness and surface area in frontal, temporal and occipital cortices were observed between homozygous Val carriers and Met carriers that correspond to dif-

ferent maturational rates and developmental BDNF expression patterns in these regions. The Val66Met BDNF polymorphism is associated with function and structure of the developing brain and in ways that impact children's cognitive abilities in development.

A71

RESTING-STATE FUNCTIONAL CONNECTIVITY PATTERNS IN BILINGUALS REFLECT AGE OF ACQUISITION

Jonathan A. Berken[1,2], Xiaoqian Chai[1], Jen-Kai Chen[1], Vincent L. Gracco[1,2], Denise Klein[1,2]; [1]McGill University, Montreal, Quebec, Canada, [2]Centre for Research on Brain, Language, and Music, Montreal, Quebec, Canada — Of current interest is how variations in early language experience shape patterns of functional connectivity in the human brain. In the present study, we compared simultaneous (two languages from birth) and sequential (second language learned after age 5 years) bilinguals using a seed-based resting-state magnetic resonance imaging approach. We focused on the inferior frontal gyrus (IFG) as our region of interest, as recent studies have demonstrated both neurofunctional and neurostructural changes related to age of second language acquisition in bilinguals in this cortical area. Stronger functional connectivity was observed for simultaneous bilinguals between the left and right IFG, as well as between the inferior frontal gyrus and brain areas involved in language control, including the dorsolateral prefrontal cortex, inferior parietal lobule, and cerebellum. Functional connectivity between the left IFG and the right IFG and right inferior parietal lobule brain regions was also significantly correlated with age of acquisition for sequential bilinguals; the earlier the second language was acquired, the stronger was the functional connectivity. In addition, greater functional connectivity between homologous regions of the inferior frontal gyrus was associated with reduced neural activation in the left IFG during speech production. The increased connectivity at rest and reduced neural activation during task performance suggests enhanced neural efficiency in this important brain area involved in both speech production and domain-general cognitive processing. Taken together, our findings highlight how the brain's intrinsic functional patterns are influenced by the developmental timeline in which second language acquisition occurs.

A72

INFERENCES DURING AUDITORY SENTENCE COMPREHENSION IN THE DEVELOPING BRAIN

Salomi S. Asaridou[1], Özlem Ece Demir-Lira[2], Sarah Tune[1], Susan Goldin-Meadow[2], Steven L. Small[1]; [1]Department of Neurology, University of California, Irvine, [2]Department of Psychology, The University of Chicago — Language comprehension involves extracting information from sentences. These rarely appear in isolation but are embedded in a given context. As they unfold in time, sentences provide listeners with contextual information that help them compute inferences about the meaning of upcoming sentences. While there are several studies on how the adult brain implements such inferences, little is known about these processes in children. In the current study, we investigated how children make inferences during auditory sentence comprehension. fMRI data were collected from 23 children (12-14yrs old) while they listened carefully to short stories comprised of one context and one target sentence. The target sentence could either confirm or disconfirm the expectations set up in the context sentence, thereby decreasing or increasing inference demands (e.g. Context: "Lindsey loved warm weather." Target: "Summer was her favorite season" vs. "Winter was her favorite season."). The data were analyzed using AFNI, SUMA and Freesurfer, and group statistics were computed on the two-dimensional cortical surface. Our results show increased activation in the transverse temporal gyri and the superior temporal gyri bilaterally with increased inference demand. This finding is in agreement with meta-analysis data showing more activation in the auditory cortex when sentences are less meaningful. We also found increased activation in the left inferior frontal gyrus (pars triangularis and orbitalis), middle temporal, and angular gyrus, areas that more activated when adult listeners process real-world violations in speech. In conclusion, children recruit neural networks similar to those found in adults when making inferences during auditory sentence comprehension.

A73

WHITE-MATTER STRUCTURAL PLASTICITY INDUCED BY FOREIGN LANGUAGE LEARNING IN ADULTS

Michelle Han[1], Zhenghan Qi[1], Todd Thompson[1], Keri Garel[1], EeSan Chen[1], Anastasia Yendiki[2], John Gabrieli[1]; [1]Massachusetts Institute of Technology, [2]Massachusetts General Hospital — Second-language learning during adulthood is exceptionally difficult. However, little is understood regarding how language learning reshapes adult brains. In this study, we examined the structural plasticity of white matter after intensive language training. 47 subjects were recruited and assigned to 3 groups: language-training (N=14), active control (N=19), and passive control (N=14). Diffusion-weighted images (DWI) were acquired at two time points spaced 4 weeks apart. Between the two sessions, the language-training and active control groups took part in an intensive training regimen of either introductory Mandarin or Multiple Object Tracking (MOT), respectively. The passive control group did not participate in either training program. The DWI data were processed using TRACULA's longitudinal stream to generate maps of fractional anisotropy (FA), axial diffusivity (AD), and radial diffusivity (RD). Whole-brain voxel-wise analyses showed clusters of significant interaction between scan session and group at the forceps minor and the left inferior longitudinal fasciculus (ILF), with greater increase of FA and more reduction of RD in the language-training group compared to either the active control or the passive control group. Post-hoc analyses confirmed a significant increase of FA in the language-training group (forceps minor, W=-77, p=0.0067; left ILF, W=-81, p=0.0043), while no significant change was observed in the two control groups. These data suggest that intensive language training enhances structural connectivity between two hemispheres as well as within the left language areas.

A74

CONSOLIDATON OF PREDICTION IN DISCOURSE AS A FUNCTION OF CLOZE PROBABILITY IN YOUNG AND OLDER ADULTS

Shruti Dave[1], Trevor Brothers[1], Matthew Traxler[1], Tamara Swaab[1]; [1]University of California, Davis — Electrophysiological effects of prediction benefits have been found across age during single word, sentence, and discourse level processing (Kutas & Federmeier, 2011); a reduced N400 is found to predicted versus unpredicted words. We assessed the effects of local and global discourse constraints on prediction in young and older readers. Two-sentence passages ending in moderate cloze critical words were presented. While cloze probability was held constant for each of the passages (global context), the second sentence of each passage in isolation was either low cloze (i.e. "It is obviously a...") or moderate cloze (i.e. "He had to ask them for money for summer...") for the critical words (local context). Both young and older adults showed significant N400 effects of prediction. Both age groups also showed a larger N400 prediction effect when cloze probability of the critical word was primarily driven by the constraint of the first sentence of the passages rather than by the constraint of both sentences. . We suggest that readers may have had more time to consolidate their predictions in passages for which the second sentence required minimal additional integration of content into the discourse representation (i.e., low cloze second sentence). This effects was particularly pronounced for readers with high working memory span, for both younger and older adults. This finding is consistent with previous studies (Boudewyn, Long, & Swaab, 2013) demonstrating increased reliance on global over local context in individuals with higher working memory spans.

A75

THE FRUIT ATTENTION TASK: A NOVEL METHOD FOR TESTING INCIDENTAL WORD-OBJECT MAPPING

Srishti Nayak[1], Diletta Mittone[1], Hiba Salem[1], Amanda Tarullo[1]; [1]Boston University — Word-mapping studies usually employ explicit instructions to remember words, or passive exposure to word-object pairs, to test learning. We developed a novel age-appropriate computerized measure of children's incidental word-object mapping (IWM) while they are engaged in an unrelated task. We also evaluated Age and Gender related variation in task performance. 6;0-8;0 year old children (n=40; females=17) played the Fruit Attention Task (FAT), which paired each of six fruit images simultaneously with a familiar (English) and unfamiliar (Hindi) auditory-visual label for 4 seconds. On each trial, the aim was to indicate via button press which side of the image the English or Hindi word (counterbalanced) had appeared. Children were thus repeat-

edly exposed to novel Hindi fruit labels along with familiar English words and images, but were not required to remember them. Children completed 12 practice, and 48 test trials, followed by a 15 minute break of distractor games and free play, before they were tested on word mapping. In the IWM test, children matched AV Hindi fruit labels to the correct fruit, choosing from six simultaneously presented images. Each label was randomly presented 3 times, totaling 18 trials. Mean IWM accuracy was significantly above chance (55%), as was the mean number of fruits identified correctly all 3 times (approximately 2). Age, but not Gender, significantly predicted both scores. Results suggest that children learn and retain novel language word-object pairs incidentally even with brief exposure. The FAT is thus a promising tool for studying IWM in children, keeping in mind age-related variation.

A76

STRUCTURAL BRAIN ALTERATIONS IN KINDERGARTENERS WITH SPEECH SOUND DISORDERS

Jennifer Zuk[1,2], Bryce Becker[1], Elizabeth Norton[1,3], Ola Ozranov-Palchik[1], Meaghan Mauer[1], Sara Beach[2,3], Tiffany P. Hogan[4], John Gabrieli[3], Nadine Gaab[1,2,5]; [1]Laboratories of Cognitive Neuroscience, Boston Children's Hospital, [2]Harvard Medical School, [3]McGovern Institute for Brain Research, Massachusetts Institute of Technology, [4]MGH Institute of Health Professions, [5]Harvard Graduate School of Education — Speech sound disorders (SSD) are characterized by speech production errors that often lead to unintelligible spoken phrases, and impact roughly 1 in 7 children in the U.S. Children with SSD often show early phonological deficits and later co-morbidity with dyslexia, yet it remains unclear to what extent these disorders share similar underlying mechanisms. While reduced gray matter volume indices in left-hemispheric posterior brain regions have been found in young children at risk for dyslexia, the structural morphology of children with SSD at the kindergarten age has yet to be explored. Therefore, the present study investigated the structural correlates of kindergarteners with SSD compared to those with typical speech abilities while accounting for phonological skill and risk for dyslexia. It was hypothesized that kindergarteners with SSD would show differential gray matter volume indices in regions critical for speech production, distinct from those at risk for dyslexia. From an ongoing longitudinal investigation of 186 children with and without risk for dyslexia, a subset of kindergarteners with and without SSD has been retrospectively identified. Monolingual American English speaking kindergarteners completed psychometric evaluation and magnetic resonance imaging (MRI), and groups were matched in age, IQ, gender, phonological ability, and socioeconomic status. Kindergarteners with SSD as compared to typical speech abilities showed structural brain differences in gray matter regions critical to speech, including left-hemispheric basal ganglia and bilateral thalamus, insula, and inferior frontal gyrus. These preliminary findings implicate structural alterations in kindergarteners with SSD that are distinct from typical speech abilities and risk for dyslexia.

A77

DEVELOPMENTAL DYSLEXIA: EMOTIONAL IMPACT AND CONSEQUENCES

Emily M. Hirst[1], Linda S. Siegel[2], Urs Ribary[1,2,3]; [1]Simon Fraser University, [2]University of British Columbia, [3]Behavioral and Cognitive Neuroscience Institute, Vancouver, Canada — Dyslexia is a learning disability that requires better support and continued research. The consequences of dyslexia and poor recognition and diagnosis may be underestimated. We therefore conducted a comprehensive review into current literature, focusing on consequences for the (i) individual, (ii) family and (iii) society, demonstrating the need for further research into high-quality diagnosis and intervention of dyslexia. Based on evidence from 92 articles analyzed, dyslexia and its associated emotional outcomes speaks to the need for proper and early detection of this learning disability. Dyslexia is associated with poor outcomes in academic, social, emotional, occupational, and economic domains. Dyslexia consists of problems with reading, spelling and writing, resulting in various primary and secondary consequences. Such consequences are poor academic and work performance and isolation. Emotional and self-esteem support for individuals with dyslexia is pivotal in reducing the negative impact of dyslexia at the level of the individual, the family, and society. The primary and secondary consequences of dyslexia are highly related and therefore suggest multiple avenues of support, especially including interventions (e.g. cognitive brain-based programs), academic support, early diagnosis and education (family support, social support, and emotional support). This analysis highlights the need for early, high-quality assessment and diagnosis of dyslexia with support for academic, emotional, and self-esteem needs. This review further illustrates and recommends routine screening for dyslexia at early age, proper education, support, including behavioural and brain-imaging research to improve early and accurate diagnostic markers for dyslexia.

A78

MATURATIONAL DIFFERENCES IN THALAMIC STRUCTURAL ASYMMETRY IN CONTROL AND DYSLEXIC READERS

Garikoitz Lerma-Usabiaga[1], Manuel Carreiras[1,2], Pedro M. Paz-Alonso[1]; [1]BCBL. Basque Center on Cognition, Brain and Language, [2]IKERBASQUE. Basque Foundation for Science — Neuroimaging and postmortem studies with typical and atypical readers have underscored functional and structural differences in the thalamus during reading processes (Galaburda et al., 1994; Pugh et al., 2013). Nevertheless, there is limited evidence of the typical structural maturation of this brain structure over development. Here, we present results from two developmental studies aimed at investigating the structural correlates of thalamic volume and performance on the Rapid-Automatized-Naming (RAN) task in a group of 24 dyslexic readers and 27 matched controls (Study I), and characterising across the life span the typical neurodevelopmental trajectories of thalamic volume and its relation with other structures in 325 individuals (age range: 4-83 years; Study II). In Study I, our results showed that the left-right thalamic volume asymmetry strongly predicted performance on the RAN task in dyslexic readers, not in controls, and similar asymmetry effects were also found consistently in other structures within the visual stream (i.e., V1 and optic radiations). Additionally, different from dyslexic readers, control readers showed age-related changes in thalamic volume asymmetry, as well as associations between thalamic volume asymmetry and visual cortex cortical thickness (O'Muircheartaigh et al., 2015). Study II confirmed the structural patterns found in control readers in Study I. Overall, our findings highlight the crucial role of the thalamus in dyslexia and confirm the structural differences observed in controls over a large cohort of healthy participants.

A79

A DEVELOPMENTAL ERP STUDY OF INDIVIDUAL DIFFERENCES IN OCCIPITOTEMPORAL TUNING FOR VISUAL WORD RECOGNITION

Elizabeth Sacchi[1], Sarah Laszlo[1]; [1]Binghamton University — Dyslexic individuals often evince reduced left hemisphere (LH) activation in tandem with increased right hemisphere (RH) activation in response to visual word forms, a pattern referred to as RH compensation. One proposed mechanism for RH compensation is overinvolvement of the visual object recognition system, as the increased RH activation is seen in RH object recognition areas. Previous work in adults of varying reading abilities has supported this hypothesis, in that poorer readers differentiate words and objects less strongly in the RH occipitotemporal system than do better readers. The current study aimed to explore the interaction of RH de-differentiation for words and individual reading development. To this end, we collected ERPs while children in grades 2-10 (who thus had a range of reading abilities) viewed words, objects, and word/object ambiguous items (e.g., "HEART" shaped like a heart). This design allows us to examine whether RH de-differentiation is already present in children still learning to read, and whether, as in adults, RH differentiation of word forms varies according to children's reading abilities. Results replicated previous findings in adults: children who are poorer readers show reduced differentiation of words from other visual stimuli in the RH occipitotemporal system. We conclude that poor RH occipitotemporal tuning for word forms is characteristic of individuals who demonstrate poorer reading behavior even in a developmental population with substantially less reading experience than the typically reading college students who have been studied with this design previously.

A80

BRAIN ACTIVATIONS OF LEXICAL TONE AND EMOTIONAL PROSODY PERCEPTION IN SCHOOL-AGED CHILDREN WITH HIGH-FUNCTION AUTISM

Feng-Ming Tsao[1], Wei-Chin Hsu[2], Huei-Mei Liu[3]; [1]National Taiwan University, [2]National Taiwan University of Science and Technology, [3]National Taiwan Normal University — Despite normal verbal intelligence,

children with high-functioning autism (HFA) experience the difficulty in perceiving emotional prosody, one component of pragmatic language. However, it remains unclear whether the perceptual deficit in children with HFA is only restrict to emotional prosody or generalized to lexical tones, phonetic units of tonal language and having similar acoustic features (e.g., pitch variation) with emotional prosody. This study aimed to characterize perceptual shift between language-specific phonetic (lexical tones) and language-general pragmatic (emotional prosody) components in children with HFA. School-age children with HFA (n = 10, 8-12 years of age) and typically-developing (TD, n =11) children, matched with chronological age and general intelligence, participated in this fMRI study. The fMRI tasks were two paired experimental blocks comparing random vs. fixed target syllable positions on emotional prosody and lexical tones: Emotion (random) vs. Emotion (fixed), and Tone (random) vs. Tone (fixed). Same speech stimuli of both experimental blocks were used in fMRI trials and children judged whether emotional prosody or lexical tone in a trial were the same or different. Results revealed that perceptual difference between emotional prosody and lexical tone was activated at Medial Frontal Gyrus (MFG, right hemisphere) in TD children, but Inferior Parietal Lobule (IPL, right hemisphere) was activated in HFA children. Compared with TD children, HFA children activated Posterior Cingulate when judging emotional prosody. The activation of IPL in HFA children suggest that HFA children rely more on the sensory integration mechanism than TD children in switching judgment between emotional prosody and lexical tones.

A81

SPEECH RHYTHM AND CORTICAL OSCILLATIONS: A STUDY IN TYPICALLY DEVELOPING CHILDREN

Hélène Guiraud[1], Karim Jerbi[2], Ana-Sofia Hincapié[2,3], Véronique Boulenger[1]; [1]Laboratoire Dynamique Du Langage, CNRS/Université Lyon 2 UMR 5596, Lyon, France, [2]Université de Montréal, Montréal, Canada, [3]Pontificia Universidad Católica de Chile, Santiago de Chile, Chile — The current study investigates neural entrainment to speech rhythm in typically developing children. Growing evidence shows that ongoing brain oscillations in the theta band synchronize with slow modulations of speech, which convey syllabic information important for comprehension. Whether such phase-locking also occurs in children, especially for natural speech produced at a fast rate, has not been investigated. We recorded brain activity of 15 French native right-handed children (8-13 years old) using a 275-channel whole-head magnetoencephalography (MEG) system, while they were listening to natural sentences produced at a normal rate (6.76 syllables per second) or at a faster rate (9.15 syll/s). Time-frequency analysis and coupling (coherence) between the MEG signals and speech temporal envelope were computed with Fieldtrip toolbox. Source-level analysis was performed with beamforming. Preliminary results show that activity in the 4-7 Hz range increases in a left fronto-parieto-temporal network for both speech rate conditions, with a decrease of left frontal activity for fast rate as compared to normal rate speech. Cerebro-acoustic coherence is observed at 4-7 Hz in the right auditory cortex for normal rate speech, whereas coupling between brain activity and fast rate speech occurs at 7-10 Hz in the right auditory and the left parieto-temporal junction, suggesting that cortical oscillations track speech rhythm. These findings seem consistent with models suggesting a role of theta activity in the parsing of syllabic information and in the establishment of predictions on relevant acoustic events in speech, ensuring efficient information processing (Ding & Simon, 2014; Peelle & Davis, 2012).

A82

ASSOCIATIONS BETWEEN FAMILY STRESS, LANGUAGE INPUT, AND NEUROCOGNITIVE DEVELOPMENT: EXAMINING ENVIRONMENTAL MECHANISMS FOR BRAIN AND BEHAVIOR

Samantha A. Melvin[1], Kristen Gillaspy[1], Megan Wenzel[1], Kimberly G. Noble[1]; [1]Teachers College, Columbia University — The quantity and quality of language heard in the home has important implications for children's language and cognitive development (Weisleider & Fernald, 2013) and for the brain regions that support these processes (Sheridan, Sarsour, Jutte, D'Esposito, & Boyce, 2012). A separate literature has examined how family stress may influence children's neurocognitive and brain development (Ursache, Noble, & Blair, 2015). However, rarely have the home language environment and family stress been considered concurrently in a single study. We hypothesized that greater family stress would be associated with reduced child-directed language spoken by parents, as well as decreases in children's neurocognitive development. In a pilot study of 39 five- to seven-year-old children (M = 6.34 years, 16 males) from socioeconomically diverse backgrounds, we measured the quantity of adult language heard by children, parent-reported family stress (including measures of material deprivation, perceived stress, and impact of recent life events) and a series of neurocognitive tests from the NIH Toolbox, including measurements of receptive vocabulary, executive function, and memory. Results showed that higher family stress was associated with lower adult word count ($r = -.54$, $p = .002$) and poorer neurocognitive performance ($r = -.36$, $p = .039$). There was no interaction between stress and word count, and adult word count did not statistically mediate the link between family stress and neurocognitive performance. These findings suggest that language input and family stress may contribute independently to children's neurocognitive development.

A83

NEUROCOGNITIVE CORRELATES OF SYNTACTIC PROCESSING IN CHILD AND ADULT SECOND LANGUAGE LEARNERS

Fatemeh Abdollahi[1], Janet G. van Hell[1]; [1]Pennsylvania State University — Second languages (L2) are taught in millions of classrooms worldwide, but we know little about the neural correlates of syntactic processing in L2 classroom learners, and the extent to which individual variation in cognitive abilities and first language (L1) fluency impact L2 processing, particularly in children. In this study, English adult (18+yr) and child (~10yr) intermediate learners of L2 Spanish read grammatical and ungrammatical L1 and L2 sentences of varying syntactic categories, and Event-Related Potentials (ERPs) were recorded. In the L1, adults, but not children, showed a robust P600 effect for all grammatical structures, indicating that processing of L1 syntax in 10yr olds is distinctly different from adults. For the L2, group-based ERP analyses showed that adult L2 learners' sensitivity to syntactic violations in the L2 (i.e., P600 or N400 effects) was related to the degree of similarity with corresponding L1 structures, but their behavioral performance (accuracy in grammaticality judgment) was at chance. To examine individual variation in language processing, Response Dominance Indexes (RDIs) were calculated, dividing learners into profiles of N400 or P600 dominance. Clear individual differences in response dominance during L2 processing emerged, previously averaged out in traditional group-based analyses. Correlations between RDI and individual difference measures of affect, executive function and working memory revealed no clear patterns. Group level ERP analyses showed that children, unlike adults, were not significantly sensitive to syntactic violations in the L2. These results show there is great variability in L2 learners, not captured in traditional group-based analyses.

LANGUAGE: Other

A84

LANGUAGE PROCESSING IN ARABIC DIGLOSSIA: MMN AND N400 RESPONSES TO SHARED VERSUS NON-SHARED FEATURES IN MODERN STANDARD ARABIC AND SPOKEN ARABIC

Reem Khamis-Dakwar[1], Guannan Mandy Shen[2], Trey Avery[2], Karen Froud[2]; [1]Adelphi University, [2]Teachers College, Columbia University — While recent years have shown increased brain research into multilingualism, diglossia remains poorly understood. Diglossia is a sociolinguistic situation in which two language varieties co-exist. In Arabic, for example, spoken dialects (SA) are acquired naturally and used for daily spoken communication; while Modern Standard Arabic (MSA) is used for formal and written communication, and taught scholastically. The few Arabic ERP studies have focused on orthographic processing [1-5], but little work has examined cognitive representations of, and interactions between, diglossic varieties [e.g. 6, 7]. In this study, we examined phonemic and lexical processing in eight speakers of Levantine Arabic, learners of MSA since first grade. We examined mismatch negativity (MMN) responses to Arabic phonemic contrasts that are either shared between MSA and SA, or unique to MSA; and N400 responses to auditory lexical decision, with words either shared between MSA and SA, or unique to MSA. Pseudowords either followed phonotactic constraints of Arabic ("lexical pseudowords") or used English phonotactics ("phonological pseudowords"). Arabic speakers showed significant MMN enhancement to shared speech contrasts. In response to MSA-only speech

contrasts, a positivity in the MMN latency range was observed. For lexical decision, a small N400 to lexical pseudowords and a positivity to phonological pseudowords were observed. N400 differences for MSA-only real words were evident only when proficiency and current Arabic use were controlled for. These results highlight the need to control for diglossic factors, especially exposure to and use of MSA, in investigations of cognitive processing for the two language varieties in Arabic diglossia.

A85

CROSS-MODAL ERP PRIMING EFFECTS IN ADULTS WITH DYSLEXIA

Priya Mitra[1], Marianna D. Eddy[2,3], Phillip J. Holcomb[1,4]; [1]Tufts University, [2]U.S Army Natick Soldier Research, Development, and Engineering Center, [3]Center for Applied Brain and Cognitive Sciences, Tufts University, [4]San Diego State University — We used a cross-modal, repetition priming paradigm in combination with the recording of event-related potentials in order to investigate the time course of mapping orthographic units onto phonological units among both typical readers and individuals with dyslexia. Stimuli consisted of repeated and unrelated prime-target pairs with primes presented visually and targets presented auditorily. Pairs were comprised of either high frequency words or pronounceable pseudowords with no orthographic neighbors, allowing us to better distinguish lexical and sublexical mappings between orthographic and phonological representations. As expected, typical readers show a large, widespread cross-modal priming effect for both word and pseudoword stimuli, such that unrelated auditory targets elicit a larger N400 than repeated targets. An interaction between group and lexical status revealed that the dyslexic group's N400 repetition priming effects were smaller and occurred later than controls' in the pseudoword condition, but comparable real word priming effects were seen in both groups. These findings suggest that individuals with dyslexia are able to effectively map between orthographic and phonological representations at the lexical level, but may struggle to map sublexical graphemes onto their associated phonemes. We also measured participants' phoneme discrimination abilities using a mismatch negativity (MMN) paradigm. Among individuals with dyslexia, the size of the MMN correlated with the mean amplitude of their cross-modal priming effects for real words. This correlation was not seen in typical readers.

A86

CHANGES IN RESTING STATE FUNCTIONAL CONNECTIVITY IN PERSONS WITH APHASIA FOLLOWING SUCCESSFUL WORD-FINDING TREATMENT

Chaleece Sandberg[1]; [1]Penn State University — Persons with aphasia (PWA) who are trained to generate abstract words (e.g., justice) in a specific context-category (e.g., courthouse) have been shown to improve not only on the trained items, but also on concrete words (e.g., lawyer) in the same context-category (Sandberg & Kiran, 2014). However, the underlying neural mechanisms of this behavioral gain are not fully understood. To help further our understanding of this brain-behavior relationship, the current study compares changes in resting state functional connectivity MRI (rs-fcMRI) in PWA before and after treatment to normal scan-scan changes in rs-fcMRI in healthy age-matched controls, using ROI-ROI analysis in the CONN toolbox. Ten (5 M) healthy right-handed adults, aged 47-74 (M 62.6), and seven (5 M) right-handed PWA, aged 47-75 (M 60) and in the chronic stage of post-stroke recovery, each participated in two fMRI scans, approximately 10 weeks apart. During the 10 week period, PWA received word-finding treatment, but the age-matched controls did not. As predicted, healthy adults showed few changes in rs-fcMRI from scan to scan. However, PWA who responded to trained items, and also generalized to nontrained items, showed more changes in rs-fcMRI than the control group, both within and outside of the default mode network. These results complement and extend our previous work, in which we found increases in task-based functional connectivity related to successful treatment outcomes (Sandberg, Bohland, & Kiran, 2015), by showing that changes in intrinsic activity can occur after successful therapy, making rs-fcMRI a promising tool for capturing treatment-induced neuroplasticity in PWA.

A87

BILINGUAL WORD SEGMENTATION: A CROSS-LANGUAGE ERP INVESTIGATION.

Annie C. Gilbert[1], Inbal Itzhak[1], Baum Shari[1]; [1]McGill University — An extensive body of research on word segmentation across languages has shown that different languages rely on different cues and strategies to segment meaningful units from the speech stream. For instance, English listeners tend to rely on lexical stress to locate word onsets, whereas French listeners will use phrase final lengthening to locate word offsets. These cross-language differences can make it difficult for L2 learners, who cannot simply transfer their L1 strategies onto the new language, but instead must learn a new set of cues and adopt a different approach to segmentation. To investigate this, we designed an EEG task in which English-French bilinguals listened to English and French sentences with ambiguous syllable strings containing either two monosyllabic words (e.g. key we) or one bisyllabic word (e.g. kiwi). Auditory sentences were produced with context-specific natural prosody. A picture prompt representing either the first monosyllabic word (e.g. a key), or the bisyllabic word (e.g. a kiwi) was presented at the offset of the first syllable of the ambiguous region. Each sentence was paired with each picture, permitting us to compare responses to the same pictures presented with different utterances. Preliminary analyses reveal differences in early visual components to the same pictures presented in different utterance segmentation contexts, in both the dominant and non-dominant languages, although the specific pattern of responses varies across languages. The results are considered with regard to L2 language proficiency and cognitive demands indexed by the N1 and N2 components.

A88

BRAIN OSCILLATIONS IN BILINGUAL SPEECH PROCESSING

Jon Andoni Dunabeitia[1], Manuel Carreiras[1,2,3], Margaret Gillon-Dowens[4], Alejandro Pérez[1]; [1]Basque Center on Cognition, Brain and Language, [2]University of the Basque Country, [3]Ikerbasque, Basque Foundation for Science, [4]University of Nottingham Ningbo — Neuronal oscillations play a key role in auditory perception of verbal input, with the oscillatory rhythms of the brain showing synchronization with specific frequencies of speech. Here we investigated the neural oscillatory patterns associated with perceiving native, foreign, and unknown speech. Spectral power and phase synchronization were compared to those of a silent context. Power synchronization to native speech was found in frequency ranges corresponding to the theta band, while no synchronization patterns were found for the foreign speech context and the unknown language context. For phase synchrony, the native and unknown languages showed higher synchronization in the theta-band than the foreign language when compared to the silent condition. These results suggest that neural synchronization patterns are markedly different for native and foreign languages.

A89

CHANGES IN THE COMPLEX AUDITORY BRAINSTEM RESPONSES INDUCED BY TRAINING ON A PERCEPTUAL LEARNING FOR SPEECH TASK

Stephanie Del Tufo[1,2], Emily Myers[1,2], Megan Speed[1], Erika Skoe[1]; [1]University of Connecticut, [2]Haskins Laboratories — While individuals flexibly adapt to talker-specific phonetic variation, it is unknown whether this flexibility differs in individuals with dyslexia. Perceptual learning for speech is a paradigm that induces a reorganization of phonetic space to accommodate new variation in speech input. In experiment one, intensive (3-day) lexically-guided exposure (see Kraljic & Samuel, 2008) was intended to implicitly introduce listeners to a talker in which one phoneme (either /s/ or /sh/) was replaced with an ambiguous token (an /s/--/sh/ blend). Following exposure, listeners performed a phonetic categorization task to determine the extent of exposure-induced reorganization of phonetic category processing. In a mixed logistic regression the inclusion of reading ability (typical vs. dyslexic readers) in the model significantly increased the model fit, suggesting that typical and dyslexic readers diverge in the degree to which they show exposure-related phonetic changes. In experiment two, the complex Auditory Brainstem Response (cABR) was used to assess changes in the electrophysiological response following lexically-guided exposure. During the cABR, listeners passively listened to two phonetic category endpoints (/s/ and /sh/) as well as the ambiguous midpoint (i.e. 50% /s/ & 50% /sh/). Following training, change in cABR encoding was

reflective of training induced phonetic reorganization (despite the acoustics remaining the same on day 1 and day 3). Specifically, the cABR for the ambiguous midpoint moved closer to the training induced category endpoint and away from the non-trained endpoint. Across experiments, intensive training resulted in behavioral and electrophysiological evidence of reorganization of phonetic space.

A90

PROCESSING ACCENTED SPEECH IN A SECOND LANGUAGE: INSIGHTS FROM ERPS DURING SENTENCE COMPREHENSION IN BILINGUALS

Sarah Grey[1], Laura C. Schubel[1], James M. McQueen[2,3], Janet G. van Hell[1]; [1]Pennsylvania State University, [2]Radboud University, [3]Donders Institute for Brain, Cognition, and Behaviour — We examined the effects of accented speech on non-native listeners' sentence comprehension using event-related potentials (ERPs). Previous research shows that speaker identity cues such as accent affect the neural correlates of spoken language comprehension. For example, Dutch native listeners showed equivalent N400s for semantic processing of native- and foreign-accented Dutch speech, and a P600 during grammatical processing of native-accented Dutch, but no P600 for foreign-accented Dutch (Hanulikova et al., 2012); similar ERP findings have been shown with Spanish native listeners (Romero-Rivas et al., 2015). Native listeners such as those tested in previous studies may use the accent cue differently than non-native listeners, who have a unique experience as both speakers and listeners of the non-native language.We tested 25 Dutch-English bilinguals who listened to sentences in English, their non-native language. Sentences were spoken by a native American English-accented speaker and a Chinese-English accented speaker while EEG was recorded; sentences were either correct, or contained a semantic anomaly or grammatical error in the use of subject pronouns (he/she). We analyzed comprehension accuracy and ERPs. Comprehension accuracy was high for both accent conditions. In the American English-accented condition, ERP results showed N400s to both grammatical and semantic errors; for semantic errors the N400 was preceded by an anterior positivity. In the foreign Chinese-English accented condition, semantic anomalies also elicited an N400, but with a delayed onset; there were no effects for grammatical errors. These results provide insight on the effects of accented speech on the neural correlates of non-native sentence comprehension.

A91

NUMBER JUDGMENT PERFORMANCE IS MODULATED BY TASK IN A CASE OF NUMBER ALEXIA.

Anne-Marie Schuller[1,2], Samuel Di Luca[1], Charlotte Sosson[1], Christine Schiltz[1]; [1]University of Luxembourg, [2]Rehazenter — Numbers are processed in both hemispheres: Whereas the left hemisphere allows converting the visual form of Arabic digits into verbal output, the right hemisphere is predominantly involved in giving access to quantity representation. Here we report the case of a person with a left brain lesion (KB), who is showing alexia for numbers, despite preserved digit writing. Residual number processing capacities were investigated through three computerized number judgment tasks: Parity (odd/even), magnitude (smaller/larger than 5) and ordinality judgment (before/after 5). On 192 trials, a forced-choice judgment task was done by KB on single digits, presented in auditive and visual modality. Results demonstrate preserved number processing capacities on auditive input. For visual input, however, access to semantic knowledge was impaired, with KB performing at chance level on the parity task. In the magnitude task, performance was modulated by the distance effect (linear trend F (1,23) 8.432; $p < 0.05$), with digits close to 5, accuracy dropped at chance level, while remoter digits (e.g. 1 or 9) where discriminated above chance (75-88%). Astonishingly, in the ordinality task KB showed an order effect (linear trend F (1,23) 8.903; $p < 0.005$), with better than chance accuracy for the first three digits (80%). These facilitation could result from counting strategies, acting as a topdown modulation of visual representations of digits in the right hemisphere. The results highlight the functional difference between verbal and visual, as well as cardinal and ordinal number processing and are discussed in the light of the hemispherical organization of the number processing system.

A92

THE RELATIONSHIP BETWEEN AN AUTISM- ASSOCIATED POLYMORPHISM ON CNTNAP2, BRAIN STRUCTURAL CONNECTIVITY AND MULTISENSORY SPEECH INTEGRATION

Lars A. Ross[1], Victor A. Del Bene[1,2], Young Jae Woo[1], Sophie Molholm[1], Gizely Andrade[1], Brett S. Abrahams[1], John J. Foxe[1,3]; [1]Albert Einstein College of Medicine & Montefiore Medical Center, [2]Ferkauf Graduate School of Psychology, Yeshiva University, [3]The Ernest J. Del Monte Institute for Neuromedicine, University of Rochester School of Medicine and Dentistry — There is evidence that Autism Spectrum Disorder (ASD) is associated with impaired ability to integrate information from different sensory modalities. A possible source of this deficit may be aberrant white matter connectivity, which has repeatedly been reported in ASD. A key question is whether behavioral differences in multisensory integration (MSI) can be explained by ASD- associated genetic susceptibility and to what extent this variability is mediated by structural white matter connectivity. CNTNAP2, a gene on chromosome 7 encoding a cell adhesion protein (Caspr2) of the neurexin superfamily, has been suggested to confer ASD risk and has frequently been associated with language development. In this study we investigated the relationship between genotype of a single nucleotide polymorphism (SNP: rs7794745) at the CNTNAP2 locus, structural white matter connectivity as assessed by diffusion tensor imaging (DTI) using tract based spatial statistics (TBSS), and performance on a multisensory speech integration task in a cohort of neurotypical adults. We found significant group differences between risk and non-risk carriers in audiovisual performance and widespread differences in fractional anisotropy (FA) in white matter tracts as well as significant correlations between audiovisual performance and FA. Mediation analysis revealed that FA in white matter regions in the precentral gyrus, parts of the optic radiation and the anterior corona radiata served as mediators of the effect of genotype on performance. Our findings provide novel insights into genetic and neurobiological sources of inter-individual variability in MSI and a possible neurogenetic pathway for multisensory speech processing deficits in ASD.

A93

THE INFLUENCE OF LANGUAGE ON NONLINGUISTIC LEARNING

Sofia Vallila-Rohter[1], Swathi Kiran[2]; [1]MGH-Institute of Health Professions, [2]Boston University — It is widely accepted that humans are capable of learning without language. Many studies have demonstrated that pre-verbal children are sophisticated statistical learners, adept at extracting pattern regularities from a sound stream as they acquire language (Saffran, Aslin, & Newport, 1996; Saffran, Newport, & Aslin, 1996). As adults, however, we engage in multiple additional types of learning, many of which require, or benefit, from the development of verbal strategies and rules (Ashby & Maddox, 2005; Smith & Grossman, 2008). Under other conditions, the ability to verbalize may bias adults towards implementing verbal strategies, even when implicit, procedural, mechanisms would lead to more effective learning (Vermaercke et al., 2014). Thus, language ability presents a potentially important factor for the execution of learning in adults. What happens, therefore, in adulthood, when a language system that is fully developed becomes compromised, as is the case across disorders such as Alzheimer's, Parkinson's disease and aphasia? In the current study, we used functional magnetic resonance imaging (fMRI) to examine the neural regions involved when individuals with aphasia (n=8) completed feedback-based and paired associate nonlinguistic category learning tasks. Results demonstrated a relationship between the engagement of left-hemisphere language regions and success with feedback-based learning. This relationship was not observed following paired-associate instruction. Results provide support for the hypothesis that instruction method can impact strategy and neural engagement in learning. Results will be discussed in the context of language deficits and whether participants utilize optimal strategies in the presence of impairment.

LONG-TERM MEMORY: Episodic

A94

PROSPECTIVE MEMORY: ELECTROPHYSIOLOGICAL CORRELATES OF A CLINICAL MEASURE

Sarah Raskin[1], Erin Aisenberg[1], Tessa Bloomquist[1], Consuelo Pedro[1]; [1]Trinity College — Prospective memory (PM) involves the ability to form and realize intentions after a delayed period of time (Einstein & McDaniel, 1990). The purpose of this experiment is to examine the relationship between a clinical measures of PM and an event-related potential paradigm (West & Ross-Munroe, 2002). Electrophysiological data was collected while performing a computerized laboratory PM measure and was compared to a clinical measure, the Memory for Intentions Screening Test (MIST) (Raskin, Buckheit, & Sherrod, 2011) in healthy adults (HA), and individuals with acquired brain injury (ABI). Results revealed that individuals with ABI performed significantly worse than HA on all variables of the MIST except for the 24 hour task. Similar findings were obtained for the laboratory measure performance. MIST total score was found to be significantly correlated with performance on the laboratory task and with the formation LPC waveform, previously shown to differentiate intention trials from ongoing trials. Both the N300 and formation LPC waveform were found to be significantly different in amplitude between HA and ABI. The N300 was significantly correlated with event-based PM but not time-based PM on the MIST. These findings lend support to the notion that PM has multiple components and that the separate waveforms are correlated with separate aspects of PM.

A95

A TWO-DAY CONSOLIDATION PERIOD IMPROVES MEMORY FOR OTHER-RACE FACES TO A GREATER EXTENT THAN MEMORY FOR SAME-RACE FACES

Bryant P. Reininger[1], Greg A. Caparis[1], Carly C. Reier[1], Carmen E. Westerberg[1]; [1]Texas State University — After learning, memories are transformed for long-term storage through systems consolidation, which optimally occurs during sleep. During this process, memories are strengthened and undergo qualitative changes that are adaptive for survival. Recent research indicates that the correspondence between new memories and future goals and motivations can influence the extent of these changes. Accordingly, memories that vary in social relevance may be differentially impacted by consolidation. It is well documented that memory is superior for same- compared with other-race faces. This finding is frequently attributed to motivational differences in remembering in-group versus out-group members at encoding. Yet, the extent to which these memory differences persist following consolidation is unknown. Here, Hispanic and Caucasian participants studied same- and other-race faces. Recognition memory was tested immediately and after a delay that included two nights of sleep, for which subjective sleep measures were obtained. Whereas memories for same-race faces did not improve across the delay, a significant improvement for other-race faces was observed. Furthermore, this improvement was correlated with subjective sleep measures across the delay (Experiment 1). Importantly, when immediate memory for same- and other-race faces was equated by increasing study time for other-race faces (Experiment 2), the same pattern of results was present, indicating that greater perceptual expertise with same- versus other-race faces could not account for the results. Thus, although a memory benefit for same- versus other-race faces may initially exist, consolidation processes can counteract such differences, suggesting that motivational factors that influence face memory encoding are less relevant during memory consolidation.

A96

NEUROPSYCHOLOGICAL CORRELATES OF AUTOBIOGRAPHICAL MEMORY CONJUNCTION ERROR SUSCEPTIBILITY

Aleea L. Devitt[1,2], Lynette J. Tippett[1,2], Daniel L. Schacter[2], Donna Rose Addis[1,2]; [1]School of Psychology & Centre for Brain Research, The University of Auckland, [2]Brain Research New Zealand, [3]Department of Psychology, Harvard University — Because of its reconstructive nature, autobiographical memory (AM) is subject to a range of distortions. One distortion involves the erroneous incorporation of features from one episodic memory into another, known as a conjunction error. Given that healthy aging is generally associated with increased rates of false memories, we investigated for the first time the impact of aging on vulnerability to AM conjunction errors. We also explored potential cognitive processes underlying the formation of these errors. A recombination paradigm was used to elicit AM conjunction errors in young and older adults, where novel past events were imagined using recombined details taken from authentic AMs. On a subsequent source monitoring test, conjunction errors occurred when recombined detail sets were incorrectly judged as depicting real memories. Participants also completed a battery of neuropsychological tests targeting relational memory and inhibition. Overall, older adults were more susceptible to AM conjunction errors than younger adults. Results indicated that a decline in inhibitory control may underlie the increased rates of AM conjunction errors with age, and account for some of the individual variation in conjunction error susceptibility in younger adults. In contrast, relational memory functioning does not appear to contribute to AM conjunction error rates. These findings speak towards an overreliance on the sense of familiarity garnered by the individual details of a conjunction lure as contributing to the formation of AM conjunction errors. Disinhibition may also contribute to excessive binding between details originating from separate memories by allowing related, though irrelevant, memory traces to be activated.

A97

FORGETTING IS MORE WORK THAN REMEMBERING

Tracy H. Wang[1], Katerina Placek[2], Jarrod A. Lewis-Peacock[1]; [1]University of Texas at Austin, [2]University of Pennsylvania — Forgetting is often passive, but it can also be an active process providing control over the tenure of undesired thoughts. Prior work suggest that different strategies may underlie deliberate forgetting: direct suppression by top-down control mechanisms or active substitution of thoughts during memory rehearsal (Benoit & Anderson, 2012). Based on these and recent findings on incidental forgetting (Lewis-Peacock & Norman, 2014), we hypothesize that deliberately induced neural competition between memories contributes to the intentional weakening of unwanted memories. Here, we used item-method directed forgetting (N=20) to test whether the intention to forget produces competitive neural dynamics that lead to weakening of memory items. Applying multi-voxel pattern analysis to fMRI data in ventral temporal cortex revealed that item processing was stronger following an instruction to forget vs. an instruction to remember. Moreover, neural processing of items that were intentionally forgotten was stronger compared to items that were incidentally forgotten. Finding increased processing during directed forgetting is consistent with an active forgetting process requiring more, rather then fewer, neural resources. Preliminary analyses identified a non-monotonic plasticity relationship between neural activity associated with the intention to forget and subsequent memory such that items that were moderately activated were more likely to be forgotten, compared to items that were more weakly or more strongly processed. This relationship did not hold for items that participants were told to remember. Together, these results corroborate the existence of active forgetting, and suggest that the induction of competitive neural dynamics between memories may contribute to deliberate forgetting.

A98

STIMULUS PROPERTIES MAY ENHANCE ASSOCIATION-MEMORY BY RECRUITING HIPPOCAMPAL ACTIVITY

Jeremy B. Caplan[1], Chris R. Madan[2,1]; [1]University of Alberta, [2]Boston College — The hippocampus is thought to support association-memory, particularly when tested with cued recall. One of the most well known and studied factors that influences accuracy of verbal association-memory is imageability; participants remember pairs of high-imageability words better than pairs of low-imageability words. High-imageability words are also remembered better in tests of item-memory. However, we previously found that item-memory effects could not explain the enhancement in cued recall, suggesting that imageability enhances association-memory strength. Here we report a fMRI study designed to ask, what is the role of the hippocampus in the memory-advantage due to imageability? We tested two alternative hypotheses: 1) Recruitment Hypothesis: high-imageability pairs are remembered better because they recruit the underlying hippocampal association-memory function more effectively. Alternatively, 2) Bypassing Hypothesis: imageability recruits extra-hippocampal regions to better organize the pair, enhancing memory in a way that bypasses the hippocampus, as has been found, for example, with explicit unitization-imagery strategies. Results found, first, hippocampal BOLD signal was greater during study and recall of high-

than low-imageability word-pairs. Second, subsequently recalled pairs had greater hippocampal activity than subsequently forgotten pairs, but this did not interact with imageability, challenging the bypassing hypothesis, but consistent with the predictions derived from the recruitment hypothesis. Our findings suggest that certain characteristics of stimulus may leverage— rather than avoid— the associative function of the hippocampus to support superior association-memory.

A99

APPROACH AND AVOIDANCE MOTIVATION MODULATE HUMAN SPATIAL EXPLORATION AND LEARNING IN A REAL-LIFE ENVIRONMENT

Kimberly S. Chiew[1], Alasdair Newson[1], Laura Lerebours[1], Lee K. Gans[1], Jordan Hashemi[1], Nathan J. Clement[1], Mai-Anh T. Vu[1], Guillermo Sapiro[1], Nicole E. Heller[2], R. Alison Adcock[1]; [1]Duke University, [2]Dwight Center for Conservation Science, Pepperwood Foundation — Exploration and learning of large, open-ended spaces is key to adaptive behavior, yet remains a complex computational problem for cognitive science. Prior work indicates that motivational framing has broad effects on cognition and behavior: in particular, approach motivation may be associated with enhanced exploration and memory of a virtual-reality environment (Murty et al., 2011), which may be due to enhanced dopaminergic engagement under approach vs. avoidance-motivated learning (Duzel et al., 2010). We aimed to investigate these effects outside the laboratory, by examining exploration and subsequent memory for an art exhibit thematically focused on relationships between humans and the natural environment. Motivational framing was manipulated via an exhibit statement at entry describing potential human response to environmental problems in terms of gaining rewarding outcomes (Promotion condition) or avoiding punishing outcomes (Prevention condition). The exhibit was otherwise unchanged between conditions. Participants freely explored the exhibit and were tracked via video camera. 24 hours later, participants returned for free recall and spatial memory tests of the exhibit. Measures of personality, reward responsivity, and environment attitudes were also collected. Despite equivalent exhibit exploration time across framing conditions, profiles of exploration and movement through the exhibit differed by motivational condition. Further, the relationship between exploration time and subsequent memory was significant in the Promotion, but not Prevention, condition. Similarly, personality and environmental attitudes predicted behavior only under Promotion. Thus, in this real-world setting, the specific motivational context constrained the expression both of individual predictors of motivated engagement with the exhibit and of memory depth-of-encoding effects.

A100

DECODING THE CONTENTS OF RECOLLECTION WITHIN THE CORE RECOLLECTION NETWORK

Preston Thakral[1], Tracy Wang[2], Michael Rugg[3]; [1]Harvard University, [2]University of Texas at Austin, [3]University of Texas at Dallas — Recollection – retrieval of qualitative information about a past event – is associated with enhanced neural activity in a consistent set of neural regions (the 'core recollection network') regardless of the nature of the recollected content. Here, we employed multivariate pattern analysis (MVPA) to assess whether the content of recollected information could be decoded from retrieval-related fMRI activity in core recollection regions, including the hippocampus, left angular gyrus, medial prefrontal cortex and posterior cingulate. During study, participants viewed objects and concrete words that were subjected to different study tasks. Test items were words that corresponded to studied words, the names of studied objects, or unstudied words. Participants judged whether the items were recollected, familiar, or new by making 'remember', 'know' and 'new' responses, respectively. MVPA was restricted to voxels within regions of the core recollection network, in each of which univariate analysis revealed conjoint recollection effects (remember > know) for both objects and words. Multivariate classifiers were trained with the test phase data to discriminate remember trials based on their study history (remember-object versus remember-word trials). The classifier was then tested on a separate set of test phase data. The study history of the remembered test items could be reliably decoded in every core recollection region. Additional analyses revealed that these findings did not extend to know responses. The results indicate that while aggregate neural activity in the members of the core recollection network is generically sensitive to successful recollection, the recollection-related activity they manifest carries information about recollected content.

A101

INDIVIDUAL DIFFERENCES VARY ACROSS NETWORKS AND TRIAL TYPES

Benjamin Turner[1], Evan Layher[1], Michael Miller[1]; [1]University of California, Santa Barbara — Group-averaged fMRI results have clearly demonstrated that some patterns of task-related brain activity are common across participants. However, this approach ignores a fundamental truth of neuroimaging: patterns of activity are often more variable across individuals than they are consistent. Earlier work has shown that a substantial proportion of this variability can be explained from a relatively small set of individual difference factors, including anatomy, strategy, personality, and so forth (Miller et al., 2012). Here, we extend this work on individual differences in two directions. First, we examine how the relationship between brain activity and other individual differences factors varies across functional brain networks. Second, we investigate whether this relationship differs across different trials within a given task. Our results demonstrate unsurprisingly that both dimensions matter: the relationship between neural similarity and similarity along other individual difference factors depends on both the functional brain network and the putative cognitive process. More importantly, our results suggest that the nature of these relationships is empirically interesting in its own right. For instance, there is a greater proportion of explainable variability on trials requiring less task engagement; the relative explanatory power of different groups of variables differs between trials, with state of mind for instance explaining a relatively larger portion of the variability in these lower-engagement trials; and these relationships further vary across networks, with performance-related variables for example explaining more variability in networks proposed to be task-engaged. Funding statement: this research was supported by the Institute for Collaborative Biotechnologies under grant W911NF-09-D-0001.

A102

PHASE OF SPONTANEOUS SLOW OSCILLATIONS DURING SLEEP INFLUENCES MEMORY-RELATED PROCESSING OF AUDITORY CUES

Laura Batterink[1], Jessica Creery[1], Scott Cairney[2], Gareth Gaskell[2], Ken Paller[1]; [1]Northwestern University, [2]University of York — Slow oscillations during slow-wave sleep (SWS) play an important role in memory consolidation, regulating interactions between hippocampal and cortical networks. Slow oscillations appear as high-amplitude, synchronized EEG activity, corresponding to active up-states of depolarization and subsequent down-states of hyperpolarization. Memory reactivations occur spontaneously during SWS, and can also be induced by presenting learning-related cues associated with a prior learning episode during sleep. This technique, targeted memory reactivation (TMR), selectively enhances memory consolidation. Given that memory reactivation is thought to occur preferentially during the slow-oscillation up-state, we hypothesized that TMR stimulation effects would depend on the phase of the slow oscillation. Participants learned arbitrary spatial locations for objects that were each paired with a characteristic sound (e.g., cat—meow). Then, during SWS periods of an afternoon nap, half of the sounds were presented. When object location memory was subsequently tested, recall accuracy was significantly better for those objects cued during sleep. We report here that this memory benefit was predicted by slow-oscillation phase at the time of stimulation in data re-analyzed from several experiments. For cued objects, location memories were categorized according to amount of forgetting from pre- to post-nap. Conditions of high versus low forgetting corresponded to stimulation timing at different slow-oscillation phases, suggesting that learning-related stimuli were more likely to be processed and trigger memory reactivation when they occurred at the optimal phase of a slow oscillation. These findings provide insight into the mechanisms of memory reactivation during sleep, supporting the idea that reactivation occurs preferentially during cortical up-states.

A103

EFFECTS OF BRIEF ELECTRICAL STIMULATION TO THE AMYGDALA IN HUMANS ON MEMORY FOR NEUTRAL STIMULI

Cory Inman[1], Kelly R. Bijanki[1], David I. Bass[1], Joseph R. Manns[2], Robert E. Gross[1], Stephan Hamann[2], Jon T. Willie[1]; [1]Department of Neurosurgery, School of Medicine, Emory University, [2]Department of Psychology, Emory University — Emotional events are often remembered better than neutral events, and this emotional benefit to memory depends on the amygdala, a key brain region involved in both memory and emotion. Based on similar studies in rodents, the present study examined whether brief electrical stimulation to the amygdala in humans immediately following the presentation of neutral stimuli enhances recognition memory. To determine the effects of amygdala stimulation on memory, we recruited epilepsy patients undergoing intracranial EEG monitoring in whom either unilateral or bilateral depth electrodes were surgically implanted in the amygdala. Subjects underwent either sham or acute bipolar electrical stimulation to electrode contacts in either the left or right amygdala (8 trains of 4 pulses at 50 Hz and 0.5 mA for 1 second) immediately following presentation of neutral object photos as local field potentials (LFPs) were simultaneously recorded. Recognition memory was tested immediately and one day later. Preliminary results suggest that amygdala stimulation improved subsequent recognition of the object images at both delays. Patients were subjectively unaware of the effects of amygdala stimulation. In summary, these findings suggest that brief electrical stimulation to the human amygdala delivered immediately after the presentation of neutral objects may enhance episodic memory for neutral stimuli.

A104

IS THE MEDIAL TEMPORAL LOBE SENSITIVE TO THE TIME ORIENTATION OF MENTAL CONSTRUCTIONS?

Daniela Palombo[1,2], Scott M. Hayes[1,2], Kristina M. Peterson[1,2], Margaret M. Keane[3,1,2], Mieke Verfaellie[1,2]; [1]VA Boston Healthcare System, [2]Boston University School of Medicine, [3]Wellesley College — The medial temporal lobe (MTL) is involved in remembering past events as well as imagining future experiences. For instance, fMRI studies of healthy adults demonstrate MTL engagement during future thinking and amnesic patients with MTL damage are impaired in imagining the future. Intriguingly, work by Andrews-Hanna and colleagues (2010) shows that the MTL is preferentially engaged when individuals think about the future relative to thinking about the present, suggesting that future time orientation drives MTL engagement. Yet, the observed MTL difference may be due to differential demands on scene construction, because future probes were more episodic and present probes were more semantic in nature. The present study explored the alternative account that scene construction, rather than future time orientation, is responsible for the MTL difference observed by Andrews-Hanna et al. (2010). Using fMRI, we directly contrasted MTL activity in (1) present- and future-oriented conditions equated in scene construction demands, and (2) high- and low-scene construction conditions equated in future thinking demands. Consistent with the alternative account, the MTL, in conjunction with other midline regions, was more active for high- versus low-scene construction conditions. By contrast, MTL differences were not observed for future versus present conditions. Moreover, multivariate analyses revealed that the magnitude of MTL activation was associated with the extent to which participants pictured a scene but was not associated with the extent to which participants thought about the future. These findings are important as they help disambiguate the putative contribution of the MTL to imagination.

A105

A THETA-BURST TRANSCRANIAL MAGNETIC STIMULATION INVESTIGATION OF THE FEELING-OF-KNOWING

Anthony J Ryals[1], Jonathan T O'Neil[1], Joel L Voss[1]; [1]Northwestern University Feinberg School of Medicine — Feeling-of-knowing (FOK) judgments involve prospective memory monitoring, whereby an individual must reflect on instances of retrieval failure (i.e., misses) and then estimate the likelihood of correctly identifying missed items later. Little is known regarding neural mechanisms for FOK judgments. Recent evidence implicates anterior prefrontal cortex (aPFC) in memory awareness, with left aPFC lesions specifically associated with reduced FOK accuracy. We used theta-burst transcranial magnetic stimulation (TBS) to temporarily modulate aPFC to test for effects of hemisphere on memory and FOK accuracy. For each subject, left and right aPFC (Brodmann area 9) and vertex (sham) locations were identified based on structural MRI. Prior to performing associative recognition memory tasks incorporating trial-level FOK judgments, one of these targeted locations was stimulated during each of three separate sessions (in counter-balanced order). Preliminary findings indicate reduced recognition memory accuracy following left aPFC TBS stimulation compared to vertex TBS. Furthermore, trial-by-trial estimates of the accuracy of FOK judgments (i.e., correlations between FOK judgments and subsequent accuracy) were reduced following left aPFC TBS. These findings are consistent with those from lesion-deficit studies in small samples of individuals with aPFC damage, highlighting the crucial role of aPFC in memory and memory awareness. Discussion will include implications for prospective awareness disruptions in clinical populations as well as future directions involving additional repetitive TBS parameter manipulations.

A106

CONTEXT REINSTATEMENT CAN HELP AND HINDER EPISODIC MEMORY: A RECONSTRUCTIVE RETRIEVAL ACCOUNT

Manoj Doss[1], Jamila Picart[1], David Gallo[1]; [1]University of Chicago — Context is critical for episodic memory. The reinstatement of an encoding context at retrieval can facilitate memory of a studied event. Although context reinstatement can support successful, hippocampally-dependent memory retrieval, it is also possible that context reinstatement can contribute to reconstructive processes that drive false memories. We tested this hypothesis using a recognition memory task that has been shown to engage the hippocampus. In our paradigm, participants encoded objects superimposed over scenes (e.g. cat on the beach) across two days separated by 24 hours. After the second encoding session, participants were given a memory test for the objects that included the same objects (targets; e.g. the same cat), similar objects (similar lures; e.g. a cat posing or colored differently), or new objects (e.g. dissimilar lures; a leprechaun), and needed to make a corresponding response from memory ("same," "similar," or "new"). Additionally, context reinstatement was manipulated at retrieval by either presenting the targets or lures on the same scene (congruent; e.g. beach) or different scene (incongruent; e.g. forest) as the corresponding object from encoding. Typical context reinstatement effects were observed for targets, such that hit rates were greater for congruent compared to incongruent scenes. Critically, false alarms to similar lures also were increased by context reinstatement, and these effects were larger after a delay. These results suggest that context reinstatement effects that have been attributed to the hippocampus not only support true memory, but also can contribute to error-prone reconstructive processes at the time of retrieval.

A107

REWARD RETROACTIVELY ENHANCES MEMORY CONSOLIDATION FOR RELATED ITEM.

Vishnu Murty[1], Anuya Patil[2], Joseph Dunsmoor[2], Elizabeth Phelps[2], Lila Davachi; [1]University of Pittsburgh, [2]New York University — Murty VP, Patil A, Dunsmoor JE, Phelps EA(?), Davachi L Reward motivation is thought to enhance episodic memory in order to support future adaptive behavior. However, information that may seem inconsequential during encoding can gain affective significance based on future experiences. A prominent animal model of 'behavioral tagging' has demonstrated that memory for neutral information can benefit from periods of enhanced plasticity after learning via memory consolidation. We have previously shown that fear conditioning can retroactively strengthen memory for related information; however, these mechanisms have not yet been tested in the appetitive domain. To investigate these processes, participants first incidentally encoded trial-unique pictures of animals and tools. Following this, participants underwent an instrumental conditioning session in which novel pictures drawn from a stimulus category was associated with a higher monetary reward than the other category. Reward contingencies were counterbalanced across categories between participants. Participants then performed a surprise memory test either immediately or after a 24-hour delay. Results indicated that during the immediate memory test there was no influence of reward on memory. However, at the 24-hour delay, reward enhanced memory not only for items appearing during conditioning, but also for related items presented prior to conditioning —i.e., memoranda drawn from the same category as rewarded information. These findings

suggest that reward motivation can facilitate memory for seemingly inconsequential information by facilitating consolidation. Further, these findings provide greater evidence for mechanisms of behavioral tagging in humans.

A108

ACROSS-SUBJECT REPRESENTATIONAL CONSISTENCY DURING ENCODING AND RETRIEVAL OF SCENE IMAGES

Erik Wing[1], Benjamin Geib[1], Roberto Cabeza[1]; [1]Duke University — Past research has shown that information pertaining to stimulus identity can be detected in distributed patterns of brain activity, both during active perception and during memory retrieval. While the majority of these analyses are performed within subjects, the feasibility of cross-subject methods (using data from one subject to predict neural or behavioral responses in another subject) has also been demonstrated. In the present study, we examined cross-subject representational similarity in an experiment where subjects viewed scene pictures paired with descriptive labels at encoding and later mentally recalled the images given only the word labels. In examining the consistency of information corresponding to perceiving individual scenes (encoding) across subjects, we found pattern similarity increases for matched scenes in perceptual processing regions—including cuneus and lateral occipital areas—and also in somewhat more anterior regions of ventral occipitotemporal cortex (VOTC). An analogous comparison that focused on trials where only scene labels were shown (retrieval) also showed effects in occipital cortex. In addition, cross-subject consistency in encoding-retrieval similarity (ERS) was found both in early visual cortex and in posterior midline, near retrosplenial cortex (RSC). The findings based on encoding data point towards some measure of cross-subject consistency in brain patterns for scene perception. Consistency of stimulus-specific patterns that incorporate both phases (ERS) may also be driven by conceptual information common to scenes and their corresponding labels, particularly in regions like posterior midline, which previous research has linked to supporting semantic context and conceptual relationships.

A109

HIGH VALUE LEADS TO IMPROVED EXPLICIT RECOLLECTION, BUT REDUCED IMPLICIT MEMORY, WHEN LEARNING KALEIDOSCOPE IMAGES

Michael S. Cohen[1], Larry Cheng[1], Ken A. Paller[1], Paul J. Reber[1]; [1]Northwestern University — Recognition judgments typically rely on MTL-dependent explicit memory, but in some cases, participants can make accurate guesses seemingly driven by implicit memory (e.g., Voss et al. 2008). These "implicit recognition" effects provide a rare opportunity to observe interactions between implicit and explicit memory systems, but have also proven somewhat challenging to study. Here, we use a value-directed recognition (VDR) paradigm to elicit recognition responses that either depend on explicit memory or benefit from a contribution of implicit memory. Two novel kaleidoscope images were shown simultaneously in two different spatial quadrants during study, one marked high-value and one low-value, in blocks of 16 stimuli. After each study block, participants performed source memory (quadrant) and yes-no recognition to assess explicit memory. Explicit memory was better for high point-value items, likely due to increased encoding effort. After all 7 study blocks, participants also completed a forced-choice recognition memory test, previously shown to be more sensitive to contributions of implicit memory. Here, there was an interaction between value and confidence, with low point-value items tending to produce higher levels of accurate guessing on the forced-choice test than high-value items. Thus, previously reported effects of VDR—improved explicit memory for high-value items—extend from verbal memory to novel, non-verbalizeable stimuli, while more robust implicit memory contributions can be elicited from items marked low-value. This approach will enable further investigation of the neural basis of interactions between these two forms of memory, and of when implicit memory representations inform guesses on recognition memory tests.

A110

TARGETED MEMORY REACTIVATION DURING SLEEP WITH PREVIOUSLY IMAGINED IMAGES: NO INCREASE IN FALSE OR VERIDICAL MEMORIES.

Iliana Vargas[1], Ken Paller[1]; [1]Northwestern University — Many findings suggest that sleep is important for memory consolidation. For example, reactivation of specific neuronal firing patterns in rats occurs during slow-wave sleep in both the hippocampus and the visual cortex. These results imply that sensory areas involved in visual perception can be reactivated during sleep without visual stimuli. One way to study memory consolidation during sleep is to reactivate memories with auditory stimulation; Targeted Memory Reactivation (TMR) with sounds associated with prior learning can strengthen memories for cued information. In this experiment, we examined whether we could increase false memories for imagined objects using TMR. Previous research has shown that vivid imagining can lead to false memories for imagined objects (Gonsalves & Paller, 2000). We asked participants to imagine common objects when cued with the corresponding word. On some trials, participants saw a photograph of the object as well as an associated sound; on other trials, they only heard the associated sound. During the NREM portion of an afternoon nap, participants were presented with half of the sound cues for the objects that were only imagined. Results showed no differences in false memory for cued versus uncued imagined-only objects. In a similar experiment, we used verbal cues during NREM sleep for objects that were both seen and imagined, and we found that TMR did not lead to improved memory for those objects. We thus speculate that false or veridical memories as studied with the Gonsalves/Paller procedures are not amenable to change using these TMR methods.

A111

EFFECTS OF POST-ENCODING STRESS ON BRAIN ACTIVITY ASSOCIATED WITH EMOTIONAL MEMORY RETRIEVAL.

Andrew M. McCullough[1], Maureen Ritchey[1], Charan Ranganath[1], Andrew P. Yonelinas[1]; [1]University of California, Davis — Studies have shown that acute stress after learning enhances recognition memory performance, and evidence from a variety of experimental methods suggests that stress influences memory via the combined actions of glucocorticoid hormones and adrenergic activity (in the hippocampus and amygdala, respectively) both during and after the encoding episode. Little is known, however, about whether those processes translate into differences in neural activity during successful retrieval. Thus, we used a novel fMRI paradigm to examine how post-encoding stress influences neural activity associated with successful recognition of emotional and neutral pictures. Fifty participants completed the cold-pressor test or a control task after encoding, and recognition memory was tested 24 hours later in the MRI scanner. A region of interest analysis revealed that stress had selective effects on recollection-related activity for emotional pictures. That is, stress led to significant increases in recollection-related activity in the amygdala ($p<.05$), as well as the anterior ($p<.01$) and posterior hippocampus ($p<.05$) for negative emotional pictures, but did not influence memory-related activity for neutral pictures (all p's $>.3$). The results suggest that post-encoding stress preferentially impacts the medial temporal lobe processes involved in retrieving emotional rather than neutral materials, and support the theory that post-encoding stress influences memory via mechanisms in both the amygdala and hippocampus.

A112

INTERACTIVE IMAGERY AND THE ELECTROPHYSIOLOGY OF ASSOCIATION-MEMORY

Yvonne Y. Chen[1], Shrida S. Sahadevan[1], Sandra A. Wiebe[1], Jeremy B. Caplan[1]; [1]University of Alberta — Interactive imagery is a highly effective strategy for learning associations between pairs of words; for example, to remember CHAIR–CUP, one might imagine a cup on a chair. Our group recently showed that the peg-list method, a strategy known to be effective in memorizing serial lists, could also be adapted to lists of pairs. To use the peg-list method, one forms interactive images combining each new list-item with one of a standardized set of pre-memorized "peg" words, corresponding to numbers; for example, 1–BUN, 2–SHOE, …, 10–HEN. We asked, does the peg-list method operate on the same interactive-imagery process (linking CHAIR to BUN) as interactive-imagery binding the paired items themselves (CHAIR to CUP directly)? Our hypothesis was that the ERP subsequent-memory effect for inter-item interactive imagery would resemble the subsequent-memory effect that predicted recall of the pegs themselves. Research on expert knowledge raises an alternative possibility, that the peg-list method operates on different cognitive processes, specialized for binding new learning onto prior knowledge. One group studied pairs using interactive imagery, and a second group used the peg-list method, and memory was tested with cued recall. Peg-list participants were also asked to report the peg associated with each studied item. The subsequent-memory effect was significant for interactive-imag-

ery-based cued-recall at 400-800 ms, but for item–peg recall, at 800-1200 ms. Moreover, the topographic patterns were dissimilar between the two strategies. Our findings suggest interactive imagery binds pegs to words differently than item-item imagery, possibly exploiting the benefits of anchoring new information to previously learned knowledge.

LONG-TERM MEMORY: Other

A113

A META-ANALYTIC REVIEW OF HUMAN HABIT LEARNING

Tara K. Patterson[1], Barbara J. Knowlton[1]; [1]University of California, Los Angeles — Studies of habit learning come in a variety of forms. Three of the most common means of studying habits are by observing behavior during probabilistic classification, maze navigation, and instrumental learning. Experiments in non-human animals using maze navigation and instrumental learning tasks have implicated the striatum in the development of habitual behavior, and there is evidence suggesting that within the striatum, the dorsolateral striatum (analogous to the putamen in the human brain) underlies habitual behavior while the dorsomedial striatum (analogous to the caudate in the human brain) underlies non-habitual, goal-directed behavior. To assess the degree to which this functional heterogeneity is present in the human striatum, we conducted a meta-analytic review of the human fMRI experiments that have employed these three common assays of habit behavior. We found that in studies employing the probabilistic classification task, activations were more anterior and tended to include both caudate and putamen, while studies employing maze navigation reported activation of the body and tail of the caudate. Studies using an instrumental learning paradigm reported activation of the putamen, consistent with work in non-human animals.

A114

PAIRED ASSOCIATE ENCODING INFLUENCED BY ENTRAINED THETA POWER

Nicholas Ketz[1], Randall O'Reilly[1], Tim Curran[1]; [1]Department of Psychology and Neuroscience, University Colorado Boulder, Boulder, CO — EEG studies of long-term memory have generally shown successful encoding to be positively correlated with theta power, and alpha and beta power to be negatively correlated. Some studies have entrained these oscillations through visual stimulation at the desired frequency in an attempt to induce changes in memory performance. Results from these studies, however, have been mixed, and the oscillatory relationships with memory can change depending on the encoding and/or retrieval task used. We sought to clarify these issues within the encoding of paired associates, and testing with old/new recognition followed by cued-recall in an attempt to measure both item and associate level memory. Critically, participants were entrained during encoding with 6Hz (theta), 10Hz (alpha), and 20Hz (beta) visual stimulation as well a non-periodic baseline condition to test the hypothesis that theta entrainment would increase cued-recall performance and alpha/beta might impair performance. A behavioral study showed increased cued-recall performance for 6Hz compared to baseline, and no other significant differences in cued-recall or recognition. A follow-up EEG study showed a significant increase in power for each entrainment frequency in its respective condition, however no significant differences in behavioral performance were found. Subject level, and trial level models of entrained power predicting memory performance showed a significant relationship with cued-recall in the 6Hz condition only, and no relationship with recognition memory. These EEG results suggest entrained theta power enhances the encoding of paired associates, however inconsistent behavioral results suggest there are mitigating factors not yet accounted for.

A115

EFFECTS OF BRAIN STIMULATION ON MEMORY AND METAMEMORY.

Elizabeth Chua[1,2], Rifat Ahmed[1]; [1]Brooklyn College of the City University of New York, [2]Graduate Center of the City University of New York — Previous research has shown that activity in the prefrontal and temporal cortices correlates with successful retrieval of semantic information. Furthermore, these regions have also been implicated in the "feeling-of-knowing" that currently inaccessible information can be retrieved later. The goal of this study was to use high definition transcranial direct stimulation (HD-tDCS), a non-invasive form of brain stimulation, to determine if these regions had a causal role in memory and the feeling-of-knowing. Participants first attempted to recall the answer to a general knowledge question, then gave a feeling-of-knowing (FOK) judgment, followed by a 4 alternative forced choice recognition task. Participants completed the same task with different questions under 3 different tDCS conditions: left frontal stimulation, left temporal stimulation, and sham stimulation. Participants receiving tDCS over the DLPFC showed worse recall than those receiving tDCS over the lateral temporal cortex, $t(26)=-2.31, p<0.03$, but there were no differences in recognition performance. We next examined the effects of stimulation on FOK ratings, and there was a significant accuracy x stimulation interaction [$F(2,52)=7.52$, $p<0.001$], with a bigger difference in FOK ratings for hits and misses for the frontal group compared to the other groups, suggesting that the frontal group was more metacognitively accurate. Using a trial-by-trial measure of metacognitive accuracy, da, the frontal group showed better FOK accuracy compared to the temporal group, $t(26)=2.55$, $p<0.02$. These data show that HD-tDCS over the left DLPFC has effects on both memory and metamemory.

A116

CONTEXTUAL FEAR GENERALIZATION IS MODULATED BY CONTEXT PRE-EXPOSURE AS WELL AS TIME UNTIL FEAR RETRIEVAL

Marta Andreatta[1], Dorothea Neueder[1], Evelyn Glotzbach-Schoon[1], Andreas Muehlberger[2], Paul Pauli[1]; [1]Department of Biological Psychology, Clinical Psychology, and Psychotherapy, University of Würzburg, Germany, [2]Department of Clinical Psychology and Psychotherapy, University of Regensburg, Germany — In animals, an increase in time between fear acquisition and fear retrieval causes fear generalization. Such fear generalization is prevented by pre-exposure to the context (CTX) before its association with an aversive unconditioned stimulus (US). We investigated the effects of pre-exposure and time-passing on human fear generalization. On Day1, 42 participants (pre-exposure group) explored two virtual offices, while 41 participants (no-pre-exposure group) explored a virtual stadium. On Day2, participants learned to associate one office (CTX+) with unpredictable USs, and another office (CTX-) with safety. On Day3, participants visited CTX+, CTX-, and a new generalization context (G-CTX). Half of the participants of each group returned either 24h (recent test) or 2weeks (remote test) later. After successful context conditioning, we found fear generalization for verbal responses (G-CTX was rated as negative, arousing and anxiougenic as CTX+, and more than CTX-), but safety generalization for startle responses (startle attenuation to CTX- and G-CTX vs. CTX+). The pre-exposure compared to the no-pre-exposure group showed facilitated extinction for verbal responses (equal ratings for CTX+ and CTX-) presumably due to latent inhibition effects. Moreover, memory traces of the contexts might have weakened with time since participants of the remote test group exhibited comparable startle responses to all three offices (fear generalization). In summary, participants generalized fear on an explicit level (ratings), an effect that could be weakened by pre-exposure to the context but did not change with time. On an implicit level (startle), participants generalized safety and the passage of time caused forgetting of contextual fear.

A117

CONTINGENCY AWARENESS AS A PREREQUISITE FOR DIFFERENTIAL CONTEXTUAL FEAR CONDITIONING

Patric Meyer[1,2], Christian Baeuchl[1], Michael Hoppstädter[1], Herta Flor[1]; [1]Department of Cognitive and Clinical Neuroscience, Central Institute of Mental Health, Medical Faculty Mannheim / Heidelberg University, [2]School of Applied Psychology, SRH University Heidelberg — Contingency awareness during fear conditioning describes the phenomenon of becoming consciously aware of the association between a conditioned stimulus (CS) and an aversive stimulus (US). Despite the fact that the development of contingency awareness is known to be necessary for associative learning in some conditioning paradigms, its role in contextual fear conditioning, a variant that uses a context-CS instead of a cue, has not been characterized thus far. We investigated in this study, if contingency awareness is a prerequisite for contextual fear conditioning and if subjects classified as aware differ from unaware subjects on the hemodynamic, autonomic and behavioral level. To this end we applied a previously developed paradigm (Baeuchl, et al., 2015) during functional magnetic resonance imaging (fMRI) and skin conductance response (SCR) recordings. SCR analyzes revealed that only aware subjects got conditioned

to the US-associated CS (CS+). Brain activity related to the CS+ was more strongly pronounced in fear associated areas like the insula in the aware relative to the unaware group. Finally, the hippocampus was functionally connected to cingulate cortex and posterior medial frontal gyrus in aware subjects relative to unaware subjects. These task-related differential connectivity patterns suggest that information exchange between the hippocampus and regions involved in expression of conditioned fear and decision uncertainty is crucial for the acquisition of contingency knowledge. This study demonstrates the importance of contingency awareness for contextual fear conditioning and points to the hippocampus as a potential mediator for contingency learning.

A118

PATTERNS OF CARDIAC RESPONDING FOLLOWING INTENSIVE MEDITATION PREDICT LONG-TERM ENCODING OF EMOTIONAL SCENES

Brandon G. King[1], Anthony P. Zanesco[1], Phillip R. Shaver[1], Tonya L. Jacobs[1], Quinn C. Conklin[1], Clifford D. Saron[1]; [1]University of California, Davis

— Our willingness to engage in altruistically-motivated behaviors is profoundly influenced by how we react when exposed to others' distress. Accordingly, Buddhist contemplative traditions have developed sophisticated training regimens that focus, in part, on increasing awareness and elaborated processing of suffering in order to promote compassionate responding. Here, we present data from a longitudinal, wait-list controlled study examining whether intensive meditation training in a formal retreat setting is associated with increased stimulus processing of representations of suffering. Instruction included meditation designed to increase one's capacity to sustain attention over time, and to develop benevolent and compassionate traits and attitudes. Participants passively viewed emotionally evocative images, which varied in negative thematic content (human suffering vs. violent threat), at both the beginning and end of a three-month training period. Cardiac waveforms, acquired over a six-second viewing interval, were used to index stimulus salience via the orienting response. During retreat, training participants exhibited enhanced cardiac deceleration to suffering-relevant, but not threat-relevant, stimuli; no changes were observed in the control group across assessments. Approximately seven years later, training participants completed a recognition task assessing their remote emotional memory for images initially encoded at the end of the retreat. Greater cardiac orienting during retreat predicted higher memory accuracy and lower intensity ratings for images of suffering, but not threat, that were initially viewed over six years prior. Overall, these findings suggest that certain forms of contemplative training may selectively enhance the motivational significance of themes of human suffering, promoting lasting effects on recollective experience.

A119

ANTEROLATERAL ENTORHINAL CORTEX VOLUME LOSS CORRELATED WITH ALTERED INTRA-ITEM CONFIGURAL PROCESSING

Lok-Kin Yeung[1], Rosanna Olsen[2], Hannah Bild-Enkin[1], Maria D'Angelo[2], Arber Kacollja[2], Doug McQuiggan[2], Anna Keshabyan[1], Jennifer Ryan[1,2], Morgan Barense[1,2]; [1]University of Toronto, [2]Rotman Research Institute, Baycrest, Toronto ON

— The anterolateral entorhinal cortex (alERC) is one of the regions affected earliest by Alzheimer's disease (AD) pathology (Khan et al, 2014). Thus, it is of critical importance to elucidate its cognitive functions, which would support the development of inexpensive cognitive tests for the earliest symptoms of AD. As the alERC receives inputs from the perirhinal cortex, and projects into the CA1 subfield of the hippocampus, we theorized that it would be involved in the binding of features into complex item/object representations. To investigate this possibility, high-resolution T2-weighted structural scans (0.43x0.43mm in-plane) were acquired for a group of 35 community-dwelling, ostensibly healthy older adults (59-81 years old), and manual segmentation was performed on the hippocampal subfields (CA1, CA3/DG, subiculum) and the MTL cortices (ERC, PRC, PHC) following the Olsen-Amaral-Palombo protocol (see Yushkevich et al, 2015). The entorhinal cortex was further subdivided into anterolateral (alPRC) and posteromedial (pmERC) halves, following the protocol of Maass et al (2015). Participants performed an incidental viewing task on individual, computer-generated, configural objects (comprised of two interchangeable halves bound together) while their eye movements were recorded as an indirect measure of novelty. We found that alERC volume - but none of the other MTL/hippocampal areas evaluated - was correlated to increased viewing to the central region where the parts of the configural object were conjoined, and decreased viewing to peripheral regions. This suggests that changes in intra-item configural processing may serve as a proxy for alERC dysfunction, and thus an early marker of AD detection.

A120

FOUR THE SAKE OF SPATIAL COGNITION – APOLIPOPROTEIN E E4, SPATIAL PERFORMANCE, AND HIPPOCAMPAL VOLUME IN HEALTHY YOUNG ADULTS

Eva Stening[1], Jonas Persson[1], Elias Eriksson[2], Lars-Olof Wahlund[3], Henrik Zetterberg[4,5], Hedvig Söderlund[1]; [1]Uppsala University, Uppsala, Sweden, [2]Institute of Physiology and Neuroscience, Sahlgrenska Academy, University of Gothenburg, Sweden, [3]Division of Clinical Geriatrics, Karolinska Institute, Stockholm, Sweden, [4]Institute of Neuroscience and Physiology, the Sahlgrenska Academy at the University of Gothenburg, Mölndal, Sweden, [5]UCL Institute of Neurology, Queen Square, London, UK

— The apolipoprotein E (APOE) ε4 allele has been linked to episodic memory decline and hippocampal atrophy in both healthy and demented elderly populations. In young adults, the association between APOE ε4 and cognition shows a different pattern, with ε4 carriers often showing better episodic memory compared to non-carriers. Spatial memory, however, has not been thoroughly assessed in relation to APOE in spite of its dependence on the hippocampus. Here, we assessed the effect of APOE genotype on a variety of spatial and episodic memory tasks as well as hippocampal head, body and tail volume, assessed through manual tracing, in young adults (20-35 years old). We also assessed potential interactions with sex. APOE ε4 had positive effects on spatial function and memory and object location memory, but no effect on word recognition. Men were superior to women in spatial function and memory, but there were no sex differences in the other tasks, and there was no interaction between APOE genotype and sex. Despite APOE ε4 carriers excelling in spatial tasks, no difference related to genotype was found in hippocampal volume. However, multivariate analyses on hippocampal structural covariance suggested that APOE ε4 carriers differ in how their anterior and posterior hippocampus are related to the rest of the brain. Our findings suggest a specific positive effect of APOE ε4 on tasks with spatial components, and fill a gap in our understanding of the relation between APOE genotype and cognition in young age.

A121

DISTINCTIVE VIRTUAL REALITY ENVIRONMENTS PROVIDE CONTEXTUAL SUPPORT TO MITIGATE INTERFERENCE DURING THE LEARNING OF TWO HIGHLY SIMILAR LANGUAGES

Joey Ka-Yee Essoe[1], Niccolo Reggente[1], Ailieen A. Ohno[1], Priyanka S. Mehta[1], YounJi Baek[1], Jacob Yu Villa[1], Gabriel M. Hughes[1], Dana Frostig[1], Xin Song[1], Jesse Rissman[1]; [1]University of California, Los Angeles

— When studying multiple sets of potentially confusable material, learners are often subject to interference. For instance, if one were traveling to a foreign country where two languages are spoken and wished to learn a common set of vocabulary in both languages, it might prove challenging to keep track of which translation went with which language. We examined whether distinctive virtual environments (VEs) could provide learners with contextual support during encoding, such that during later retrieval of information learned in one particular context, they could mentally reinstate that context to facilitate recall. Participants learned translations for 50 English words: 10 were learned only in Swahili, 10 only in Chinyanja, and 30 in both languages. Participants were divided into two groups: a Dual-Context group who learned each language in a different VE, and a Single-Context group who learned both languages in the same VE. Prior to cued recall for each foreign word, participants were instructed to mentally reinstate either the VE room in which they had learned the word (congruent) or a room in the other VE (incongruent). When tested in a non-VE setting after an overnight delay, results revealed that congruent context reinstatement aided Dual-Context participants' ability to recall high interference words. In striking contrast, congruent context reinstatement was detrimental to participants in the Single-Context group who had learned the competing translation within the same VE. These results demonstrate how virtual reality can provide memorable contexts, helping to compartmentalize knowledge during learning and providing cues for interference-resistant recall, via mental reinstatement.

A122

ECOLOGICAL PROSPECTIVE MEMORY ASSESSMENT IN EARLY ALZHEIMER'S DISEASE: EVIDENCE FROM VIRTUAL REALITY

Valentina La Corte[1,2], Valentine Facque[1,2], Maria Abram[1,2], Agnès Michon[4], Aurélie Guignebert[4], Bruno Dubois[4,5], Pascale Piolino[1,2,3]; [1]Institute of Psychology, University Paris Descartes, Sorbonne Paris Cite, France, [2]INSERM UMR 894, Center of Psychiatry and Neurosciences, Memory and Cognition Laboratory, Paris, France, [3]University Institute of France, Paris, France, [4]Institut de la Mémoire et de la Maladie d'Alzheimer (IM2A), Départment de Neurologie, Hôpital Pitié-Salpêtrière, AP-HP, Paris, France, [5]Institut du Cerveau et de la Moelle Epinière (ICM), CNRS UMR 7225- INSERM U1127 Paris, France; Sorbonne Universités, Université Pierre et Marie Curie-Paris 6, Paris, France — Prospective memory (PM) is the ability to form, maintain and execute intended actions after a delay, in the appropriate context in the future. The realization of intentions consists in remembering that something has to be done in the future, remembering the exact action to be executed (retrospective component) and the context in which it has to be done (prospective component). According to the context of the intention retrieval, three different types of PM have been defined: time-based (TB), event-based (EB), and activity-based (AB) actions. The aim of this study was to investigate the cognitive mechanisms underlying PM deficits in healthy elderly subjects and in Alzheimer's disease (AD) patients using a naturalistic environment crated with virtual reality. Participants walked in a virtual town comprising general urban elements such as building, traffic lights, pedestrians etc...and then they performed a retrospective (RT) and a prospective memory tasks. Preliminary results show that AD patients are impaired in both tasks. Nevertheless they are more impaired in the RT compared to the PT. Within the PT they were deeply impaired in time-based tasks compared to event-based tasks. Furthermore congruent links between cues and actions facilitate execution of intentions in event-based tasks. These finding suggest that virtual environments entail considerable potential for the assessment of PM in neurodegenerative diseases and they pave the way to future applications in cognitive rehabilitation programs focused on PM.

A123

THE NEURAL CORRELATES OF NON-CONSCIOUS RECOGNITION MEMORY

Trevor T-J Chong[1], Masud Husain[2], Clive R Rosenthal[2]; [1]Macquarie University, Australia, [2]University of Oxford, United Kingdom — Recognition memory enables us to discriminate whether an event has occurred in the past, and is thought to be driven by medial temporal areas, including the hippocampus and parahippocampal cortex. Although recognition memory is widely interpreted to reflect the conscious retrieval of episodic traces, we recently reported evidence of recognition memory in the absence of visual awareness for stimuli presented at study and at test (Chong, Husain & Rosenthal (2014). Current Biology, 24, R1033-5). In the present experiment, we used functional magnetic resonance imaging to probe the neural basis for this effect by using a conventional study-and-test design. Participants were presented with a series of individual words in the study phase, followed by a series of probe single-word retrieval cues in the test phase. Critically, all words in both phases were masked from visual awareness, and participants were required to judge whether the word-based retrieval cues were old (studied) or new (unstudied). Signal detection theory based analyses revealed that observers recognised masked old words, despite being unaware of the stimuli in both phases. Medial temporal areas were significantly more active for subsequent hits compared to subsequent misses ('non-conscious subsequent memory effect'), whereas non-conscious recognition memory was associated with separate regions of the temporal cortex. Together, these findings demonstrate that distinct temporal areas play a role in the encoding and retrieval of mnemonic events related to non-conscious recognition memory. These results challenge current neurobiological accounts of recognition memory that are centered on the conscious retrieval of episodic traces or familiarity.

METHODS: Neuroimaging

A124

THE RELATIONSHIP AMONG GRAY MATTER CORTICAL THICKNESS, BRAIN ACTIVITY, AND BILINGUAL BACKGROUND VARIABLES

Aurora I. Ramos Nunez[1], David Vazquez[2], Maya R. Greene[1], Kelly A. Vaughn[1], Adam Felton[2], Brandin Munson[1], Christine Chiarello[2], Arturo E. Hernandez[1]; [1]University of Houston, [2]University of California Riverside — The lexical representations of two languages are always active in the bilingual brain and to effectively manage two languages, the bilingual person has to select the correct language in the correct context (Green, 1998). Cognitive control processes that might require additional brain networks beyond those classically involved in language processing are involved. Regions such as prefrontal, anterior cingulate cortices, inferior parietal lobule, and caudate have been found to be involved in such processes (Abutalebi & Green, 2007). The present study examined whether or not bilingual experience shapes the structure and function of cognitive and language regions. Participants were 49 Spanish-English bilinguals (age range = 18-34) who learned English between 0 and 17 years of age. Cortical thickness measures were obtained from a high-resolution T1-weighted anatomical scan. Functional activity during a picture-naming task requiring switching between the two languages on a trial-by-trial basis was acquired in a functional Magnetic Resonance Imaging (fMRI) scanner. The present study found two major results: 1) Learning a second language early in life was related to thicker cortex of the right dorsolateral prefrontal cortex (DLPFC), a cognitive control region, and 2) Thicker cortex of cognitive control regions including DLPFC, inferior frontal gyrus (IFG), anterior cingulate cortex (ACC), and superior temporal gyrus (STG) was associated with greater functional activity during a difficult condition that required switching between naming pictures in the two languages. These results carry implications for the understanding of how language experience shapes the functional and neural correlates of the bilingual brain.

A125

FEATURE SELECTION PRIOR TO CLASSIFICATION BASED MVPA: UNIVARIATE ANALYSIS IS NOT ALWAYS OPTIMAL

Joshua Koen[1], Michael Rugg[1]; [1]University of Texas at Dallas — Multi-voxel pattern analysis (MVPA) has become a popular method of fMRI analysis. Given the large number of potential features (voxels) in a typical fMRI study, researchers frequently perform feature selection prior to MVPA, with the goal of identifying features likely to be most discriminative to the variables of experimental interest. One common approach to feature selection is to select the voxels that show the largest differences in univariate BOLD signal between different experimental conditions. Here, we investigated the role of such a feature selection approach in classifier-based MVPA. Participants performed one of four tasks (Artist, Function, Pleasantness, and Vacation) on a series of words while undergoing fMRI. For each encoding task, we selected the 250 voxels that showed the largest "task-selective" responses as identified by univariate contrasts, and used these four feature sets to classify the four tasks using cross-validation. The results indicated that, across participants, each of the four feature sets was able to accurately classify all four of the tasks. Moreover, a feature set selective for one task (e.g., Artist) was able to discriminate above chance between the three other tasks. Furthermore, for two of the four feature sets, classification accuracy was no better than it was for a random selection of 250 of the voxels that did not belong to any of the four original feature sets. These results suggest that the use of univariate contrasts for MVPA feature selection does not always identify the voxels that are most diagnostic for multi-variate classification.

THINKING: Other

A126

RESTING-STATE FUNCTIONAL CONNECTIVITY ENCODES HIGHER-ORDER (BUT NOT LOWER-ORDER) COGNITIONS

G. Andrew James[1], Tonisha E. Kearney-Ramos[2], Jennifer L. Gess[1], Jennifer S. Fausett[1], Clinton D. Kilts[1]; [1]University of Arkansas for Medical Sciences, Little Rock, AR, [2]Medical University of South Carolina, Charleston, SC — Growing evidence

suggests that functional connectivity during wakeful rest may encode cognitive ability. However, the generalization of these findings across studies and cognitive modalities is limited by between-study differences in samples, statistical methodology, and cognitive assessments. To address this barrier, we evaluated resting-state neural representations of clinically-validated neuropsychological assessments spanning multiple cognitions within a large normative adult sample. Forty-five participants (mean(sd) age=31(9.6) years; 18 male and 27 female) completed a resting-state functional MRI scan and neuropsychological assessments spanning motor, visuospatial, language, learning, memory, attention, working memory, and executive function performance. Robust linear regression related cognitive performance to resting-state connectivity among 200 a priori determined functional regions of interest (ROIs). All regressions of neuropsychological performance to resting-state connectivity (surviving false-discovery rate correction for multiple comparisons, $q \leq 0.05$) were negative, suggesting that functional independence among brain regions at rest facilitates cognitive performance. Furthermore, significant brain-behavior relationships were exclusively observed for higher-order cognitions (learning, working memory, and executive function) but not lower-order cognitions (motor performance, visual perception, and language). Our findings are consistent with graph theoretic analyses which characterize the brain as dynamically reorganizing to facilitate cognitive task demand. We provide a methodologically rigorous statistical framework for mapping brain-behavior relationships in healthy adults and will translate these findings to clinical decision-making in patients with psychiatric or neurological illnesses.

METHODS: Neuroimaging

A127

WHEN MULTI-VOXEL PATTERN SIMILARITY AND GLOBAL ACTIVATION ARE INTERTWINED: ASSESSING APPROACHES TO DISENTANGLING CORRELATION FROM ACTIVATION

Karen F. LaRocque[1], Tyler Davis[2], Kenneth A. Norman[3], Jeanette A. Mumford[4], Russell A. Poldrack[1], Anthony D. Wagner[1]; [1]Stanford University, [2]Texas Tech Unversity, [3]Princeton University, [4]University of Wisconsin-Madison — A growing practice in functional magnetic resonance imaging is to apply parallel univariate and pattern similarity analyses, with univariate analyses targeting hypotheses about a region's engagement during events, and pattern similarity analyses targeting hypotheses about how events are represented within a region. In order to use these two types of analyses to answer substantively different questions about psychological and neural processing, it is necessary that estimates of pattern similarity between experimental events are not contaminated by the magnitude of global activation elicited by these events. Here, we use simulated data to demonstrate that global activation and pattern similarity (as assessed by correlation), although theoretically independent, are often intertwined in practice. Specifically, we demonstrate that increased global activation for trials within a given condition may (a) add new shared variability or (b) increase the ability to detect pre-existing shared variability in the patterns of activation elicited during these trials, selectively increasing observed pattern similarity between these trials. Given this influence of global activation on observed pattern similarity, we then assess whether it is possible to statistically separate the contributions of global activation and underlying pattern similarity to observed activation patterns using several popular statistical techniques — regression approaches, matching activation across conditions, and inclusion of control conditions. Through additional simulations, we demonstrate that the efficacy of these techniques depends on a variety of signal parameters that are difficult to specify in practice, highlighting the need for interpretive caution when drawing distinct inferences from univariate and pattern similarity analyses.

A128

ELASTIC NET CLASSIFICATION OF AUTISM SPECTRUM DISORDER: INDIVIDUAL-LEVEL DIFFERENCES USING INTRINSIC FUNCTIONAL-CONNECTIVITY OF SALIENCE- AND VALUATION-SENSITIVE NETWORKS

Merage Ghane[1], John A. Richey[1], Ralph-Axel Müller[2], Colleen P. Chen[2], Kenneth T. Kishida[3]; [1]Virginia Polytechnic Institute and State University, [2]San Diego State University, [3]Virginia Tech Carilion Research Institute — Social decision-making requires the determination of relevant information (i.e., salience-processing) and actions that lead to optimal outcomes (i.e., value-based decision-making). Atypical behavior related to deficits in salience- or value-based processing has been identified in individuals with Autism Spectrum Disorder(ASD). Individual-differences in neural processes supporting these computations likely contribute to heterogeneity characteristic of ASD; however, this has yet to be shown. We demonstrate that individual-level resting-state functional connectivity(rs-fcMRI) within and between task-relevant, a-priori defined, regions-of-interest in valuation- and salience-sensitive networks can be used to differentially classify ASD and typically-developing(TD) individuals. Our sample included rs-fMRI data from 41-ASD(M-age=13.90, SD=2.68) and 44 matched TD(M-age=13.12,SD=2.83) adolescents. Data were preprocessed using standard procedures. We produced a pair-wise correlation matrix between 28 regions from peak-task activation coordinates for salience-sensitive and valuation-networks(Litt et al., 2011). Subject-level correlation-coefficients were r-z′ transformed and separated into valuation,salience,and between salience-valuation network connections. We trained four cross-validated penalized logistic-regression models(two within-, one between-networks, and one combination model) using a variable selection and model regularization approach called "elastic-net"(Zou and Hastie, 2005). Model fit was calculated and validated on an age-matched sample of publicly available data. Area under the curve(AUC) for each model was 0.8969, .9124, .9762, .9978 with sensitivity and specificity of 90.24%, 73.17%, 95.12%, 97.56% and 75.00%, 100%, 93.18%, 100% respectively. Validation sample AUCs′ were .6498, .6279, .7744, .7559 with sensitivity and specificity of 86.36%, 86.36%, 45.45%, 77.27% and 51.85%, 48.14%, 100%, 77.78% respectively. Each model performed differentially at the individual-level, with implications for the heterogeneous presentation and complex treatment of ASD.

A129

NETWORK REPRESENTATIONAL SIMILARITY ANALYSIS OF VISUAL AND SEMANTIC STRUCTURE

Christopher Cox[1], Urvashi Oswal[1], Matthew Lambon Ralph[2], Robert Nowak[1], Timothy Rogers[1]; [1]University of Wisconsin-Madison, [2]University of Manchester — Representational Similarity Analysis (RSA) seeks brain regions that encode representational similarities among stimuli. We developed a new approach for whole-brain RSA that can discover arbitrarily structured brain networks (possibly widely distributed and non-local) that encode similarity information. We pose RSA as a sparsity-regularized multi-task regression problem. This allows us to search over all subsets of voxels (not just localized clusters) to detect similarity-encoding networks. We apply this Network RSA (NRSA) to the analysis of simulated and real fMRI datasets. In both datasets a single set of visual stimuli are associated with two target similarity structures---visual and semantic---specified a priori. Simulations demonstrate the kinds of structure that NRSA is sensitive to. With real fMRI data, NRSA was used to discover the voxels that encode these structures and to generate predicted similarity structures to evaluate the model fit. Searchlight RSA was also conducted. Both the predicted visual and semantic structures fit the originals better than chance. When modeling visual similarity structure, voxels in early visual areas and middle temporal gyrii were discovered; when modeling semantic structure, voxels in the posterior ventral temporal lobes and the anterior temporal lobes were discovered. The Searchlight RSA discovered visual structure in early visual areas, and semantic structure in the posterior ventral temporal lobes, but not the anterior temporal lobes. The points of consistency between Searchlight RSA and NRSA support the validity of the new method, while the differences highlight advantages of NRSA and have implications for how visual and semantic structure are encoded in the brain.

A130

PREDICTING AN INDIVIDUAL'S AGE FROM THEIR CORTICAL STRUCTURE

Christopher Madan[1], Elizabeth Kensinger[1]; [1]Boston College — Despite inter-individual differences in cortical structure, cross-sectional and longitudinal studies have demonstrated a large degree of population-level consistency in age-related changes in brain morphology. Our goal was to determine how accurately we could predict an individual's age based on estimates of cortical structure obtained using FreeSurfer. We used complexity of the cortical ribbon, i.e., unparcellated gray matter, quantified using fractal dimensionality analyses, as previous research has shown

cortical complexity to decrease as a function of age. This analysis outputs a single value for each individual's structural MRI, representing whole-brain cortical complexity. This framework was trained using T1-weighted MRI volumes obtained from nearly 1200 individuals, aged 18-97, collected from multiple sites, and evaluated using two datasets obtained from independent scanning sites. We found predictions to have an average error of 12 years. As changes in cortical structure are non-linear over the lifespan, we additionally constrained our analyses to older adults (aged 50+), reducing our training set to 650 individuals. In held-out test samples, predictions were off by 6 years. As it is well-known that some regions are more susceptible to cortical atrophy, we calculated regional cortical complexity, but found minimal prediction improvement. For comparison, whole-brain mean cortical thickness resulted in poorer predictions, errors of 14 and 7 years, respectively; regional cortical thickness did reduce age predictions to 10 and 6 years, respectively. Thus, we were successful at obtaining reliable age predictions from cortical structure. Furthermore, despite cortical thinning occurring differentially over the cortex, cortical complexity may decrease similarly across the cortex.

A131

THE EFFECT OF MUSIC ON RESTING-STATE FMRI Ziyong Lin[1], Elisabeth Wenger[2], Simone Kühn[2]; [1]University of Michigan, [2]Center for Lifespan Psychology, Max Planck Institute for Human Development — Previous studies have shown that different mental states may produce changes in variability of fMRI resting state. We investigated the effects of listening to different types of music on 5 min resting state fMRI. We tested 29 adults (18-28 years old), each measured with MRI over two consecutive time points, approximately 12 weeks apart. Participants were musicians recruited in Berlin, Germany. At each time point, all participants underwent 3 resting state conditions: no music, listening to a piece by Johann Sebastian Bach (classical), and listening to a piece by Anton Webern (atonal). The fMRI images were preprocessed and analyzed by using the DPARSF toolbox v3.1, focusing on regional homogeneity (ReHo). The patterns of ReHo were consistent for the two time points, that is, there was no change over time in how participants listened to the musical pieces. We observed similar patterns of ReHo in Bach conditions compared to no music condition. Interestingly, participants showed significantly higher ReHo in bilateral temporal regions when listening to the atonal compared to the classical pieve (left superior temporal gyrus, peak MNI coordinate -45 30 9, 516 voxels in this cluster; right superior temporal gyrus, peak 54 -15 3, 696 voxels; $p < 0.05$, with FDR correction). One may suspect that the very unusual, atonal music of Webern elicits a stronger, or more intense listening response indicated by more coherence in auditory cortex than "more typical", in our culture well-known music such as a piece by Bach.

A132

EMPIRICAL VALIDATION OF DIRECTED FUNCTIONAL CONNECTIVITY ACROSS FMRI AND MEG Ravi D. Mill[1], Anto Bagic[2], Walter Schneider[2], Michael W. Cole[1]; [1]Rutgers University, Newark, [2]University of Pittsburgh — Mapping directions of influence within the human brain connectome represents the next phase in understanding its functional architecture. To this end, the efficacy of various methods of directed functional connectivity (or effective connectivity) have been investigated in the fMRI and MEG literatures, primarily via recovering "ground truth" connectivity patterns embedded in simulated datasets. However, such approaches rely on numerous assumptions in the generative models used to simulate neuroimaging data. We explore a different strategy involving empirical data in which a ground truth directed connectivity structure could be anticipated with confidence. Specifically, we exploited the established "sensory reactivation" effect in episodic memory, in which the retrieval of sensory information leads to reactivation of regions implicated in the perception of that sensory modality. Subjects underwent separate fMRI and MEG scanning whilst performing a paired associate task in which the onset of a visual stimulus cued reactivation of its auditory associate ("Visual-Auditory" condition), and the onset of an auditory stimulus cued reactivation of its visual associate ("Auditory-Visual" condition). This task format enables a powerful empirical validation by inducing a reversal in information flow between sensory brain regions, i.e. from visual to auditory cortices in the "Visual-Auditory" condition, and from auditory to visual cortices in the "Auditory-Visual" condition. This reversal was successfully recovered across different directed connectivity algorithms (including Granger Causality and Bayes Network models), and across fMRI and MEG imaging modalities. These results extend simulation studies of directed connectivity, and begin to elucidate the dynamics that integrate brain regions during task performance.

A133

INDIVIDUAL DIFFERENCES IN FUNCTIONAL ORGANIZATION OF THE SECOND GRADE BRAIN Stephen Bailey[1], Laurie Cutting[1]; [1]Vanderbilt University — Recent studies have shown that the healthy adult brain has an efficient organization for transferring information by segregating into functionally related "communities" that have similar patterns of activity. Knowing how this organization arises throughout development and how it facilitates specific cognitive skills is of crucial interest. However, few studies have investigated individual differences in community structure. Here, we compare the functional brain organization of a large number of second-graders (N = 74) using a commonly-cited set of 264 whole-brain ROIs to the original adult data (Powers et al., 2011). Six minutes of resting-state functional MRI data was acquired while children fixated on a crosshair. Confounding signals from motion, CSF and white matter tissue were removed using the CONN toolbox. We compared the group average network with the community assignments from Powers et al. Community assignment in the present dataset was largely similar (normalized mutual information = 0.579). This suggests that on the average functional organization for second graders is largely similar to adults. However, at the individual levels, there is significant deviation from the template, as estimated by normalized mutual information coefficients were lower (mean=0.293, std=0.059). Upon further investigation, we found that, despite regressing out motion from the fMRI timeseries, the total number of outlier volumes had a significant negative correlation with the degree of mutual information (r = -0.352). These results contribute to our growing understanding of the impact of motion on metrics of network architecture and provide a foundation for further analysis of individual differences and cognitive traits.

PERCEPTION & ACTION: Audition

A134

A ROLE FOR THE AUDITORY-MOTOR DORSAL STREAM IN PROCESSING NON-WORDS Keith Doelling[1], Andrew Heusser[1], Gwyneth Lewis[1], Bijan Pesaran[1], David Poeppel[1,2]; [1]New York University, New York, NY, [2]Max Planck Institute for Empirical Aesthetics, Frankfurt, Germany — The role of activity in motor and sensorimotor brain regions for perceiving speech continues to elicit controversy. Despite claims for a causal role of motor activation in speech perception, most studies that argue for motor effects in clear speech use syllable discrimination tasks. These tasks arguably require fine-grained phonemic analysis that is unnecessary in processing known words. Here we test the hypothesis that the dorsal sensorimotor pathway is specifically engaged when listeners process non-words – phonotactically legal items for which the subject has no lexical-semantic entry – even in pure listening tasks. Such a role, while not necessary for typical speech perception, would be essential for both language development and the learning of new words in adulthood. To test this hypothesis, we ran a 2x2 design memory experiment, contrasting words vs. non-words and heard vs. spoken items. We provide potential evidence for a facilitative interaction between non-word processing and speech production, perhaps reflecting use of similar neural pathways. MEG data suggest that regions related to motor activity are also driven by specific lexical characteristics of non-words but not words, even in a task with no production component. Taken together, these data point to a split of functions between the ventral and dorsal pathways in dealing with known and unknown words, respectively, presumably due to the types of phonological analyses they provide.

A135

NEURAL CORRELATES OF PLANNING AND MONITORING DURING MUSIC PERFORMANCE Brian Mathias[1], William J. Gehring[2], Caroline Palmer[1]; [1]McGill University, [2]University of Michigan, Ann Arbor — In order to produce complex auditory sequences such as language and music quickly and accurately, performers engage in the planning of upcoming sequence

events, as well as the monitoring of their productions via auditory feedback. We investigated neural correlates of performers' planning and monitoring processes by presenting altered auditory feedback during a music performance task. Altered auditory feedback has previously been shown to disrupt performance, particularly when feedback contents match planned events. Pianists performed isochronous melodies from memory at a cued production rate while EEG was recorded. Pitch feedback heard by pianists was occasionally altered to match either an immediately upcoming Near Future pitch (next sequence event) or a more distant Far Future pitch (two events ahead of current event) in the sequence. The timing of pianists' keypresses slowed down after Near – but not Far – Future feedback, suggesting greater interference of Near Future feedback with planning processes. Greater slowing was associated with a larger feedback-related negativity (FRN), which was elicited by both feedback types. Auditory sensory potentials elicited by the pitch event immediately following the altered auditory feedback were enhanced (increased N1/decreased P2) following Near Future feedback compared to Far Future feedback; these attention-related enhancements suggest that feedback monitoring is more influenced by the perception of auditory feedback that matches immediately upcoming sequence events compared to more distant events. Overall, findings support a role of planning in the performance of complex musical sequences, but suggest that planning occurs with limited scope.

A136

NEURAL PROCESSING OF MULTIPLE MELODIC VOICES: THE ROLE OF MOTIF IDENTITY

Madeline Huberth[1], Takako Fujioka[1]; [1]Stanford University — Musical textures can contain one or multiple motifs that repeat in different melodic lines (voices). Previous event-related potential (ERP) studies have shown that the mismatch negativity (MMN) reflects encoding of melodic motifs. Also, when two voices sound simultaneously, the encoding of the upper voice is advantaged. Interestingly, our recent results showed that the upper voice advantage may extend to non-simultaneous (i.e. alternating) voices, even if voices contain the same motif. The present study is aimed at examining whether differentiation between upper and lower voices is enhanced when each voice has its own motif. Thus, we recorded electroencephalogram (EEG) from 13 musicians, and compared MMN responses across voices and number of motifs present. For 20% of trials in each voice, the 5th note contained a contour-changing deviant. Within one voice, motif entry pitch varied within one-half-octave range; the pitch separation between voices was one octave on average. Results showed that, regardless of the number of motifs, upper voice MMN was larger and earlier compared to lower voice MMN, replicating the upper voice advantage seen in non-simultaneous motifs. MMN in the two-motif condition was larger in both voices compared to the one-motif condition. Particularly, MMN was attenuated in the lower-voice shared-motif condition. The results suggest that voices are better encoded when each has a distinct melodic identity, perhaps because melodic identity serves to differentiate different streams similarly to other acoustic features.

A137

TIMING PREDICTABILITY OF THE UPCOMING SOUND SEQUENCE ENHANCES REGULARITY ENCODING IN THE HUMAN AUDITORY BRAINSTEM

Natàlia Gorina-Careta[1,2], Katarzyna Zarnowiec[1,2], Jordi Costa-Faidella[1,2], Carles Escera[1,2]; [1]Institute for Brain, Cognition and Behavior (IR3C), University of Barcelona, Catalonia-Spain, [2]Brainlab - Cognitive Neuroscience Research Group, University of Barcelona, Catalonia-Spain — Neural activity in the auditory system is reduced after repeated stimulation. This phenomenon, known as repetition suppression (RS), is thought to be the neural mechanism underlying regularity encoding, a critical function of the human auditory system. It has been demonstrated that timing predictability influences the encoding of regularities in the auditory cortex, but its effect in a subcortical level remains unknown. This study was set out to investigate whether timing predictability influences the brainstem response to repetitive sounds and ascertain if RS can be observed at the auditory brainstem. We recorded the human auditory brainstem frequency–following response (FFR) to consonant–vowel stimuli (/wa/) delivered in two timing conditions. In the Predictable timing condition, stimuli were delivered with isochronous stimulus onset asynchrony (SOA) of 366ms; in the Unpredictable timing condition, SOA varied randomly between 183 and 549ms. When contrasting the FFR to both timing conditions, a decrease of amplitude was found for the Predictable condition compared with the Unpredictable one. Pitch strength values indicated a stronger phase-locking to the stimulus F0 when the timing was predictable and showed separable patterns in the two timing conditions across the history of repetitions. Additionally, the amplitude of the FFR was more suppressed as the history of stimulus repetitions increased, irrespectively of the timing condition. Our findings confirm that repetition suppression is observed at the human auditory brainstem and demonstrate, for the first time, that timing predictability of the incoming stimulation influences the brainstem response to repetitive sounds, eliciting a better and faster encoding of regularities.

A138

WHERE THE RHYTHM PLAYS: USING MACHINE LEARNING TO LOCATE THE ENCODING OF RHYTHM

Michael P. Notter[1,2], Michael Hanke[3], Micah M. Murray[1,2,4,5], Eveline Geiser[1,6]; [1]The Laboratory for Investigative Neurophysiology (The LINE), Department of Radiology, and Neuropsychology and Neurorehabilitation Service, University Hospital Center and University of Lausanne, Switzerland, [2]EEG Brain Mapping Core, Center for Biomedical Imaging (CIBM), Lausanne, Switzerland, [3]Psychoinformatics lab, Institute of Psychology II, Otto-von-Guericke-University and the Center for Behavioral Brain Sciences, Magdeburg, Germany, [4]Department of Ophthalmology, University of Lausanne, Jules-Gonin Eye Hospital, Lausanne, Switzerland, [5]Department of Hearing and Speech Sciences, Vanderbilt University, Nashville, TN, USA, [6]McGovern Institute, Massachusetts Institute of Technology, Cambridge, MA, USA — Hearing necessarily unfolds over time, and the brain generates auditory experiences by integrating acoustic temporal patterns over the range of several seconds. Differences in the relative temporal proximity between acoustic events lead to temporal grouping perception, also referred to as rhythm. Both where and how the brain produces the perception of rhythm remains unknown. Most studies on rhythm perception have applied standard univariate analyses of functional MRI (fMRI). However, these types of analyses are often unable to distinguish between different activation patterns within identical neural populations. By contrast, a multi-voxel pattern analysis (MVPA) is able to identify specific spatial or temporal distributions of brain activity associated with perceptual categories. We used PyMVPA, a python based MVPA-toolbox, to test whether the perception of two different rhythms can be decoded from cortical activation patterns. fMRI data were used to train a linear SVM classifier to identify the activation pattern specific for either rhythm. Results indicate that activation patterns within auditory cortices, the right inferior temporal gyrus, and the premotor cortex help discriminating rhythm. For the first time, we are able to show that the auditory cortex can distinguish between different rhythms. This finding indicates that both sensory and higher cortical areas are involved in rhythm discrimination.

A139

SIZE MATTERS: AN ERP STUDY OF INTERVAL SIZE JUDGEMENTS IN AUDIOVISUAL INTEGRATION

Wy Ming Lin[1], Kellyn Maves[1], Janani Iyer[1], Psyche Loui[1]; [1]Wesleyan University — Interval size can be determined by spatial distance between two visual events or pitch distance between two auditory events. Little is known about whether neural mechanisms for determining interval size are similar or different between sensory modalities. In this experiment, participants performed an audiovisual interval size judgment task while EEG was recorded. Auditory stimuli were small or large pitch intervals (1-2 or 9-10 semitones respectively) and visual stimuli were small or large distances traveled by dots on a screen. Trials were either unimodal or audiovisually congruent or incongruent. Audiovisual congruent and incongruent trials were grouped into congruent standard/incongruent deviant blocks and incongruent standard/congruent deviant blocks, thus controlling for the effect of stimulus deviance. Behavioral data show significant main effects of and significant interaction between deviance and congruence. ERPs for visual and auditory events show robust N1 effects. The second event within an interval elicited a P300, and ERPs for deviant and/or incongruent events elicited an MMN, which correlated with interval size. Source localization of the MMN using LORETA showed peaks of activity centering on Brodmann Areas 47, followed by 45, 46, and 44. Finally, ERPs for audiovisual events resemble unimodal auditory events up to 200 ms post-stimulus, but more closely resemble unimodal visual

events at 200-600 ms post-stimulus. These results suggest an early auditory followed by a late visual and frontal integration that together give rise to interval size estimation.

A140

A PSYCHOPHYSICAL MEASURE OF AUDITORY IMAGINATION IN JAZZ MUSICIANS

Emily Przysinda[1], Psyche Loui[1]; [1]Wesleyan University — Imagination is the skill of mental simulation. A core construct of imagination is creativity: the ability to produce work that is novel, useful and desirable (Sternberg, Lubart, Kaufman, & Pretz, 2005). The current study uses jazz improvisation as a model for understanding domain-specific creativity and imagination. We have developed a battery of behavioral and electrophysiological tests to investigate the development of creativity and imagination in non-musicians, classical musicians, and jazz musicians. Specifically, in a scale imagery task (modified from Navarro-Cebrian and Janata, 2010) we ask participants to listen to a scale (either major, harmonic minor, or blues) and judge whether the last note is modified in pitch. Trials are presented in a perceptual condition, where all notes play, and an imagery condition, where some of the notes are left out. This task allows us to create a psychometric function that measures the accuracy of auditory imagery relative to auditory perception. Preliminary data showed that all subjects performed significantly above chance, but jazz and classical musicians are more accurate than non-musicians in auditory imagery as well as perception. The psychometric function of jazz musicians is comparable to that of classical musicians, but showed a steeper slope compared to non-musicians. Furthermore, all participants were more accurate on major and minor scale trials compared to the blues scale. Together, results suggest that classical and jazz musicians have an advantage in auditory imagery, which may be useful in creative improvisation.

A141

STABILITY OF THE P1-N1-P2 AND T-COMPLEX OF THE AUDITORY EVOKED POTENTIALS (AEP) TO NATURAL SPEECH IN INDIVIDUAL SUBJECTS

Monica Wagner[1], Colleen O'Brien[1], Francesca Mingino[1], Evis Haxhar[1], Zahra Hejazi[1], Valerie L. Shafer[2]; [1]St. John's University, Queens, New York, [2]The Graduate Center, City University of New York — Atypical P1-N1-P2 and T-complex waveforms of the AEP found in individuals with auditory processing deficits may result from an absence of a synchronized neural response to an acoustic feature within a spoken word. Alternately, atypical sensory waveforms may result from instability in neural responding to an acoustic feature. In the current study we assess stability of single trial P1-N1-P2 and T-complex responses to naturally spoken non-words in 48 healthy adults. Electroencephalograms (EEG) were recorded while participants listened to the words, which contained the phoneme sequence onsets "st", "set", "pt" and "pet". Half of the single trial responses to each word type were randomly selected and compared to the remaining half of the responses (i.e., split epoch averages). Pearson's correlation coefficient was used to assess association between these split epoch averages for the P1-N1-P2 and T-complex for each subject. Results found split epochs to be highly correlated for the P1-N1-P2 complex and moderately correlated for the T-complex. Root mean square (RMS) was calculated as a single measure of amplitude for each split epoch waveform. Amplitude values for the split P1-N1-P2 and T-complex waveforms were found to be highly similar for each subject for all word types. Also, we identified 65 single trials to be sufficient for obtaining reliable P1-N1-P2 and T-complex waveforms to multiple productions of natural speech. This research provides benchmarks for future studies examining stability of cortical sensory responses in individuals with auditory processing deficits.

A142

MOTOR SYSTEM EXCITABILITY INTERACTS WITH AUDITORY RHYTHMS IN BEAT PERCEPTION

TC Chiang[1], Daniel J. Cameron[1], Jessica A. Grahn[1]; [1]Brain and Mind Institute, The University of Western Ontario, London ON, Canada — Humans synchronize movements with the perceived, regular emphasis (the beat) in musical rhythms. Neural activity during beat perception is dynamic, time-locked, and largely based in the motor system (Fujioka et al., 2012; Nozardan et al., 2011). Past research has indicated that motor system excitability may increase at particular times related to the beat, 100 ms before, or on, the beat (Cameron et al., 2012). Here, we characterized the time course of motor system excitability during beat perception. Participants (n=15 & 14) listened to beat-based and non-beat-based auditory rhythms (35s, in three tempi, presented in random order). Single pulse transcranial magnetic stimulation (TMS, 110% of motor threshold) was applied to dominant motor cortex at specific time positions (asynchronies) before the beat (0-20% of the inter-beat interval). Motor evoked potential (MEP) amplitudes were recorded with electromyography from the first dorsal interosseous muscle (FDI) to index motor system excitability. Mean normalized MEP amplitudes were greater at beat positions (asynchrony = 0), as well as 1.25% and 2.5% before the beat, for beat-based vs. non-beat-based rhythms. This indicates that motor system excitability is dynamically modulated, peaking just before the beat occurs.

A143

A COMPARISON OF FREE-FIELD AND HEADPHONE BASED SOUND LOCALIZATION USING SOLOARC

Amara Balhorn[1], Roman Tyshynsky[1], Jacob Westerberg[1], Jeremy Loebach[1]; [1]St. Olaf College — The SoLoArc is a free-field audiovisual localization apparatus designed to present sound in a 180° arc from speakers placed every 5° and lights every 2.5°. The arc can be positioned for azimuth, front/back, or vertical localization. A Matlab interface allows stimuli of any frequency and intensity to be delivered to each speaker and light independently. Here, we present data from 3 studies, comparing free-field sound localization in the azimuth with synthetic Interaural Level Difference (ILD) and Interaural Time Difference (ITD) cues presented over headphones. 48 normal hearing participants completed 3 sound localization tasks: localization of a 440 Hz sinusoid with ITDs varying +/-640 microseconds, localization of a 6000 Hz sinusoid with ILDs varying +/- 21 dB, and a 1000 Hz sinusoid at 70 dB from the SoLoArc, and indicated their response on a table of angles. Regression analyses revealed that while each method was related to the ideal, the free-field localization task was more accurate (ITD: R^2=.891, $F(1,12)$=98.924, $p<0.001$; B=.858, t=9.946, $p<0.001$); (ILD: R^2=.891, $F(1,12)$=98.924, $p<0.001$: B=.858, t=9.946, $p<0.001$); (Free-field: R^2=.989, $F(1,12)$=1047.901, $p<0.001$; B=.887, t=32.371, $p<0.001$), and participants reported that the free-field task was easier to complete and more natural and intuitive. Future research plans include testing audiovisual integration in vertical and horizontal planes, FEF activity during a saccade countermanding task.

A144

MOTIVATION AND SPEECH CATEGORY LEARNING: A DUAL-LEARNING SYSTEMS APPROACH

Y. Catherine Han[1], Seth Koslov[1], W. Todd Maddox[1], Bharath Chandrasekaran[1]; [1]University of Texas at Austin — Social and cognitive neuroscience research suggests that the brain systems involved in motivation and cognition overlap. A three-factor motivation-cognition framework was proposed by Maddox and Markman (2010) who argued that a "fit" between global and local motivation increases frontally mediated reflective processing, whereas a "mismatch" increases striatally mediated reflexive processing. Our previous imaging work indicated the striatum as the primary mediator of speech category learning (Yi, et al, 2014). Thus, we predict enhanced speech category learning under regulatory mismatch conditions relative to regulatory fit conditions. We tested this prediction in native English speakers learning Mandarin tone categories under one of four conditions constructed from the factorial combination of a Global Motivation (Promotion or Prevention) manipulation with a Local Motivation (Gains or Losses) manipulation. Promotion focused participants could earn an entry into a raffle drawing for $50 if they exceeded a performance criterion. Prevention focused participants were given the raffle ticket upon entry into the lab but were told that they would lose it if they did not exceed a performance criterion. Gains condition participants earned points on each trial with the goal of gain-maximization, and Losses condition participants lost points on each trial with the goal of loss-minimization. As predicted, regulatory mismatch participants (Promotion-Losses and Prevention-Gains) showed faster speech category learning than those in a fit (Promotion-Gains and Prevention-Losses). Neurobiologically-inspired computational modeling suggested that individuals in a regulatory mismatch shifted to a striatal, reflexive strategy more quickly than those in a regulatory fit, and evidenced less perceptual noise.

PERCEPTION & ACTION: Multisensory

A145

SLOW AND STEADY WINS THE RACE: DOES MULTISENSORY ENHANCEMENT IN OLDER ADULTS REFLECT SLOWER UNISENSORY PROCESSING?

Samuel Couth[1], Emma Gowen[1], Ellen Poliakoff[1]; [1]The University of Manchester — Previous studies have demonstrated greater multisensory reaction time (RT) facilitation for older adults compared to younger. Typically, these studies compare the distribution of RTs for the multisensory stimulus to the distribution of RTs for the unisensory stimuli combined (i.e. the race model). For older adults, the multisensory response probability is usually greater than that predicted by the race model (i.e. race model violation), suggesting that multisensory enhancements are due to coactivation (i.e. multisensory integration) of bimodal stimuli. Since ageing is a variable process, we explored individual differences in race model violation and how this might relate to unisensory processing speed. Younger (n=34) and older adults (n=30) made speeded responses to visual, auditory or tactile stimuli, or any combination of these (bi-/tri-modal). The test of the race model suggested greater coactivation of audiovisual stimuli for older adults compared to younger, but only for individuals who demonstrated race model violation. Moreover, unisensory RTs were significantly slower for individuals who demonstrated race model violation, and there was a significant positive correlation between fastest unisensory RTs and the magnitude of race model violation, for both age groups. Therefore multisensory response enhancement may be related to slower unisensory processing, rather than integration per se. Specifically, multisensory integration is not necessarily stronger for older adults, but rather multisensory enhancements are more observable for older adults due to their slower responses. Nevertheless, the fact that multisensory RT facilitation is observed for older adults with slower unisensory RTs has implications for therapeutic interventions and technology for the elderly.

A146

FLUCTUATIONS IN PRE-STIMULUS NEURAL ACTIVITY REFLECTED IN THE BOLD RESPONSE INFLUENCE REPORTING OF TACTILE STIMULI

Matt Craddock[1], Ellen Poliakoff[2], Wael El-Deredy[2], Ekaterini Klepousniotou[1], Donna Lloyd[1]; [1]University of Leeds, UK, [2]University of Manchester, UK — Increasing evidence suggests that intrinsic fluctuations in ongoing brain activity influence the probability of detecting near-threshold sensory stimuli. We examined whether such fluctuations also influence reports of stimuli which are not present (false alarms). During fMRI, 17 participants performed the Somatic Signal Detection Task (SSDT). In the SSDT, near-threshold tactile stimuli are delivered alone or paired with light flashes, which increases hit rates. Light flashes which occur without tactile stimuli also increase false alarms. A 20ms tactile pulse was delivered at the participant's sensory threshold to their left index finger on tactile present trials, either alone or with a simultaneous flash from an LED directly above their finger. On tactile absent trials, the light sometimes appeared alone. Participants reported whether they had felt a touch using a response box in their right hand. In an analysis of stimulus-locked activity, we found a significant interaction between vision and touch across multiple areas including ipsilateral SI, SII and premotor cortex and bilateral V1. We then examined pre-stimulus activity as a function of response. On tactile present trials, BOLD activity was significantly greater in ipsilateral somatosensory and premotor cortex prior to hits vs. misses and significantly greater in extrastriate areas prior to misses vs. hits. Finally, on tactile absent trials, pre-stimulus activity was higher for false alarms vs. correct rejections in ipsilateral premotor cortex. Our results suggest that fluctuations in pre-stimulus activity in ipsilateral somatosensory and premotor cortices are a determinant of both correct detections and false alarms.

A147

FROM VISION TO VOICE: ESTABLISHING BI-DIRECTIONALITY IN AUDIO-VISUAL INTEGRATION

Colleen Paul Latzke[1], Ferrinne Spector[1]; [1]Edgewood College — Most people do not overtly associate visual stimuli to sounds. Nonetheless, there are established consistencies in associations across the auditory and visual domains (e.g., lower pitch, darker colors; higher pitch, lighter colors; Hubbard, 1996; Marks, 1974). Much of this research involves audio-visual integration, when an auditory stimulus elicits a visual response. The purpose of this study is to examine visual-audio integration, when a visual image elicits an auditory response. By doing this, we can examine whether cross-modal associations remain consistent regardless of whether the stimulus is presented in the auditory or visual domain. We created sixteen images based on form constants commonly present in synesthetic visualizations and mild hallucinations (Betancourt, 2007; Klüver, 1926). Images came from three general categories: lattice, circular, and free-form. Participants (n = 40) viewed the images and produced a vocal sound (≤10 seconds) that they believed to effectively "describe" the viewed image. Vocal sounds were audio/video recorded for analysis of relative pitch, rhythm, intervallic patterns, and melodic modality. Results with a subset of responses (n = 11) suggest that there are systematic associations between elements of a visual stimulus and vocal response matching those that are established cross-modal associations. For example, lighter colored images elicited higher pitched vocalizations. These results suggest that consistencies in associations across auditory and visual domains are robust to bi-directionality, providing further evidence that multisensory associations may represent a universal sensory code by which all sensory information can be translated.

A148

TRIGGERING THE USE OF EXTERNAL SPACE IN CONGENITALLY BLIND INDIVIDUALS

Stephanie Badde[1,2], Pia Ley[1], Brigitte Röder[1]; [1]University of Hamburg, [2]New York University — When localizing a tactile stimulus, humans automatically integrate information about its locations on the body and within (visual) space. This process seems to partially depend on early visual experience: Seeing and late-blind participants' performance decreases when body and space locations conflict, e.g., when touch is applied to crossed hands. Congenitally blind participants do not show crossing effects in tasks that do not require remapping of touch into external space. We tested whether emphasizing external space could trigger integration, measured by crossing effects, in congenitally blind participants. The first task accentuated external space by requiring participants to indicate the location of the first of two successive tactile stimuli, each to one hand, with respect to its side of space rather than by indicating the hand that received the first touch. In the second variation of the task, trials randomly comprised two tactile stimuli, two auditory stimuli, or one of each modality. A subset of congenitally blind participants showed crossing effects in the first task, which accentuated external space through the response mode. When external space was additionally stressed by interleaving auditory trials, crossing effects were larger and occurred in all participants. These results suggest that the abilities to remap tactile stimuli into external space and to integrate the resulting coordinates can develop in the absence of vision. Rather the automaticity of the integration process seems to critically depend on early vision. Additionally, the results suggest that combining touch and audition might facilitate the exploration of external space by blind individuals.

A149

DISSOCIABLE NEURAL MECHANISMS OF EXPECTING "WHAT" AND "WHEN" IN THE AUDITORY PROCESSING STREAM

Ryszard Auksztulewicz[1,2], Anna C. Nobre[1], Charles E. Schroeder[3,4], Wolf Singer[5], Karl Friston[2], Lucia Melloni[3,5,6]; [1]University of Oxford, UK, [2]University College London, UK, [3]Columbia University, NY, USA, [4]Nathan Kline Institute, NY, USA, [5]Max-Planck Institute for Brain Research, Frankfurt, Germany, [6]NYU Langone Medical Center, NY, USA — The brain infers statistical regularities in the environment to guide behavior, however whether expecting various stimulus attributes relies on similar mechanisms remains unknown. We collected electrocorticographic data from 6 participants undergoing presurgical diagnosis of pharmacologically resistant epilepsy. In the experimental paradigm, participants were asked to respond to auditory stimuli, which could be predictable or not with respect to their identity and/or temporal onset. We analyzed the auditory evoked response at grid electrodes implanted over temporal and prefrontal lobes. Significant main or interaction effects of "what" and "when" expectancy were identified in all subjects. Object-based ("what") predictions increased the amplitude of late (420-460ms post-stimulus) potentials at prefrontal electrodes, while temporal ("when") predictions increased the amplitude of both early (180-310ms) and late (430-450ms) potentials over prefrontal and premotor cortex. Finally, "what" and "when" predictions showed an interactive effect on the amplitude of the evoked response

(peaking at 165ms) in the superior temporal gyrus. We then employed dynamic causal modeling to explain the observed responses. This technique enables fitting of the observed responses using biologically realistic mean-field models of coupled dynamical systems. We based our model architecture on three regions (sensory, prefrontal, and premotor) using canonical cortical microcircuits, and compared alternative models of connectivity and gain modulation by object-based and time-based predictions. In the optimized model, object-based predictions increased top-down dependent gain modulation in sensory regions, consistent with their reliance on NMDA-dependent short-term plasticity. Temporal predictions, on the other hand, increased the gain of premotor areas, possibly via classical neuromodulatory mechanisms.

A150

MENTAL MOTOR IMAGERY REVEALS A DISTORTION OF THE BODY SCHEMA IN EATING DISORDERS Juliann B. Purcell, B.A., MSc[1,2,3], Caitlin Breslin, B.A.[3], Samantha Winter, M.S.[4], Nicole C. White, M.S.[1,2,3], Michael R. Lowe, Ph.D.[4], H. Branch Coslett, M.D.[1,2,3]; [1]Perelman School of Medicine, University of Pennsylvania, [2]Center for Cognitive Neuroscience, University of Pennsylvania, [3]University of Pennsylvania, [4]Drexel University — One account of eating disorders, such as anorexia and bulimua nervosa, is that they reflect a distortion of the body schema such that one's body is perceived as heavier than it really is. We tested this hypothesis by asking subjects with eating disorders and normal subjects to trace with the index finger of their right hand or imaging tracing movements along or around 6 body parts; we reasoned that subjects with eating disorders would imagine body parts thought to be sensitive to distortion from eating disorders (e.g., stomach, thigh, and buttocks) to be larger than they are, but would imagine body parts not likely to be sensitive to distortion from eating disorders (e.g., head, shin, forearm) to be represented accurately. As the time to mentally simulate actions is approximately the same as the time required to execute the action, we predicted that the ratio of imagined to real action tracing of the "sensitive" body parts would be larger than the ratio for "insensitive" body parts. Participants included 41 healthy women and 42 subjects with eating disorders, including Anorexia Nervosa (n=20), Bulimua Nervosa (n=13), and Eating Disorder NOS (n=9). As predicted, subjects with eating disorders, but not controls, exhibited significantly higher ratios of imagined to real actions for the "sensitive" as compared to "insensitive" body parts. These data support the hypothesis that eating disorders are consisted with a distortion of the body schema in which one's body is perceived to be heavier than it really is.

A151

EMBODIMENT MODULATES MULTISENSORY PERCEPTION OF VISUAL AND TACTILE STIMULI IN MOTION R. M. Joly-Mascheroni[1], Sonia Abad-Hernando[1], Bettina Forster[1], Beatriz Calvo-Merino[1]; [1]City University London, UK — This study explores how biological attributes modulate multisensory perception of stimuli in motion. Participants judged the simultaneity of two biologically congruent or incongruent events which were perceived both visually and tactually. In all conditions, tactile stimuli were delivered to the palms of the participants' hands. In experiment 1, visual stimuli could be either biologically congruent with the tactile stimuli (two hands suggesting a clapping movement) or incongruent (geometrical shapes performing the same apparent movement). We measured the differences in point of subjective simultaneity (PSS) during the perception of visuo-tactile events in these two conditions. Results showed the PSS increased significantly in the biologically congruent visuo-tactile condition, compared to the incongruent condition. In experiment 2, we further explored the biological modulation of this effect by comparing two types of visual biological stimuli: hands (highly congruent with the tactile stimuli) and ears (a biological stimulus non-congruent with the tactile event to be judged for simultaneity). Results showed an increase in the PSS for both the visuo-tactile biologically congruent and incongruent conditions, although the pattern of responses show this increase is larger for the hand condition. Overall results suggest that biological congruency between tactile and visual events modulates the delay on the perception of simultaneity. The size of this delay increases with the level of biological congruency between the visual and tactile stimuli, suggesting that embodiment mechanisms modulate multisensory processing.

A152

AUDIOVISUAL CUES IMPROVE SPATIOTEMPORAL MOVEMENT ACCURACY FOLLOWING LEFT HEMISPHERE STROKE. Spenser Haffey[1], Elanor Schoomer[1], Alicia MacKay[1], Brian Herman[1], Brenda Hanna-Pladdy[1]; [1]University of Maryland Baltimore — Patients with limb ideomotor apraxia (IMA) are impaired in retrieval of tool-use action that results in functional dependence following left hemisphere stroke (LHD). Rehabilitation efforts for IMA have previously focused on motor as opposed to cognitive paradigms, and thus have displayed limited utility. There is anecdotal evidence that providing sensory cues may improve retrieval of spatiotemporal object-action features. In this study, we evaluated skilled movement accuracy across sensory cue conditions (verbal, auditory, visual, multisensory) in patients with LHD (n=46) and healthy controls (n=127). LHD patients were impaired relative to controls, with the greatest impairment for cortical relative to subcortical lesions. Patients with LHD cortical lesions improved in accuracy across conditions, consistent with greater access to movement representations when auditory motion attributes were added to visual object features (multisensory cues). Furthermore, all sensory cue conditions reduced temporal errors in LHD patients with cortical and subcortical lesion locations, while visual cues reduced spatial errors for patients with cortical lesions. The addition of visual cues to auditory cues reduced semantic errors for patients with LHD cortical involvement. These results suggest that visual object features provide salient spatial cues, while audiovisual multisensory cues provide temporal and semantic features of object-related action. Our findings are consistent with the established relationship between auditory processing and skilled movements, evidence of auditory mirror neurons, and the left hemisphere cortical representation of spatial and semantic aspects of skilled movements.

A153

EVENT-RELATED POTENTIALS EVOKED BY CARMEN IN MUSICIANS AND DANCERS Hanna Poikonen[1], Mari Tervaniemi[1], Petri Toiviainen[2]; [1]University of Helsinki, Finland, [2]University of Jyväskylä, Finland — Event-related potentials (ERPs) evoked by simple tones in the brain have been extensively studied. However, in reality the music surrounding us is spectrally and temporally complex and dynamic. Thus, the research using natural sounds is crucial in understanding the operation of the brain in its natural environment. Music is an excellent example of natural stimulation, which, in various forms, has always been an essential part of different cultures. In addition to sensory responses, music elicits vast cognitive and emotional processes in the brain. When compared to laymen, professional musicians have stronger ERP responses in processing individual musical features in simple tone sequences, such as changes in pitch, timbre and harmony. Here we show that the ERP responses evoked by rapid changes in individual musical features are more intense in musicians than in laymen also while listening to long excerpts of the composition Carmen. The P200 amplitudes are significantly larger for musicians when compared to dancers and laymen. Interestingly, the P200 latencies of musicians are significantly shorter whereas the latencies of laymen are significantly longer when compared to dancers. These results, gained with a novel ERP methodology for natural music, suggest that we can take the leap of studying the brain with long pieces of natural music also with the ERP method of electroencephalography (EEG) as has already been made with functional magnetic resonance (fMRI), these two brain imaging devices complementing each other.

PERCEPTION & ACTION: Motor control

A154

METHYLPHENIDATE IMPROVES PERFORMANCE AND ALTERS BRAIN CONNECTIVITY BETWEEN THE INSULA AND MOTOR CORTEX DURING AND AFTER A MUSCLE FATIGUING EXERCISE. Michael King[1], Laurie Rauch[1], Samantha Brooks[1], Dan Stein[1], Kai Lutz[2,3]; [1]University of Cape Town, South Africa, [2]University of Zurich, Switzerland, [3]Cereneo Center for Neurology and Rehabilitation, Switzerland — A central fatigue theory proposes that motor drive is limited to maintain homeostasis. The insula has been identified as a key structure for processing disturbed homeostasis and the decision to terminate exercise. The insula and motor cortex (M1) are thought to interact to limit motor drive during muscle fatigue. Stimulants,

such as Methylphenidate (MPH), can enhance motor drive during exercise. However, the neural correlates of MPH-related force improvements are unknown. This study examines the effect of MPH on behavioral performance and the cortical response to a muscle-fatiguing handgrip task. In a double blind counter balanced design subjects (n=16) ingested placebo or MPH and subsequently performed three functional magnetic resonance imaging scans: (1) pre-task resting scan (2) task scan during handgrip and (3) post-task resting scan. We investigated seed-based effective connectivity (EC) during the task and functional connectivity (FC) pre- and post-task. Our results show that MPH was associated with an increase in force and a task-related change in EC from negative to positive between the insula and hand motor area. After the task we observed interhemispheric M1 FC disruption, which was more pronounced in MPH conditions. Similar to our EC findings, MPH was associated with a post-task change in FC from negative to positive correlation between the insula and hand motor area. Our study suggests that (1) MPH can improve exercise performance (2) MPH may lift an inhibitory influence on M1 during fatigue and (3) changes in brain connectivity, which were altered in MPH conditions, continue after exercise has stopped.

PERCEPTION & ACTION: Multisensory

A155

MULTISENSORY INTEGRATION IN REAL TIME: STATISTICAL OPTIMALITY AND VARIABILITY

Benjamin Rowland[1], J. William Vaughan[1], Barry Stein[1]; [1]Wake Forest School of Medicine — Synthesizing information from multiple senses confers substantial benefits in detecting, localizing, and identifying environmental events. Indeed, animals appear to use all of the available sensory information when tested with discrete stimuli, thereby approaching statistical optimality. The aim of the present study was to determine whether this capability extends to human subjects dealing with continuous events. To examine this possibility, human subjects (n=20, 12 male, 8 female) manually tracked an expanding/contracting annulus and/or the oscillations of an FM tone. Task difficulty was increased by substantial contamination of the signal. The frequency of oscillation in one or both modalities subtly shifted on some trials. In addition to baseline tracking performance, we analyzed the probability and rapidity with which subjects detected changes in the underlying pattern, began their shift to a new behavioral pattern, and re-established stable tracking. The results show that the largest multisensory enhancements are realized in both detecting changes and the speed of adapting to them. While the performance of most subjects neared the predictions of the statistically-optimal model, there was significant individual variability (albeit no significant gender difference), with a few subjects failing to show any multisensory benefit at all. These observations suggest that averaging across groups tends to obscure the very different multisensory integration capabilities of different individuals, and the fact that some may or may not engage this process in a given task. Supported by NIH grant R03NS079849 and the Tab Williams Fund.

A156

EXPLORING THE ROLE OF BROCA'S AREA DURING MATHEMATICAL PROCESSING

Xiaofang Yang[1], Amy Daitch[1], Dhruba Banerjee[2], Josef Parvizi[1]; [1]Stanford University, [2]The University of California, Irvine — We recorded electrocorticography (ECoG) signals in patients implanted with intracranial electrodes in the left frontal lobe when they were performing numerical tasks with different complexity, including reading of single and double numerals and English words, or solving math equations. We also recorded from Broca's area when participating patients listened and recalled stories with numerical words (such as numerals, ordinals, and quantifiers). Pathological electrodes were excluded during pre-processing, and high-frequency broadband (HFB) signals were extracted to examine the dynamics of brain activity. The results showed a significant increase of HFB activity in Broca's area with anatomical selectivity when patients were solving math equations. Distinctive HFB responses were also found in sub-regions of Broca's area during three processing stages when subjects were reading numerals and number words versus non-number words with similar phonological features. Moreover, when patients were listening to narrative stories or recalling them, the occurrence of HFB activity in Broca's area had significant co-occurrence with the presence of ordinals and quantifiers compared to numerals. This study provides novel evidence that Broca's area may be playing an important role in processing mathematical concepts.

A157

AGE-RELATED COMPENSATORY NEURAL NETWORKS IN MULTISENSORY INTEGRATION

Brenda Hanna-Pladdy[1], Hyun Choi[1]; [1]University of Maryland Baltimore — Age-related neural changes can reflect either difficulty recruiting specialized neural networks or plastic reorganization such as bilateral recruitment for compensation. To elucidate the neural mechanisms of multisensory representations in aging, we developed an event-related fMRI study to identify the neural substrates of audiovisual tool-use representations. The current study evaluated BOLD signal while 14 young (ages 23-35) and 14 older adults (ages 60-74) made decisions about spatiotemporal aspects of limb movements in response to pictorial images and action sounds of 25 manipulable objects. The paradigm contrasted multisensory conditions with either congruent or incongruent audiovisual stimuli. The incongruent condition required reliance on action sounds and inhibition of mismatched object images during movement decisions. Younger adults displayed greater activations for left primary striate and left inferior and superior parietal regions during both multisensory conditions, but greater bilateral parietal activation during the multisensory incongruent condition. Older adults recruited additional bilateral cingulate and right superior temporal regions across multisensory conditions, but greater right anterior temporal and bilateral inferior frontal regions during audiovisual integration. During the incongruent condition, older adults had additional activations in the right orbitofrontal, right hippocampal and amygdala regions. Brain activation patterns for younger adults revealed the expected left posterior cortical network for spatiotemporal movement features, but greater bilateral parietal activations during auditory modulation of multisensory movement representations. The pattern of activations in older adults was consistent with compensatory mechanisms of hemispheric reduction during audiovisual integration as well as during auditory modulation of multisensory contextual information.

THINKING: Decision making

A158

EFFECT OF CHOICE DIFFICULTY ON LOCAL FIELD POTENTIALS IN FRONTAL EYE FIELD OF NONHUMAN PRIMATES

Jacob Westerberg[1], Paul Middlebrooks[2], Jeffrey Schall[2]; [1]St. Olaf College, [2]Vanderbilt University — This study continues an investigation of the role of the frontal eye field (FEF) in perceptual decision-making. Here we report an analysis of the local field potentials recorded in FEF activity of monkeys performing a saccade choice countermanding task. A trial began when the monkey fixated a spot in the center of the screen. After fixation, two targets appeared in the periphery. After the targets appeared, a 10 by 10 cyan/magenta checkerboard appeared. Saccade choice was specified by the fraction of cyan and magenta in the checkerboard. Choice difficulty was varied between trials by varying the fraction of cyan and magenta. On a subset of trials, a stop signal instructed monkeys to cancel the saccade. Here we report that evoked local field potential power varied as a function of choice difficulty. This result indicates that the neural correlates of choice difficulty can be measured across multiple levels of analyses.

A159

NETWORK ORGANIZATION OF THE THE BRAIN IN THE IOWA GAMBLING TASK

Taylor Bolt[1], Paul Laurienti[2], Robert Lyday[2], Ashley Morgan[2], Dale Dagenbach[1]; [1]Wake Forest University, [2]Wake Forest School of Medicine — Changes in functional brain network organization between rest and a complex decision-making state (Iowa Gambling Task) were examined using graph-theoretical based analyses of fMRI data. While previous functional neuroimaging studies have examined task-based activations during the Iowa Gambling Task, changes in network organization have not been explored. In this study, a repeated measures design was used in which participants were scanned during four alternating sessions of rest and the IGT allowing assessment of changes in network organization across sessions of the same task as well as changes between tasks. Global network organization shifted from a local, clustered organization (high connectivity

among neighboring nodes) at rest to a more global, integrated organization (high efficiency of information transfer across the network) during the Iowa Gambling Task. In addition, network organization was relatively stable (did not change) across sessions of the rest and the Iowa Gambling Task. Regional analyses of the Default Mode Network and Fronto-Parietal Network revealed differential patterns of change in regional network organization from rest to the Iowa Gambling Task. The degree of locally clustered organization in the Fronto-Parietal Network was negatively correlated with performance in the Iowa Gambling Task, consistent with its role as a global hub of cognitive control. The results suggest that global and regional network organization is significantly modulated between states, but also and fairly stable over time across sessions of the same task. In addition, these results suggest that graph-theoretical approaches may be fruitfully applied to the study of other cognitive tasks.

A160

MULTIDIMENSIONAL MESSAGE FEATURES MODULATE FUNCTIONAL CONNECTIVITY IN THE PERSUASION NETWORK

Richard Huskey[1], J. Michael Mangus[1], René Weber[1]; [1]University of California Santa Barbara – Media Neuroscience Lab — A growing body of research investigates the neural basis of attitude and behavior change (Falk et al., 2009). To date, the majority of work on the so-called "persuasion network" relies on standard brain-mapping paradigms while only a handful of investigations have assessed functional connectivity. For instance, Ramsay and colleagues (2013) observe functional connectivity between affective and executive structures during strong (but not weak) argument strength (AS) public service announcements (PSAs) while Seelig and colleagues (2014) found inconclusive evidence that message sensation value (MSV) modulates occipital-temporal connectivity. However, persuasion is a multidetermined construct that results from an interaction between message features and audience characteristics (Weber, et al., 2013). The present study exposes 28 subjects to anti-drug PSAs in a 2x2x2 mixed-factorial design where MSV, AS, and subject drug-use risk were systematically varied. Psychophysiological interaction analyses (Friston, et al., 1997) were used to test functional connectivity with seed regions selected from previously reported results. Contrary to Seelig et al. (2014), results reveal occipital-temporal (e.g., MTG) and affective (e.g., amygdala) functional connectivity under high MSV among high-risk subjects. While no significant clusters emerged when seeding from Ramsay's LIFG, their socioemotional persuasion hypothesis received support when seeding from the MPFC (Falk et al., 2012) which projected into affective structures (e.g., putamen, insula) for high MSV and high AS PSAs among high risk subjects. We propose that research on the neural basis of persuasion must continue to investigate network-level effects while accounting for theoretically relevant (and multidimensional) interactions between message features and targeted audiences.

A161

TOP-DOWN EFFECTS ON FEEDBACK PROCESSING: EFFECTS OF FEEDBACK VALIDITY ON FEEDBACK-LOCKED EVENT-RELATED POTENTIALS

Benjamin Ernst[1], Franz Wurm[1], Marco Steinhauser[1]; [1]Catholic University of Eichstätt-Ingolstadt — The evaluation of external feedback is an important prerequisite for optimal decision-making. This also requires taking into account the reliability of feedback so that learning from potentially invalid feedback is prevented. However, it is not yet clear how and to which extent information about feedback validity affects feedback processing. On the one hand, it is conceivable that top-down control suppresses the utilization of potentially invalid feedback for early reinforcement learning. On the other hand, it might be that only later attentional processes are affected while reinforcement learning remains unaffected. In the present study, we considered electrophysiological correlates of feedback processing – the feedback-related negativity (FRN) and the P3 – to investigate how knowledge about feedback validity affects feedback processing. Participants had to use feedback in a deterministic trial-and-error learning task to maximize their reward. Feedback was sometimes invalid, i.e. it provided false information about the outcome of a decision. The probability of invalid feedback varied between blocks. Importantly, half of the participants were informed about this probability at the beginning of each block, whereas the other half was not. We found that while prior information did not affect the amplitude of the FRN, it did affect both the P3a and the P3b. The results indicate that processing of low validity feedback was suppressed. However, this top-down effect was restricted to attentional processes whereas reinforcement learning was unaffected.

A162

ENGAGEMENT AND COGNITIVE WORKLOAD IN COMPLEX, AUTHENTIC ENVIRONMENTS: MODELING THE CARDIOVASCULAR RESPONSE TO INFORM MENTAL EFFORT

Amy Jo Haufler[1], Gregory F. Lewis[2], Maria I. Davila[2], FT Case[1], Stephen Porges[2]; [1]The Johns Hopkins University Applied Physics Laboratory, [2]University of North Carolina School of Medicine — Novel approaches are needed to quantifying cognitive workload to mitigate stress-related performance decline typically observed in complex, authentic work environments. The purpose of this study was to examine cardiovascular activity (HR, HRV, pulse-wave trend) as indices of mental effort under conditions of varying cognitive challenge. Nine subjects (8 Male) completed nine blocks of SynWork (Elsmore, 1994). The cardiovascular response was acquired by contact sensors (ECG, BioPac) and a stand-off pulse monitor (PhysioCam). Both contact and stand-off sensor signals were processed off-line and modeled to identify heart rate variability parameters associated with mental effort. During exploratory analysis of the stand-off sensor system, a novel parameter extracted from the video derived pulse signal was identified (i.e., variance in the slow (0.04 – 0.10 Hz) baseline wander of the raw pulse wave). All parameters were quantified in 30-second windows and stepwise discriminate function analysis revealed respiratory sinus arrhythmia, low frequency heart rate variability and heart period as the parameters contributing to engagement (baseline v easy condition) for each sensor. Cognitive workload level (easy vs. hard conditions) was only distinguished in 1 of 8 models for the ECG model. The magnitude of pulse wave baseline wander, a possible indicator of vasomotor activity, improved the classification for the PhysioCam with 5 of 8 models converging on a significant solution. The Cognitive Effort Tracker software program was developed to illustrate modeled engagement and workload in near real-time to demonstrate the technology and signal processing to detect, assess, and interpret human performance compatible with authentic, complex work environments.

A163

THE NEURAL UNDERPINNINGS OF TEMPORAL CONTEXT IN EXPLORATION

Hans Melo[1], William Cunningham[1], Adam Anderson[2]; [1]University of Toronto, [2]Cornell University — Objective: When confronted with making a choice in an uncertain environment, we must decide whether to exploit a known option or explore a less familiar but potentially more rewarding option. Previous work on this exploitation-exploration dilemma reveal that orbito-frontal cortex (OPFC) and interparietal sulcus are associated with explorative behaviour. However, the temporal dynamics of this process remains poorly understood. By combining multimodal neuroimaging (fMRI and EEG) with computational modeling we aimed to assess the influence of pre-trial neural activation in current choice outcome. Methods: Functional Magnetic Brain Imaging (fMRI) activity was collected from 74 healthy individuals while participants performed a four-arm bandit gambling task. A further 14 individuals also performed the task while EEG recordings were obtained. Multilevel models were implemented to test an effect of pre-trial neural activity. Results: fMRI analysis show activation of dorsolateral prefrontal cortex and interpatrietal sulcus in previous trial predicting current trial choice. Consistent with these results, power analysis of EEG data in dorsal frontal and parietal regions revealed a significant effect of alpha power in the time leading predicting decision at current trial. Conclusions: Our work elucidates the temporal dynamics of exploratory behaviour in humans. In particular we show how neural processes leading to the current decision trial influence whether individuals choose to explore versus exploit. More generally, these results provide a much needed consideration of the temporal context in which decision-making takes place. Acknowledgements: CIHR #490407 to William Cunningham, John Templeton Foundation #490225 to Adam Anderson, Varela Award # 494241 to Hans Melo.

A164

TEMPORAL DYNAMICS OF REWARD-BASED TWO-STEP DECISION MAKING

Cristian Buc Calderon[1], Myrtille Dewulf[1], Tom Verguts[2], Wim Gevers[1]; [1]Center for Research in Cognition & Neurosciences, Université Libre de Bruxelles, [2]Department of Experimental Psychology, Ghent University — Recently, Solway & Botvinick, (2012) proposed a computational model where goal-directed decision-making would result from Bayesian inversion of a probabilistic generative model of reward. A specific case of goal-directed decision-making refers to a two-step sequential decision-making situation of which the possible action outcomes are known beforehand. Imagine going out in search for food. Heading left leads to the subsequent possibility of getting either pizza or burgers, whereas heading right affords you Thai-food or burritos. Importantly, the model predicts distinct decision dynamics at the first-step (i.e. heading left/right) depending on the reward values associated with each food option. Specifically, the model predicts slower first-step decision times (DTs) when the highest reward and highest mean reward are associated with different choices (mean-max conflict). In contrast, faster DTs are expected when the highest reward and highest mean reward are associated with the same choice (no mean-max conflict). Indeed, it is hypothesized that the optimal choice is initially computed on the basis of mean rewards associated with each first-step choice; inducing an initial bias for the irrelevant choice in mean-max conflict trials. To assess this assumption we tested 15 participants in a two-step sequential decision-making task. As predicted by the model, our results show that mean-max conflict trials elicited slower DTs compared to no mean-max trials. Moreover, the proportion of choices involving the highest reward was lower in the mean-max condition. Our study suggests that during the decision process, the outcomes (i.e. expected rewards) of potential actions are progressively unraveled.

A165

MAPPING OUT THE REPRESENTATIONAL SPACE FOR DECISIONS USING EEG DELTA OSCILLATIONS

Atsushi Kikumoto[1], Theo A.S. Schäfer[2], Tessafay Samejima[1], Dagger Anderson[1], William McGuirk[1], Ulrich Mayr[1]; [1]University of Oregon, [2]Phillips-Universität Marburg — Perceptual decision making requires the process of translating sensory evidence into a representational space that identifies action-relevant categories (decision evidence). Although the neural dynamics of evidence integration have been investigated, it remains unclear how the representational space is organized for sensory versus decision evidence, how this representation adapts to task demands, and how it contributes to individual differences in decision making quality. We decoded the representation of evidence during a multisample categorization task using multivariate pattern classification analysis of scalp-recorded EEG. Participants made binary judgments about the degree the average orientation of a series of Gabor patterns (sensory evidence) was on average closer in terms of their angular distance (decision evidence) to either the cardinal or the diagonal axis. We found that the representational space of sensory evidence showed a graded, feature-selective property. In contrast, the representation of decision evidence was characterized both by graded coding of the strength of the evidence, and by a non-graded, binary coding along category boundaries. The neural measure of decision evidence predicted––to a much larger degree than the measure of sensory evidence––trial-by-trial errors as well as individuals' performance. As expectations about the dominant category for a series of stimuli increased, the binary, category distinction in the decision evidence representation was strengthened. Furthermore, when decision rules shifted from block to block, the category boundary was flexibly adjusted, indicating that the translation from sensory to decision evidence is under top-down control. These findings demonstrate a novel and robust approach to characterizing decision-relevant representations.

A166

CHARACTERIZING INTUITIVE JUDGMENT PROCESSES IN THE SOCIAL DOMAIN

Laura F. Mega[1,2,3], Kirsten G. Volz[2]; [1]Graduate School of Neural and Behavioral Sciences, Tuebingen, Germany, [2]University of Tuebingen, [3]Hans Boeckler Foundation — Nonverbal signals such as facial expressions are of paramount importance for social encounters. Their perception predominantly occurs without conscious awareness and is effortlessly integrated into social interactions. Among the most widely purported explanans of such social judgment behavior are dual-process theories (DPT) of social psychology. These posit that mental processes underlying social phenomena can be divided into two distinct types of processing: Intuitive/Automatic (Type1) and Deliberative/Reflective (Type 2). Despite the prevalence of DPT, both the psychology and philosophy community have been entrenched in critical debates about the characteristics and the interplay between the supposedly two distinct process types. In the present study, we investigated the cognitive process(es) involved in social judgments in a task that is highly motivationally relevant to species as social as humans: face perception. Two groups of participants judged the authenticity of emotional expressions, while their eye movements were recorded. Direct comparison of the two instruction groups revealed a differing viewing pattern. The intuitive pattern closely resembles a holistic viewing strategy; a finding that is supported both by a smaller amount of fixations and relatively longer fixation durations. The holistic pattern is in line with evidence showing that intuition is related to processing the "gestalt" of an object, rather than focusing on details. Our work thereby makes an important contribution to the study of intuition and DPT by providing an objective and distinguishable operating measure of intuitive processing in a real world social judgment task.

A167

VANILLA, VANILLA BUT WHAT ABOUT PISTACHIO? COGNITIVE CONTROL RESOURCES ORCHESTRATE DIRECTED-EXPLORATION, BUT NOT RANDOM-EXPLORATION.

Irene Cogliati-Dezza[1], Andreagiovanni Reina[2], Filip Van-Opstal[1], Axel Cleeremans[1]; [1]Consciousness, Cognition & Computation Group, Center for Research in Cognition & Neurosciences, Free University of Brussels, Belgium, [2]Department of Computer Science, University of Sheffield, United Kingdom — Imagine you are in ice-cream shop and you are faced with the decision of what ice-cream to order. Will you choose your favourite taste (i.e. vanilla) or will you explore different options discovering a new taste that may turn out to become your new favourite (i.e. pistachio)? This example illustrates the dilemma between exploiting high-rewarded/well-known options and exploring new ones. Several authors have proposed that cognitive control process might be necessary when switching from a highly rewarded/well-known option (i.e. vanilla) to an uncertainty one (i.e. pistachio). However, exploring the unknown can be achieved both using a random or directed strategy. Hence, the cognitive dynamics behind it might remarkably differ depending on the policy adopted. We measured behavioural dynamics of exploration and exploitation, elicited by a 2-armed-bandit task, under active cognitive control manipulation. Specifically, participants were engaged in a working-memory task while they were solving sequential decision-making problems. We classified trials according to whether the actual choice was the one predicted by our model to be the option with highest expected value (exploitation), lower expected value (random-exploration) or higher informative value (directed-exploration). Results showed that draining the availability of active cognitive control only affected participants' ability to directly explore the environment. Under this condition participants were producing more deterministic choices reducing their shift toward the highest informative option. We concluded delineating a possible dual-process, which separately supports random-exploration and directed-exploration.

THINKING: Problem solving

A168

THE EFFECTS OF TRANSCRANIAL DIRECT CURRENT STIMULATION OVER PREFRONTAL AND OCCIPITAL CORTEX FOR FLEXIBLE OBJECT KNOWLEDGE RETRIEVAL

Evangelia G. Chrysikou[1], Hannah M. Morrow[1], Austin Flohrschutz[1]; [1]University of Kansas — Research has shown that inhibitory transcranial direct current stimulation (tDCS) over left prefrontal cortex (PFC), relative to excitatory or sham stimulation, can improve performance on flexible thinking tasks; studies have also suggested that such tasks may benefit from excitation of right frontotemporal cortex. Further, functional neuroimaging investigations have reported increased activity in occipitotemporal cortex during flexible object knowledge retrieval. Here, we examined whether altering activity in PFC and occipital cortex regions using tDCS would facilitate performance on an open-ended task. We

showed participants images of everyday objects and asked them to report aloud either the common or an uncommon use for them while undergoing tDCS. A forward digit span was also used as a negative control task. In Experiment 1, participants received excitatory tDCS over right PFC with concurrent inhibitory tDCS over left PFC, the reverse montage, or sham stimulation. In Experiment 2, participants received excitatory tDCS either over right or left occipital cortex or sham stimulation. Concurrent bilateral stimulation of the PFC, regardless of polarity, did not alter performance on any task. In contrast, although excitatory tDCS over occipital cortex did not have an effect on participants' performance on the control task, stimulation over right occipital cortex tended to facilitate the speed in which participants generated responses and the number of responses produced for the uncommon uses task. These results contribute to our understanding of the role of this region in object processing and suggest that over-excitation of right occipital cortex may promote access to flexible object knowledge retrieval.

A169

EEG OSCILLATORY ACTIVITY DURING THE DECISION TO GIVE UP PROBLEM SOLVING

Masahiro Kawasaki[1,2], Eri Miyauchi[1]; [1]University of Tsukuba, [2]RIKEN, Brain Science Institute — There have been some models to explain psychological processes of giving up in problem solving and decision making, however, neural mechanism of such behavior has not been fully investigated. This study aimed to explore the mechanism of giving up processes by investigating changes of the brain activity during giving up decisions on problem solving with electroencephalograph (EEG) measurements. In the experiment, participants were instructed to solve riddles (in Japanese) presented on a computer display and either to press a keyboard button when they solved the riddles or to press another keyboard button when they gave up solving the riddles. After the solving session, answers were presented and participants were asked either to press a keyboard button when their answers were correct or to press another keyboard button when their answers were wrong for the riddles participants solved. For the riddles participants gave up on solving, participants were asked either to press a keyboard button when the answers were convincing or to press another keyboard button when the answers were not understandable. The time-frequency analysis for the EEG data showed the transient enhanced theta activities on the frontal regions just before both of the onsets of pressing keyboard to solve the riddles and to give up the riddles. Interestingly, the duration and amplitude of the theta activities between two situations were significantly different from each other. Our results suggest that the EEG modulations may reflect different processes of giving up in problem solving and decision making.

A170

EFFECTS OF PACED BREATHING ON COGNITIVE FLEXIBILITY

Bradley Ferguson[1], Brianne Herriott[2], Allison Halt[3], David Beversdorf[4,5,6,7,8]; [1]University of Missouri Interdisciplinary Neuroscience Program, [2]University of Missouri School of Medicine, [3]Washington College, [4]University of Missouri Department of Radiology, [5]University of Missouri Department of Neurology, [6]University of Missouri Department of Psychology, [7]University of Missouri Thompson Center for Autism & Neurodevelopmental Disorders, [8]Director, Center for Translational Neuroscience, University of Missouri — Previous studies show a decline in problem solving capacity with stress, and that propranolol, a nonselective beta-adrenergic antagonist, can decrease these effects. Further studies demonstrate that cognitive flexibility is regulated by the noradrenergic system and can be improved with propranolol, even in the absence of stressors. In order to determine if meditation could be utilized in place of propranolol, we examined if similar cognitive improvements could result from a slowed breathing technique, an easily implemented proxy to meditation. Furthermore, we assessed if changes in heart rate variability due to slowed breathing were associated with increases in cognition. Anagram task performance was compared in 30 participants using a within-subject design. Electrocardiogram readings, blood pressure, and stress perception were recorded during independent sessions of normal breathing and paced breathing exercise for 10 minutes, respectively. After completion of a normal or paced breathing exercise, participants completed cognitive assessments. Dependent-sample t-tests assessed differences in blood pressure or heart rate. Blood pressure was significantly different between breathing conditions only at the end of the study. No significant differences were found between heart rate, heart rate variability, or stress perception. Overall, performance on cognitive tasks was not significantly different between breathing conditions. However, linear regression revealed a significant positive association between the letter fluency change score and the standard deviation in heart rate change score, a measure of heart rate variability, suggesting inter-individual variability in response to paced breathing. Future studies may wish to investigate if daily paced breathing exercises can increase cognitive function.

A171

TASK DEPENDENT NUMERICAL REPRESENTATIONS IN NUMBER SYMBOLS DRIVE INDIVIDUAL DIFFERENCES IN MATH

Andrew Mattarella-Micke[1], Bruce McCandliss[1]; [1]Stanford University — Fluency with numerical symbols is essential for mathematical development in children. However, while previous research has proposed that the phonological (Evans et al., 2014) or magnitude (Holloway & Ansari, 2009) bases of numerical symbols are critical for math, few have investigated the underlying representation directly. Further, confounds with reaction time and difficulty implicate executive function and response selection as an alternative explanation for the functional neuroanatomy (Gobel et al., 2004) and individual differences (Fuhs & McNeil, 2013) observed. To explore the role and importance of different representations of number, we asked children to make judgments of numerical similarity depending on the dimension of "sound" or "amount", to tap into representations of phonology and quantity respectively. While stimuli were matched across the two conditions, children activated right intraparietal sulcus (IPS) when asked to compare based on amount, and bilateral inferior frontal gyrus (IFG) when asked to compare based on sound. An index of phonological or quantity similarity predicted IPS modulation and reaction time (RT) their respective tasks, however only the quantity-related measure of representational similarity predicted individual differences in math outcomes. This relationship remained robust controlling for task RTs, and for two measures of executive function. Task dependent access to symbolic magnitude representation is a critical aspect of math development.

A172

THE AHA! EXPERIENCE: INSIGHT SOLUTIONS PRODUCE DELTA-BAND, ERN-LIKE REWARD SIGNALS.

Brian Erickson[1], Monica Truelove-Hill[1], John Kounios[1]; [1]Drexel University — The defining feature of creative insight is a sudden burst of positive emotion at the moment of solution. We present a candidate EEG time-frequency signal for this event that bears a strong resemblance to the reward related positivity (RewP; alternatively, error related negativity, ERN) that occurs in gambling and other feedback tasks. Our subjects solved anagrams and reported their solution strategy as insightful or analytic on each problem. Time-frequency analysis of solution-related epochs reveals a peri-solution delta-band positivity in trials solved with insight versus analytic strategy, cluster-wise significance $p=.014$ (analyses in SPM12). This result resembles time-frequency analyses of gambling win trials reported by Foti et. al. (2014) and others. A great deal of prior work on gambling tasks also shows that smaller win/loss ratios elicit larger RewP signals; similarly, we find that subjects with fewer insight solutions exhibit larger peri-solution delta-band power, cluster-wise significance $p<.001$. Prior literature has tied gambling task win-related delta-band activity to basal ganglia activation and reinforcement learning. Thus, our results may suggest a mechanism for the application of reinforcement-learning theories to creativity. With further study, this linkage may help to explain the human imperative to undertake creative challenges, how effective choices are selected during the creative process, and how creative behavior may be learned and self-reinforcing.

Poster Session B

ATTENTION: Multisensory

B1

MATCHING A SHAPE WITH A SOUND: DOES SOUND-SHAPE CORRESPONDENCE MODULATE A NEURONAL SIGNATURE OF VISUAL SHAPE PROCESSING? Sylvia Guillory[1], Hiu Mei Chow[1], Vivian Ciaramitaro[1]; [1]University of Massachusetts Boston — Crossmodal correspondence, the association between information of one sense (e.g. a "bouba" nonsense word) to that of another sense (e.g. a round shape), is a form of multisensory phenomenon found across development and cultures. However, how crossmodal correspondence might modulate information processing across modalities is not well understood. Here we used cross-modal correspondences between the visual and auditory domain to characterize neural processing of congruent and incongruent sound-shape pairs. Steady-state visual evoked potentials were used to assess processing of a visual object, where enhancements at target frequencies have been associated with greater neural processing. We hypothesized that sound-shape congruence would modulate processing. 10 subjects passively viewed a 2-D object flickering at 20 Hz. The object was either a round or spiky shape. For a given shape, participants completed 4 conditions: no sound, neutral sound (repeated "beep"), congruent sound (e.g. "kiki" was paired with a spikey), and incongruent sound (e.g. "baba" was paired with a spikey shape). Shape type (spikey or round) was counterbalanced across participants, and order of conditions was counterbalanced within participants. We found no difference in visual shape processing (our 20Hz EEG signal) based on whether the sound was congruent or incongruent. Interestingly, there was a trend for a neutral sound to enhance the 20Hz signal compared to no sound, suggesting there is an automatic increase of attention induced by a sound, regardless of cross-modal congruence, consistent with previous literature.

B2

VISUAL WORKING MEMORY CAPACITY PREDICTS AUDITORY SELECTIVE ATTENTION IN BILINGUAL ADULTS Jimena Santillan[1], Amanda Hampton Wray[2], Eric Pakulak[1], Theodore Bell[1], Helen Neville[1]; [1]University of Oregon, [2]Michigan State University — Extensive evidence suggests that working memory (WM) capacity is closely linked to attentional control in the visual domain (Engle, 2002). Our lab has demonstrated an association between visual working memory (WM) capacity and an event-related potential (ERP) measure of auditory selective attention in monolingual English-speaking adults (Giuliano et al., 2014). The present study extends this work by testing this relationship in a sample of Spanish-English bilingual adults, while controlling for language proficiency and socioeconomic status (SES). Twenty-nine participants completed an auditory selective attention ERP paradigm in which they were simultaneously presented with two different narrative stories in English and were asked to attend to one story while ignoring the other. Neural responses were elicited by identical probes embedded in both attended and unattended narratives, and compared between attention conditions. Participants also completed a visual change detection task to measure WM capacity, standardized tests of language proficiency, and maternal education was used as a proxy for SES. WM capacity was a significant predictor of attentional modulation of the N1 component in the auditory selective attention task, controlling for English proficiency and SES ($b = -.80$, $p < .01$). A supplementary median split analysis revealed that the high WM capacity group displayed significantly larger neural modulation to attended stimuli compared to the low WM capacity group. Together, these findings provide further evidence that WM capacity and selective attention are closely linked independent of sensory modality, and also suggest that this relationship may be relatively independent of second language proficiency and childhood SES.

LANGUAGE: Other

B3

SILENT LIP READING GENERATES SPEECH SIGNALS IN AUDITORY CORTEX L. Jacob Zweig[1], Marcia Grabowecky[1], Satoru Suzuki[1], Vernon L. Towle[2], James Tao[2], Shasha Wu[2], David Brang[1,2]; [1]Northwestern University, [2]University of Chicago — Visual lip movements improve auditory speech perception in noisy environments (e.g., McGettigan et al., 2012) and crossmodally activate auditory cortex (e.g., Pekkola et al., 2005). What specific information do visual lip movements relay to auditory cortex? We investigated this question by recording electrcorticographic (ECoG) activity from electrodes implanted within primary/secondary auditory cortex of the brains of epilepsy patients, evoked by four representative auditory phonemes (/ba/, /da/, /ta/, and /tha/) or by visual lip movements (visemes) articulating these phonemes. We constructed an ensemble of deep convolutional neural networks to determine whether the identity of these four phonemes/visemes could be independently decoded from auditory cortical activity in response to either auditory-alone or visual-alone trials. Statistically significant decoding of viseme identity would provide evidence of visual coding of phoneme representations in auditory cortex. We first verified that phoneme information was reliability decoded with high accuracy from auditory-phoneme-evoked activity in auditory cortex. Next, we critically demonstrated that phoneme identity information was also reliably decoded from visual-lip-movement-evoked activity in both the left and right auditory cortices in the absence of any sound, indicating that visemes generate phoneme-specific activity in auditory cortex. Furthermore, the pattern of activity evoked in auditory cortex by each representative phoneme/viseme was similar across auditory and visual trials (e.g., the classifier trained to identify visemes successfully decoded phonemes with comparable accuracy), suggesting that visual lip movements crossmodally activate auditory speech processing in a content specific manner.

THINKING: Decision making

B4

LEARNING AND UPDATING OF STIMULUS-REWARD ASSOCIATIONS ARE REFLECTED BY ELECTRICAL BRAIN ACTIVITY Berry van den Berg[1,2], Benjamin Geib[1], Rene San Martin[1,3], Marty Woldorff[1]; [1]Center for Cognitive Neuroscience, Duke University, [2]University of Groningen, Groningen, the Netherlands, [3]Universidad Diego Portales, Santiago, Chile — In gambling tasks, learning to associate stimuli with reward requires the continuous monitoring of gains and losses. Previous research (San Martin et al., 2013) identified feedback-related brain responses associated with learning stimulus-reward associations. While the feedback-related negativity (a frontocentral negative-polarity ERP deflection peaking ~250ms after feedback onset) distinguished losses from gains, the P3 (central positive-polarity ERP at between 300-500ms) predicted whether participants were going to change their bet on the subsequent trial. A major unanswered question, however, is how the updating of stimulus-reward associations is actually implemented in the brain. Here, we sought to utilize the temporal resolution of EEG to map the cascade of processes underlying such learning and updating. Participants were presented with mini-blocks of 20 trials. On each trial, participants had to choose (and wager on) either a face or a house. In each mini-block, either the face or the house was more likely to lead to a gain. Behaviorally, participants were in most cases able to learn in each 20-trial block whether the face or house was the more likely object to be rewarded. Neurally, we replicated that the P3 is larger when participants were going to switch their choice on the next trial, while also showing that this general enhancement effect does not indicate the direction of the switch. Following this effect, oscillatory EEG activity over the face area reflected the specific direction of stimulus-reward learning. Collectively, these results delineate the neural cascade underlying the learning and updating of stimulus-reward associations during probabilistic decision-making tasks.

ATTENTION: Multisensory

B5

EXPLORING SOCIAL INFLUENCES ON BRAIN POTENTIALS DURING ANTICIPATION OF TACTILE STIMULATION

Guannan Shen[1], Joni N. Saby[1,2], Peter J. Marshall[1]; [1]Temple University, [2]University of Washington

— This study explored social influences on electrophysiological responses during the anticipation of tactile stimulation. It is well-known that broad, negative-going potentials are present in the ERP between a forewarning cue and a tactile stimulus. More recently, it has been shown that the alpha-range mu rhythm shows a lateralized desynchronization over central sites during anticipation of tactile stimulation to the hand. The current study used a joint tactile discrimination task in which a visual cue signaled that an upcoming stimulus would either be delivered to the participant's hand, to their task partner's hand, or to neither person. The cue appeared 1500 ms before the target tactile stimulus, and it indicated who (self vs. other vs. nobody) and which hand (left vs. right) the target stimulus would be delivered to. For the condition in which participants anticipated the tactile stimulation to their own hand, a strong negative potential was observed in the ERP at central sites around 500 milliseconds prior to the tactile stimulus. Significant mu rhythm desynchronization was also present in the same time window prior. The magnitudes of the ERPs and the mu desynchronization were greater in the contralateral than in the ipsilateral hemisphere. Similar ERP and EEG changes were not present when the visual cue indicated that stimulation would be delivered to the task partner. However, the ERP waveforms and the time-frequency plots showed other subtle differences during anticipation of stimulation of the partner and the condition in which neither the participant or the partner received tactile stimulation.

B6

NARRATIVE ENGAGEMENT: WHAT ARE YOU WILLING TO GIVE UP?

Samantha Cohen[1], Simon Henin[2], Lucas Parra[2]; [1]The Graduate Center of the City University of New York, [2]The City College of the City University of New York

— What is the neurological basis of narrative engagement? To investigate the mechanism and phenonmenology underlying engagement, best understood as the sacrifice of scarce resources to continue receiving narrative content, the data obtained from time-restricted subjects was compared to the extent to which stimuli evoked reliable electroenecepholographic (EEG) responses across subjects. A large sample of over 1,000 subjects was forced to allocate a restricted time period among a range of narrative stimuli with a total duration longer than that allotted (e.g. allocation of scare resources to the most engaging videos). This experimental time restriction was then validated by comparing it with data obtained from the public who watched them until they become no longer interested (e.g. cost of spending time on them exceeded their value). These behavioral metrics for engagement, utilizing the scarcity of time, were compared to the extent to which the evoked EEG responses of a separate group of individuals synchronized across subjects. This inter-subject correlation (ISC) measures the ability of the stimulus to drive responses similarly across subjects. To test the prediction that ISC is a marker of enhanced engagement, the ISC evoked by the stimuli was compared to the extent to which they retained subjects despite extrinsic time pressures. A strong correspondence was found between the neural reliability evoked by the stimulus and its ability to retain viewers. Therefore, when a narrative engages neural activity reliably, people commit more temporal resources to the stimulus.

B7

MULTISENSORY DIVIDED ATTENTION: ROLE OF THETA OSCILLATIONS

Arielle Keller[1], Lisa Payne[2], Robert Sekuler[1]; [1]Brandeis University, [2]Swarthmore College

— Alpha oscillations play a role in suppressing distractions when just one sensory modality must be attended, but are the same neural mechanisms involved when attention must be paid to multiple sensory modalities? For an answer, we investigated how divided attention impacted processing of auditory and visual sequences. In Experiment 1, subjects performed an oddball task with either auditory, visual, or concurrent audiovisual sequences in separate blocks, while the electroencephalogram was recorded using high-density scalp electrodes. During a divided-attention audiovisual condition, an oddball (a rare and unusual stimulus) could occur in either the auditory or the visual domain, requiring that attention be divided between modalities. Fronto-central theta band (4-7 Hz) activity was strongest in this audiovisual condition. Given that theta-band activity has previously been associated with both multisensory processing (Sakowitz et al., 2000) and working memory (Gevins et al., 1997), Experiment 2 sought to differentiate these possible roles of fronto-central theta activity during multisensory divided attention. Using a modified version of the oddball task from Experiment 1, the results of Experiment 2 showed that theta power was present in single-modality conditions and was independent of working memory load. Ruling out theta's association with multisensory processing and working memory, we concluded that fronto-central theta activity is likely a marker of divided attention.

B8

VISUAL AND AUDITORY PERCEPTION ARE DIFFERENTIALLY AFFECTED BY MENTAL IMAGERY AND INNER SPEECH

Mario Villena-González[1], Ismael Palacios-García[1], Vladimir López[1], Eugenio Rodríguez[1]; [1]Pontificia Universidad Católica de Chile, Santiago, Chile

— Mind wandering has been studied assuming that the specific content of thoughts (such as visual imagery or inner speech) does not differentially affects the brain processing of external stimuli. Nevertheless, no direct study has addressed this issue. In order to directly assess the impact of thought content on perception we carried out two experiments leading the hypothesis that visual imagery reduces visual sensory processing in a larger extent than inner speech, while the last might negatively impact in auditory modality. We recorded the brain activity of participants while they were exposed to a visual stimulus (experiment 1) and to an auditory one (experiment 2) during three different conditions: a) executing a task on the stimulus (externally oriented attention), and two conditions involving inward turned attention; b) generating an inner speech or c) performing visual imagery. Event-related potential results showed that visual P1 and auditory N100 amplitudes were significantly attenuated during both task involving inward attention compared with the externally oriented. When both inward turned conditions were compared, a stronger attenuation of processing to the visual stimuli was observed during the visual imagery condition. Analogously, the processing of auditory stimulus was more reduced during the inner speech condition. Our results show that attentional resources allocation to external stimuli during self-generated thoughts is differentially affected by the sensory modality of thoughts.

B9

METHODOLOGICAL INNOVATIONS FOR EXAMINING FLOW EXPERIENCES IN BRAIN IMAGING CONTEXTS

Britney Craighead[1], Richard Huskey[1], Michael Miller[1], Rene Weber[1]; [1]University of California, Santa Barbara

— We introduce a novel procedure that allows for the testing of the neural basis of flow. Flow is a positively valenced psychological state characterized by focused attention and reward that is thought to result from a balance between task challenge and individual skill (Csikszentmihalyi, 1975). The central prediction of the synchronization theory of flow (Weber et al., 2009) understands flow as an emergent property of a network synchronization process that manifests itself in functional connectivity between attentional and reward structures. However, despite 40 years of research, there is no well-established procedure for experimentally manipulating the construct. In three behavioral experiments, we validated a protocol for manipulating flow. This included development of an open-source video game stimulus that allows for a high degree of experimental control while providing a log of in-game events (e.g., player wins/loses, x/y mouse position) with a 16ms resolution. Three conditions were manipulated: (1) boredom – low challenge/high skill, (2) frustration – high challenge/low skill, and (3) flow – balanced challenge/skill. Supporting theoretical predictions, secondary task reaction times collected during gameplay were longest during the flow condition. Similarly, self-reported flow was greatest when game challenge and player skill were balanced. The implications of these studies are two-fold. First, we are pleased to introduce an open-source tool that enables examining the relationship between task difficulty, attention, and affect using a naturalistic stimulus while providing considerable experimental control and data reporting. Secondly, this paradigm provides a crucial foundation for our lab's current investigations into the neural basis of flow.

B10

PREDICTING LEARNING OUTCOMES OF INSTRUCTIONAL VIDEO CONTENT USING NEURAL MAKERS OF ENGAGEMENT Denise Robles[1], Simon Henin[1], Samantha Cohen[2], Lucas Parra[1]; [1]The City College of New York, [2]The Graduate Center of the City University of New York — Although student engagement is correlated with academic success, the mechanism by which this attentional focus translates into improved performance is unknown. We hypothesized that the level of neural reliability evoked by educational stimuli, measured via the inter-subject correlation (ISC) of electroencephalogram (EEG), would predict the extent to which subjects acquired and retained stimulus-related knowledge. To assess this, subjects' knowledge base was assessed before and after exposure to educational videos. The reliability of each individual's neural responses, recorded while watching the videos, was compared to their peers to establish a metric for their relative attentional engagement with the stimuli. Neural reliability was correlated with an improvement on test scores after exposure to the educational videos. This suggests that ISC is a marker of the stimulus-related attentional mechanisms necessary for successful leanings. In the future, ISC could be used as a metric when designing and assessing online educational content and presentation style.

ATTENTION: Other

B11

ECG, PUPILLOMETRY, AND EYE GAZE MEASURES OF MIND WANDERING ACROSS TASKS Daniel M. Roberts[1], Daniela Barragan[1], Steven D. Chong[1], Carryl L. Baldwin[1]; [1]George Mason University — Recent work has sought to identify the processes underlying mind wandering, or disengagement from a primary task being performed, in a variety of contexts including reading. Understanding the processes underlying mind wandering has the potential to support mitigation techniques, which may be especially important in operational contexts such as automobile driving. In the present experiment, participants completed three experimental blocks, including two drives on a desktop driving simulator and the sustained attention to response task (SART). Participants self-reported instances of mind wandering via button press while completing each task. While participants completed the simulated drive and SART tasks, electrocardiogram (ECG), eye tracking, pupil dilation, and body posture were recorded. Periods of mind wandering were defined as -13 to -3 seconds relative to each self-report button press, while periods of an alert state were defined as +3 to +13 seconds relative to the same button press. Linear mixed effects models were used to investigate the effects of task (driving, SART) and state (mind wandering, alert) on each outcome measure. For both the driving and SART tasks, ECG derived heart rate, pupil dilation, and the standard deviation of eye gaze location were all diminished within the time window immediately prior to self-reported mind wandering, relative to the time window following the self-report. Some differences between the current results and those previously found within reading tasks may be related to the demand of the primary task being performed.

B12

BREATH-FOCUSED YOGA FACILITATES PERCEPTUAL SENSITIVITY AND VIGILANT ATTENTION MORE THAN MOVEMENT-FOCUSED YOGA Chivon Powers[1], Laura Schmalzl[2], Anthony Zanesco[1], Neil Yetz[2], Erik J Groessl[2], Clifford Saron[1]; [1]UC Davis Center for Mind and Brain, [2]UC San Diego School of Medicine — Yoga-based practices (YBP) typically involve a combination of movement sequences, conscious breath regulation, and techniques to engage attention. Little is known about whether effects of YBP result from the synergistic combination of movement, breath, and attention or if one or a subset of these components yields similar effects. Here we compare performance on a 32-minute response inhibition task (RIT) in novices who participated in one of two 8-week yoga programs: a movement-focused practice (involving movement, breath and controlled gaze), or a breath-focused practice (involving breath and controlled gaze). Both practices were based on the Ashtanga Vinyasa system. 65 healthy participants were randomly assigned to one of the two programs consisting of two weekly classes led by a yoga instructor and a daily home practice assisted by videos. We assessed data from 40 participants (m=17, f=23; ages 18-35) who completed the RIT before and after the program. We calculated A-prime from behavioral responses as a measure of perceptual sensitivity, and Response Time Coefficient of Variability (RTCV) as a measure of attentional stability. Overall perceptual sensitivity improved only in the breath-focused yoga group. The breath-focused group also demonstrated reductions in RTCV over the course of the 32-minute session. These results suggest that, relative to a movement-focused practice, a breath-focused practice may improve vigilant attention by facilitating increases in response inhibition and reductions in reaction time variability. Differences in movement and breath-focused YBP are interpreted in terms of mechanisms of endogenous and exogenous attention.

B13

THE NEURAL CORRELATES OF WILLED ATTENTION: FRONTAL ALPHA AND FRONTAL THETA. Jesse Bengson[1,2], Alexander Morales[2], Natalia Khodayari[2], George Mangun[2]; [1]Sonoma State University, [2]University of California-Davis — An individual's attention may be captured in an exogenous (reflexive) manner, or be deployed as a result of endogenous (voluntary) processes. . Numerous studies have explored the neural correlates of voluntary attention when cued by external informative or instructive cues (e.g., arrows), but much less is known about the neural correlates of attention when allocated by a purely volitional decisional process in the absence of external information (termed willed attention). We used EEG recordings and employed a willed attention paradigm in which individuals chose whether to attend to the left or right visual field locations, or to keep attention fixed upon a central fixation marker. We found that decisions to attend relative to no-attend trials are characterized by increased frontal theta (4-7) and alpha (8-13) rhythms in the cue to target interval. We also found that willed shifts of attention induced alpha lateralization by 1100 ms post cue that was dependent upon the degree to which frontal alpha increased in response to a decision to attend, supporting a role for frontal alpha in top-down voluntary attentional control. No association was found between decision-induced frontal theta and alpha lateralization. However, decision induced frontal theta was found to correlate with the degree to which attention increased the visual-sensory P1 target evoked response. These data provide novel insight about the mechanisms of attentional control and add to the literature by isolating attentional control as a volitional top-down process independent of external cues.

B14

EXPLORING INDIVIDUAL DIFFERENCES IN ATTENTIONAL MODULATION OF THE SOMATOSENSORY EVOKED POTENTIAL Ashley R. Drew[1], Andrew N. Meltzoff[2], Peter J. Marshall[1]; [1]Temple University, [2]Institute for Learning & Brain Sciences, University of Washington — Directing one's attention to the spatial location of a stimulus enhances neural activity within corresponding sensory areas. This phenomenon has been studied extensively in the visual modality, although there is increasing interest in selective attention in the tactile modality. Here we explore correlates of individual variation in neural responses during a tactile selective attention task. Specifically, we tested whether self-reported individual differences in mindfulness are related to attentional modulation of SEPs (somatosensory evoked potentials) to tactile stimulation. EEG was recorded from 29 participants whose left and right index fingers were stimulated using an inflatable membrane (60 ms tactile stimulus, 4-5 s ISI). Across blocks, participants were instructed to focus their attention on the sensation of the tactile stimuli or toward their breathing. A median split of mindfulness scores (Cognitive and Affective Mindfulness Scale-Revised) yielded lower (N=14; M=30.3; SD=2.8) and higher (N=15; M=38.5; SD=2.0) mindfulness groups. SEPs were examined at C3 and C4, contralateral to the finger being stimulated. Similar effects of attention to tactile stimulation were observed for both groups for early SEP components (P50/N80/P100). Group differences were apparent for later, slow components in the SEP (200-300 ms), with the higher mindfulness group showing an enhanced and more sustained positivity than the lower mindfulness group during attention to the tactile stimulation compared with attention to breathing. These novel findings suggest further directions for exploring the neural correlates of individual differences in selective attention abilities.

B15

EVENT-RELATED LATERALIZATIONS INDEX INDIVIDUAL DIFFERENCES IN SPATIAL BIAS AND TOP-DOWN CONTROL OF SELECTIVE ATTENTION

Iris Wiegand[1], Anders Petersen[1], Thomas Habekost[1]; [1]Center for Visual Cognition, University of Copenhagen — Selective attention controls the distribution of our visual system's limited processing resources to stimuli in the visual field. According to Bundesen's computational "Theory of Visual Attention" (TVA), the share of resources spend on a given stimulus can be quantified by its attentional weight, w-value. By modeling an individual's performance in a partial report task (i.e., displays with targets and distracters, and displays with only targets), two independent parameters of visual selection can be estimated: 1) top-down control α, the efficiency to select relevant over irrelevant information, wD/wT, and 2) spatial bias wIndex, an attentional weight bias towards the left versus right hemifield, wL/(wL+wR). In this study, we combined a partial report task with EEG and identified neural correlates of TVA parameters of visual selection: Top-down control α was correlated with the N2-posterior-contralateral (N2pc), an event-related lateralization (ERL) towards the target elicited in displays with bilateral target-distracter configurations. Lower N2pc amplitudes were associated with better top-down control, indicating that the component indexes individuals' efficiency in allocating processing resources to relevant information for selection in space. Spatial bias wIndex correlated with ERLs computed separately for displays with targets presented in the left- or right hemifield. Left-right asymmetries in sustained ERLs were associated with individual's estimated left-vs.-right-ward bias. For the first time, we discovered direct neural indices of inter-individual differences in two distinct visual selection functions formally defined in the computational TVA framework and its neural interpretation (NTVA).

B16

CONTROL OVER EXTENT AND TIMING OF DISTRACTOR-BASED RESPONSE ACTIVATION

Kerstin Jost[1,2], Mike Wendt[3], Aquiles Luna-Rodriguez[2], Andreas Loew[2], Thomas Jacobsen[2]; [1]RWTH Aachen University, [2]Helmut-Schmidt-University/University of the Federal Armed Forces Hamburg, [3]Medical School Hamburg — In choice reaction time tasks, such as the Eriksen flanker task, performance is often influenced by the presence of nominally irrelevant stimuli, referred to as distractors. Recent research provided evidence that distractor processing can be adjusted to distractor utility: Distractors were more attended to and they also more strongly activated a related motor response when they were predictive for the upcoming target/response. In an ERP-study, we investigated whether not only the extent of distractor processing but also the timing of distractor-based response activation is subject to strategic control. In a temporal flanker task, in which a distractor stimulus preceded the target, we manipulated distractor utility (75% vs. 25% congruent distractor-target combinations) as well as the SOA between distractors and targets (350 vs. 1000 ms). Distractor utility affected early visual processing of the distractors (evidenced by amplitude modulations of the P1 and N1) independently of the SOA. Importantly, distractor-locked lateralized-readiness potentials occurred overall later when the SOA was long and not reliably when the utility was low and the SOA was long. These findings demonstrate strategic control of both extent and timing of distractor-based response activation.

B17

CAN I EAT THIS? DISGUST SENSITIVITY MODULATES EVENT-RELATED POTENTIALS TO FEEDBACK REGARDING EDIBILITY

John Treffalls[1], Natalie Ceballos[1], Allison Zborowski[1], Frank DePalma[1], Rebecca Lopas[1], Reiko Graham[1]; [1]Department of Psychology, Texas State University — Feedback-related negativity (FRN) indexes neural activity to losses/errors during risk-taking, with timing and distribution similar to the N2 (implicated in error-related processing and salience). In this study, we examined the sensitivity of the N2 to processes related to appetitive motivations. Eighteen undergraduates (10 female, mean age = 21.1 years) viewed ambiguous close-ups of foods/drinks or nonfoods/drinks, and indicated whether or not they could consume the objects. Feedback (an unambiguous image/information about stimulus type) was then provided. Disgust sensitivity (DS) was assessed and used to create two groups: a moderate/high (n = 9) and a low (n = 9) group. Analyses focused on the N2 to feedback-related events; P3 amplitudes were also assessed as an index of subsequent resource allocation. N2 amplitudes differed as a function of DS: those high in DS showed large N2s to all feedback. In contrast, N2 amplitudes in the low DS group were highest for food/correct and nonfood/incorrect trials. With respect to the P3, amplitudes were highest to food/correct items. There was also a DS group x feedback interaction, such that enhanced amplitudes for correct relative to incorrect trials were more pronounced for the low DS group than the high DS group. Although tentative, results suggest that the FRN/N2 is sensitive to appetitive motivations, indexing attentional capture to disgust-related feedback, but that this may be modulated by DS. Individuals low in DS attend to motivationally-relevant feedback (i.e., food/correct and nonfood/incorrect), whereas individuals high in DS may attend more generally to feedback related to edibility.

B18

EARLY ATTENTION AND MEMORY OUTCOMES FOLLOWING PROTON RADIATION THERAPY FOR PEDIATRIC BRAIN TUMORS

Casey L. Evans[1,2], Julie A. Grieco[1,3], Torunn I. Yock[1,3], Margaret B. Pulsifer[1,3]; [1]Massachusetts General Hospital, [2]Suffolk University, [3]Harvard Medical School — Purpose: Conventional photon radiation therapy for brain tumors is associated with negative cognitive sequelae, particularly in children. Minimizing unnecessary exposure to radiation is critical. Proton radiation (PRT) provides better targeting of tumors and spares healthy tissues outside the target region. Therefore, it is expected that radiation-related cognitive sequelae would be less after PRT. Attention and memory post-PRT were examined given their relevance for learning and academic success. Methods: 44 patients, ages 6.58-21.67 years (M=13.09, SD=3.59; 50%<12.7years) at PRT initiation (baseline, BL), were administered age-appropriate standardized measures assessing intelligence (IQ), attention, and visual/verbal/working memory at BL and ≥1year follow-up (M=2.58, SD=1.67). Results: Patients were 52% male; 93% Caucasian. Histology was medulloblastoma (36%), glial (23%), craniopharyngioma (16%), and other (25%). Median lesion size was 912.50mm^2. 41% had hydrocephalus. Most received resection (77%), involved-field PRT alone (55%), chemotherapy (59%), and had supratentorial tumors (57%). BL/follow-up mean scores were in the average range and unchanged at follow-up. Age, histology, hydrocephalus, radiation dose, chemotherapy, resection, and location were not significantly related to change on any measure. Mean scaled scores approached significance for lower verbal memory for females at follow-up (p=0.069). Conclusion: At follow-up from PRT, intelligence, attention, and memory were intact and largely stable. Younger patients did not fare worse. Females did not make age-appropriate gains in verbal memory, although no decline was observed. Early outcomes compare favorably with the literature. PRT shows promise as a treatment for pediatric brain tumor patients, reducing specific cognitive sequelae and increasing the potential for learning and academic success.

B19

STRESS AND AND VISUAL ATTENTION TO FOOD IN HEALTHY WEIGHT AND OVERWEIGHT/OBESE WOMEN

Avery Ferguson[1], Natalie Ceballos[1], Roger Samson[1], Chris Prickett[1], Reiko Graham[1]; [1]Department of Psychology Texas State University — Previous studies suggest that mood state may impact both the appeal of different types of food, and participants' food choices. The current study assessed the effects of stress on attention to food pictures, as indexed via eye-movements. Women (Mage = 23) in BMI categories of healthy weight (n = 12) or overweight/obese (n = 10) viewed high calorie savory, high calorie sweet, and low calorie foods before and after a math stressor. At both time points, high calorie foods captured attention more quickly. However, low calorie foods held participants' attention longer during the first fixation. Stress effects on attentional maintenance were reflected in greater total fixation duration and total fixation count before stress versus after stress. Further, an interaction of food type x BMI group was noted for total fixation duration. In the healthy weight group, attentional maintenance to high calorie sweet foods was decreased compared to other food types. The overweight/obese group did not show this pattern. For total fixation count, attentional maintenance to high calorie sweet foods was decreased compared to other food types regardless of BMI. Additional analyses indicated that emotional eating tendencies were correlated with both attentional capture and maintenance before stress, while hunger was correlated with maintenance of attention after stress.

Taken together, these findings suggest that food type may be a more salient feature for the initial capture of attention, while stress and BMI may exert a greater influence on attentional maintenance.

EMOTION & SOCIAL: Development & aging

B20

BRAIN-TO-BRAIN SYNCHRONY PREDICTS STUDENT ENGAGEMENT AND SOCIAL DYNAMICS IN THE CLASSROOM: A CROWD-SOURCING NEUROSCIENCE STUDY.

Suzanne Dikker[1,2], Lu Wan[3], Ido Davidesco[1], Lisa Kaggen[4], Jess Rowland[1], James McClintock[5], Matthias Oostrik, Jay Van Bavel[1], Mingzhou Ding[3], David Poeppel[1,6]; [1]New York University, [2]Utrecht University, [3]University of Florida, [4]Stanford University, [5]Trevor Day School, [6]Max Planck Institute for Empirical Aesthetics — Introduction & Methods: How does the brain support real-world dynamic group interactions? To investigate this question, we recorded simultaneous EEG from twelve high school students and their teacher during eleven 50-minute classes, spread out across the school year. We focused our analyses on brain-to-brain synchrony [1], quantified as the inter-brain-coherence between students across EEG frequency bands as they participated in regular classroom activities (lecturing, group discussion, watching videos). Results: Increased classroom engagement was correlated with more synchronous brain activity between the students as a group: Students reported higher levels of engagement for watching videos and group discussion, and brain-to-brain synchrony was higher during these classroom activities than when the teacher was reciting or lecturing. In addition, brain-to-brain synchrony between pairs of students was correlated with how close they felt to each other. Conclusion: To our knowledge, this is the first study to repeatedly record brain activity from multiple people simultaneously as they engage in everyday activities outside of a laboratory environment. We applied this paradigm in the context of classroom interactions and found that brain-to-brain synchrony across students predicted student engagement and social cohesion. Both have been found critical to the student learning experience [2]. These findings suggest that brain-to-brain synchrony might be a biomarker for dynamic classroom interactions. As such, they provide a potentially promising new avenue for investigations into the neuroscience of group interactions 'in the wild.' References: [1] Hasson et al. 2012. Trends Cogn Sci 16(2):114-21; [2] Reyes et al. 2012. J Educational Psychology 104(3):700-712.

B21

FUNCTIONAL CORRELATES OF PERSONALITY AND EMOTIONAL FACES IN YOUNG AND OLDER ADULTS

Ninni Persson[1], Natalie C Ebner[2], Tian Lin[2], Håkan Fischer[1,3]; [1]Department of Psychology, Stockholm University, Sweden, [2]Department of Psychology, University of Florida, Gainesville, FL, USA, [3]Aging Research Center, Karolinska Institutet, Stockholm, Sweden. — Individual differences in personality may affect perceptions of emotional states in others. Studies investigating the link between personality and blood-oxygen-level dependent (BOLD) activation to facial expressions of emotion are scarce. We assessed the influence of personality on peak BOLD activation from functional magnetic resonance imaging (fMRI) in the middle frontal (MFG), inferior frontal (IFG), and insula (IN) gyri to happy and angry faces contrasted with a low-level baseline, in young (n= 30, 20-31 years) and older (n=30, 65-74 years) adults, using a facial emotion identification paradigm. Self-reported information about neuroticism, extraversion, and openness was included (NEO-PI). Latent difference score models gauged the influence of personality on BOLD activation. Individuals with higher levels of neuroticism had decreased BOLD in left IN and right IFG and in the MFG to angry faces, after accounting for age. Greater openness predicted activation of IN, controlling for the influence of age. Age magnified the effect of openness and extraversion on BOLD response to angry facial expressions, to greater activation in older adults. Inter-individual differences in personality did not explain BOLD activation to happy faces. Our findings suggest that the personality trait neuroticism is associated with increased neuronal response to negative (angry) cues in key structures associated with emotional processing, IFG, MFG and IN. Greater IN activation in more extraverted and open older compared to young individuals may be of importance for age-specific differences in emotional processing.

B22

SAFETY SIGNAL LEARNING AS A NOVEL MECHANISM FOR FEAR REDUCTION DURING ADOLESCENCE

Dylan Gee[1], Dominic Fareri[2], Laurel Gabard-Durnam[3], Christina Caldera[4], Bonnie Goff[4], Martin Monti[4], Tanja Jovanovic[5], BJ Casey[1], Nim Tottenham[3]; [1]Weill Cornell Medical College, [2]Adelphi University, [3]Columbia University, [4]UCLA, [5]Emory University — Frontoamygdala circuitry and the ability to extinguish fear undergo dynamic changes across normative development. Translational studies in mice and humans have demonstrated a period of diminished cued fear extinction during adolescence, raising the question of whether adolescents may benefit from efforts to optimize fear reduction through novel mechanisms that bypass prefrontally-mediated extinction processes. Rodent studies have shown that safety signals effectively reduce anxiety to threat and prevent the development of new fears. Because they provide a context for the conditioned stimulus (CS), safety cues may rely on hippocampal projections to frontoamygdala circuitry and thus be particularly useful during adolescence. The present fMRI study examined the development of safety signal learning across childhood and adolescence (7-17 years old). Though children and adolescents both showed robust hippocampal activation to the CS paired with the safety cue, only adolescents showed increased prefrontal activation and downregulation of amygdala reactivity that was associated with behavioral evidence of safety learning. Our findings suggest that safety signals may be a powerful way to reduce fear during this developmental window. This study is expected to have important implications for optimizing treatments for anxiety in youth based on the biological state of the developing brain.

B23

LIFESPAN CHARACTERIZATION OF INTER-NETWORK STRUCTURAL COVARIANCE: A BIG-DATA CROSS-SECTIONAL MRI STUDY

Katherine Aboud[1], Yuankai Huo[1], Hakmook Kang[1], Ashley Ealey[2], Bennett Landman[1], Laurie Cutting[1]; [1]Vanderbilt University, [2]Agnes Scott College — Recent studies have characterized brain development in terms of morphological synchronization across brain regions. These structural covariance networks not only map onto functionally identified cognitive systems, but also correlate with a range of cognitive abilities across the lifespan; for instance, IQ has been found to correlate with structural covariance between frontal, temporal, and parietal regions. However, despite advances in within-network covariance examinations (e.g. covariance of regions within the language network), no studies to date have characterized inter-network structural covariance patterns (e.g. how language networks covary with visual networks). In the current study, we performed a cross-sectional analysis of volumetric network covariance in over 5000 subjects ranging in age from 5-95. Whole brain segmentation (133 label) was conducted by a multi-atlas segmentation framework. Regions of interest were grouped into 15 networks, including primary sensory, language, memory, and executive networks. The cross-age growth curves of each group were fit using a restricted cubic spline regression with bootstrap validation. Hierarchical clustering analysis was performed on the resulting network growth curves. Our findings showed significant, age-dependent inter-network covariance patterns. Specifically, children (5-12 years) showed pronounced network modularity, reflective of differential growth rates in associative versus primary sensory networks. Adolescence (13-18 years) and young adulthood (19-29 years) were marked by developmental stability (i.e. higher inter-network covariance), followed by a degradation of cross-network covariance in middle to older age groups (30-95 years). Interestingly, these covariance fluctuations were differentiated by sex and education level. This is the first study to characterize inter-network covariance trends across the lifespan.

B24

DEVELOPMENTAL CHANGES IN THE PERCEPTION OF VOLUNTARY AND INVOLUNTARY EMOTIONAL VOCALIZATIONS

Sinead H.Y. Chen[1], Saloni Krishnan[1,2], Samuel Evans[1], Stella Guldner[1], Ana Gomes[1], Nermin Khamosia[1], Cesar Lima[1], Sophie Scott[1]; [1]University College London, [2]University of Oxford — How does age affect the perception of emotion? Laughter and crying are fundamental to the human experience and are produced and

heard right from infancy to adulthood. While laughter and crying can be helpless or involuntary, voluntary versions can be deliberately used in social situations. In this study, we investigate the perception of emotional vocalizations across age. In a large-scale study conducted in the Science Museum, London, we tested 1,847 visitors. Participants were played vocalizations varying in voluntariness (involuntary/voluntary) and emotion (laughter/crying); they rated emotional sounds on 5-point Likert scales for their perceived authenticity ('How real do you think the emotion is?') and their contagiousness ('How much do you want to join in?'). Only data from 1,723 participants (1,010 females) who passed our catch-trials criterion was further analysed. Preliminary analyses showed that the developmental trajectories for perception of voluntary and involuntary expressions differed: with age, the difference between authenticity ratings increased (laughter: $R2 = 0.22$, $p < 0.001$; crying: $R2 = 0.26$, $p < 0.001$). The same was true of the contagion ratings (laughter: $R2 = 0.21$, $p < 0.001$; crying: $R2 = 0.10$, $p < 0.001$). Our results suggest a shaping of the response to voluntary sounds over the lifespan, rather than to involuntary sounds. This indicates an important, but differential, role for social factors and experience in learning about the perception of emotional vocalizations.

B25

INDIVIDUAL DIFFERENCES IN AUDITORY EMOTION PROCESSING IN OLDER ADULTS ARE REFLECTED IN BRAIN STRUCTURE

Cesar Lima[1], Nadine Lavan[2], Samuel Evans[1], Zarinah Agnew[3], Sophie Scott[1]; [1]University College London, [2]Royal Holloway University of London, [3]University of Californa, San Francisco — We use a multitude of nonverbal cues to infer others' emotional states in social interactions, such as facial expressions, body postures, touch, or vocal information. Being effective at perceiving these cues is crucial for interpersonal functioning at any age. Although a number of studies report group-level age-related decline in emotion recognition accuracy, much less is known about the neural basis of inter-individual differences at older ages. In this study, 34 older adults (Mage = 59.2 years) and 23 younger ones (Mage = 29.6 years) completed an emotion recognition task in the auditory domain, using nonverbal vocalizations (e.g., laughter, crying, screams). Participants also underwent an MRI scan; T1-weighted volumetric images were acquired in a Siemens Avanto 1.5 Tesla system, including 32-channel head coil. Behaviourally, age-related decrements were observed for positive and negative emotions, but performance varied considerably among older adults: those performing above the median of the group reached youth-like accuracy levels. We conducted a voxel-based morphometry analysis, and found neuroanatomical differences between older adults showing preserved auditory emotion recognition and those showing declining performance: higher performance was associated with increased grey matter volume in bilateral temporal systems known to support vocal communication, and with attenuated structural decline in these systems when compared to younger adults. These differences do not include the primary auditory cortex – they are likely to reflect inter-individual variability in ageing trajectories of systems supporting emotion-specific processes. These results are discussed in relation to theoretical perspectives on emotional ageing.

B26

ANTICIPATION OF A LIVE SOCIAL REWARD MODULATES NETWORK INTEGRATION IN MIDDLE CHILDHOOD

Dustin Moraczewski[1], Laura Anderson[1], Katherine Rice[1], Elizabeth Redcay[1]; [1]University of Maryland - College Park — The motivation to interact with others (i.e., social motivation) is critical to successful social development. However, the neural circuitry supporting social motivation is typically examined using non-interactive rewards (e.g., photographs of faces), which may not capture the dynamics of real-world social interaction. In the current fMRI study, we examined how anticipation of a real-time social interaction modulates reward and social brain systems. We targeted middle childhood because, although this is a period of expanding social spheres and social brain specialization, little is known about the neural circuitry supporting social motivation during this age. Twenty-two children (11 male, mean age = 10.6) participated in a modified incentive delay paradigm. Participants believed that they would receive live feedback from the experimenter on successful trials. We used task-based activation and functional connectivity graph theoretical metrics (e.g. modularity; clustering coefficient) to examine interactions with reward and social brain networks. Whole-brain contrasts show that anticipation of a live ¬¬social reward significantly modulated social reward regions including the orbitofrontal cortex, amygdala, and fusiform gyrus. Further, behavioral ratings of how "live" the social feedback felt were positively related to ventral striatum activity. In examining the integration of reward and social brain regions, we found significantly less modularity during the live condition (i.e. more network integration) and higher network-wide clustering of the ventral striatum. Taken together, these results illustrate changes in functional network organization during the anticipation of an ecologically valid social reward, an important step toward understanding the developing social brain in a real-world context.

B27

NEURAL AND BEHAVIORAL EVIDENCE FOR INFANTS' SENSITIVITY TO TRUSTWORTHY FACES

Sarah Jessen[1], Tobias Grossmann[1,2]; [1]Max Planck Institute for Human Cognitive and Brain Sciences, [2]University of Virginia — Evaluating another person regarding her character traits is essential during social encounters. Previous studies show that adults and preschool-aged children reliably evaluate a person's face with respect to its trustworthiness and dominance. However, it is unclear whether the sensitivity to facial cues of trustworthiness and dominance exists early in development and can therefore be considered an early emerging and foundational aspect of face evaluation. We therefore examined event-related brain responses (ERPs) and behavior (looking time) in 7-month-old infants viewing faces varying parametrically in perceived trustworthiness (Experiment 1) or dominance (Experiment 2). Experiment 1 revealed that infants' looking time increased monotonically with increasing trustworthiness of the face ($F(1,25) = 5.96$, $p=.022$, $\eta2 = 0.19$), suggesting a preference for trustworthy faces. Furthermore, the degree of trustworthiness of the face modulated ERP responses previously linked to emotional face processing in infancy ($F(1.97,51.21)=3.37$, $p=0.043$, $\eta2 = 0.11$). In agreement with prior adult studies, infants' detection of facial cues of trustworthiness seems to rely on processes similar to those used when detecting emotional information from faces. Critically, faces varying with respect to dominance did not elicit any behavioral or neural effects (all $\eta2 \leq .02$) in Experiment 2. Taken together, the current findings shed light on the developmental origins of face evaluation: At the age of 7 months infants are sensitive to facial cues of trustworthiness but not dominance. This suggests that trustworthiness can be considered an early-developing dimension along which faces are discriminated, whereas dominance requires more time and experience to develop.

B28

FURTHER EVIDENCE FOR INCREASED CORTICAL THINNING DURING CHILDHOOD AND ADOLESCENCE IN AUTISM SPECTRUM DISORDER

Cynthia Peng[1], Esha Mehta[1], Kirsten O'Hearn[2], Gregory Wallace[1]; [1]The George Washington University, [2]University of Pittsburgh — Although many studies have found atypical brain structure associated with autism spectrum disorder (ASD), very few to date have explored differences in longitudinal brain changes. Therefore, in the current study we compare longitudinal changes in cortical thickness among youth with ASD versus typically developing (TD) youth. 13 youth with ASD (diagnosed using DSM-IV criteria and both the Autism Diagnostic Interview and the Autism Diagnostic Observation Schedule) and 17 TD youth each provided two anatomic magnetic resonance imaging scans obtained at two time points. Groups were matched on age (ASD scan 1=13.23+/-2.66, scan 2=14.86+/-2.72; TD scan 1=13.75+/-2.45, scan 2=15.52+/-2.49), IQ (ASD=107.69+/-14.09; TD=106.88+/-10.91), and sex ratio (male:female – ASD=11:2; TD=13:4). The CIVET brain-imaging pipeline (v2.0) along with SurfStat image analysis suite were used to derive vertex-level cortical thickness values and complete longitudinal analyses. Annualized change ([thickness time 2–thickness time 1]/duration between scans) in cortical thickness was mapped to the surface across 81,924 vertices and compared between ASD and TD groups. Results revealed several regions where greater cortical thinning was observed in the ASD than the TD group; however, only one area in the left hemisphere that encompasses the insula survived family-wise error correction (at the 0.01 level) for multiple comparisons. Follow-up cross-sectional analyses revealed that this increased cortical thinning was driven by thinner cortex in this same region in the ASD (vs. TD) group at time 2. These findings add to the growing literature suggesting that ASD is characterized by an atypically increased cortical thinning during the dynamic developmental period of adolescence.

B29

EMOTIONAL FACE PROCESSING DEVELOPMENT IN FULL AND PRE-TERM INFANTS: A QUANTITATIVE ELECTROENCEPHALOGRAM STUDY.

Cintli Carolina Carbajal Valenzuela[1], Efraín Santiago Rodríguez[1], Gina Lorena Quirarte[1], Thalía Harmony Baillet[1]; [1]Instituto de Neurobiología, U.N.A.M. — Goals: To test the hypothesis that full-term and pre-term infants differ in their development of emotional face processing. Methods: A comparative, longitudinal study was conducted in premature and term infants at four and eight months of age. Absolute power of the electroencephalogram was analyzed in both groups during five conditions of an emotional face processing task: positive, negative, and neutral faces, non-face and rest. Results: Differences between conditions of the task at four months were limited to rest versus non-rest comparisons in both groups. Eight-month-old born-at-term infants had increases ($p \leq 0.05$) in absolute power in the left occipital region at the frequency 10.16 Hz and in the right occipital region at 3.52, 12.89, and 16.02 Hz during a positive face in comparison to a neutral face. They also had absolute power increases in the left occipital region at 1.95 Hz and in the right occipital region at 2.34 and 3.52 Hz during positive- compared to non-face stimuli. In contrast, positive, negative, and neutral faces elicited the same responses in pre-term infants. Conclusion: Our study provides electrophysiological evidence that emotional face processing develops differently in pre-term infants than in full-term infants, who have bilateral occipital increases in absolute power while processing positive- in comparison to neutral- and non-face stimuli at eight months old, suggesting that premature birth alters brain development mechanisms such as myelination process and consequently complex cognitive functions.

B30

INCREASED PTSD SYMPTOMATOLOGY AND GERIATRIC DEPRESSION RELATE TO DECREASED VOLUME IN CORTICAL AREAS ASSOCIATED WITH SELF-REFERENTIAL AND WORKING MEMORY

Lindsay K. Knight[1], Farah Naaz[2], Brendan E. Depue[2,3]; [1]University of Louisville, Interdisciplinary Program in Translational Neuroscience, [2]University of Louisville, Department of Psychological and Brain Sciences, [3]University of Louisville, Department of Anatomical Sciences and Neurobiology — Previous studies show geriatric depression may double the risk of developing Alzheimer's disease (AD). Individuals with a clinical diagnosis of post-traumatic stress disorder (PTSD) are also at higher risk for depression, as well as AD. Therefore, the aim of the present analyses was to better understand how geriatric depression and/or PTSD may predict morphometric features in brain regions know to be affected in AD (e.g., medial temporal lobe). To do so, we investigated cortical surface-based morphometry of 42 Vietnam War veterans diagnosed with PTSD. Data were obtained from the Alzheimer's Disease Neuroimaging Initiative (ADNI) database, funded by the National Institute on Aging and the National Institute of Biomedical Imaging and Bioengineering. Behaviorally, the Geriatric Depression Scale (GDS) and PTSD symptomatology was correlated within the group ($p=.02$), such that increased depression was related to increased PTSD symptomatology. Subsequently, FreeSurfer morphometric measures (i.e., volume, thickness, and surface area) were regressed with the GDS and lifetime PTSD symptomatology, controlling for age and intracranial volume. Results indicated that decreased volume in the left superior frontal gyrus was related to both increased scores of geriatric depression, as well as more severe PTSD symptoms. Additionally, increased PTSD severity was related to decreased volume in the anterior right temporal lobe (i.e., inferior temporal/fusiform gyrus). These results suggest that increased geriatric depression and greater PTSD severity was associated with 1) prefrontal cortical regions associated with self-referential or working memory (i.e., BA10, medial BA8) and 2) multimodal sensory areas that project to the hippocampus (i.e., anterior fusiform gyrus).

B31

WHITE MATTER MATURATION IN TEMPOROPARIETAL JUNCTION AND ITS CONNECTION TO PREFRONTAL CORTEX SUPPORTS THE EMERGENCE OF THEORY OF MIND

Charlotte Grosse Wiesmann[1], Jan Schreiber[1], Tania Singer[1], Nikolaus Steinbeis[1,2], Angela D. Friederici[1]; [1]Max Planck Institute for Human Cognitive and Brain Sciences, [2]Universiteit Leiden — Understanding what other people think and believe is a hallmark of human cognition and is referred to as Theory of Mind (ToM). In human development, a milestone in ToM is achieved around the age of 4 years when children start understanding that others can have false beliefs about the world. To date, however, it is unclear what determines this developmental breakthrough. In particular, the neural mechanisms supporting this crucial step are unknown. Here, we related this behavioral change from failing to passing false belief tests to the maturation of brain structure in 43 three- and four-year-old children. Conducting a tract-based spatial statistics (TBSS) analysis, we showed that the development of false belief understanding correlated with increased white matter maturation in the core adult ToM network, i.e. right temporoparietal junction (TPJ), medial temporal gyrus, precuneus and medial prefrontal cortex. Probabilistic tractography from seeds in these regions yielded a network connecting temporoparietal and prefrontal brain regions. Children's false belief performance correlated in particular with connectivity between the TPJ and the anterior inferior frontal gyrus (IFG) via the arcuate fascicle. These associations were independent of any co-occurring development of language or executive functions and differed from earlier-developing anticipatory looking false belief tasks. The present findings thus indicate that both, white matter maturation in brain regions that support belief processing in adults, as well as an increased connectivity of the dorsal pathway connecting the belief processing region TPJ to the IFG pave the way for the emergence of a mature ToM.

B32

AN ALE META-ANALYSIS OF FACIAL PROCESSING IN AUTISM

Zachary Grulke[1], Edward Hubbard[1]; [1]University of Wisconsin-Madison — People with autism spectrum disorders (ASD) often have social deficits that are tied to facial processing (e.g., Golari et al., 2006). The aim of the current study was to identify consistent differences between the brain regions recruited by typically developing (TD) individuals and individuals with ASD when they process faces throughout development. We therefore conducted an Activation Likelihood Estimation (ALE) meta-analysis of face processing in ASD. We included studies that used whole-brain scans that focused on facial processing tasks (e.g. determining in faces were familiar and responding to emotional faces), and directly compared activation in individuals with ASD to activation in TD individuals. Peak voxel coordinates and sample sizes were entered into GingerALE (v. 2.3) to create ALE maps, and data were visualized in Mango (v. 3.5.1). Initial results replicate previous findings (Aoki et al., 2014; Nomi & Uddin, 2015) showing that ASD individuals had reduced activation in the extended face network, including the fusiform face area (FFA), fusiform gyrus, and the amygdala, than did TD individuals. In contrast, our meta-analysis identified no regions that were more strongly activated in ASD than in TD individuals. However, previous meta-analyses have examined differences between groups without considering development. Differences in adults may be consistent with early differences, or due to differential experiences with faces (due to reduced attention to them). We will therefore conduct further analysis to explore potential age x diagnoses interactions consistent with atypical developmental trajectories in the neural mechanisms underlying facial processing.

B33

NEURAL CONNECTIONS FOSTER SOCIAL CONNECTIONS: A DIFFUSION-WEIGHTED IMAGING STUDY OF SOCIAL NETWORKS

William Hampton[1], Ashley Unger[1], Rebecca Von Der Heide[1], Ingrid Olson[1]; [1]Temple University — While we know adolescence is a period marked by important social and neural development, little is known about how an adolescent's social network size might affect neurocognitive development or vice versa. Neuroimaging research has identified several brain regions, such as the amygdala, as key to this affiliative behavior. However, white matter connectivity among these regions, and its behavioral correlates, remain unclear. Here we tested two hypotheses: that an amygdalocentric structural white matter network governs social affiliative behavior and that this network changes during adolescence. We measured social network size behaviorally, and white matter microstructure using probabilistic diffusion tensor imaging in a sample of neurologically normal adolescents and young adults. Our results suggest amygdala white matter microstructure is key to understanding individual differences in social network size, with

connectivity to other social brain regions such as the orbitofrontal cortex and anterior temporal lobe predicting much variation. In addition, participant age correlated with both network size and white matter variation in this network. These findings suggest that amygdala white matter is key to understanding individual differences in social network size, and that adolescence may constitute a critical period for the optimization of structural brain networks underlying affiliative behavior.

EMOTION & SOCIAL: Emotion-cognition interactions

B34

ADHD AND EMOTION DYSREGULATION: AN ISSUE WITH TOP-DOWN OR BOTTOM-UP PROCESSING OF EMOTIONAL STIMULI?

Brittany Alperin[1], Christiana Smith[1], Sarah Karalunas[1]; [1]Oregon Health and Science University — Emotion dysregulation is prevalent in adolescents with attention deficit/hyperactivity disorder (ADHD) and is related to clinical impairment, but substantial heterogeneity exists. Within ADHD, subgroups of children experience difficulty regulating either positive/approach emotions or negative/withdrawal emotions; however, the mechanisms underlying these differences remain unclear. Context-specific problems with emotion regulation may reflect differences in bottom-up emotional reactivity, top-down emotion regulation, or both. In the current study, event-related potentials were collected from 60 adolescents (30 with ADHD, mean age=13 years) while they completed an emotional go/no-go task with three conditions: happy (positive/approach), fear (negative/withdrawal), and neutral. The N170 was used as a marker of bottom-up attention capture by emotional face stimuli and the late positive potential (LPP) was used as a marker of top-down emotion processing. Ratings of emotional response style were collected using the well-validated Early Adolescent Temperament Questionnaire. Consistent with prior literature, typically-developing adolescents exhibited a larger N170 to fearful faces and a larger LPP to fearful and happy faces. Neither the N170 nor LPP differed between emotion conditions for adolescents with ADHD, likely due to within group heterogeneity. Within the ADHD group, N170 responses to happy faces predicted ratings of positive/approach emotion dysregulation, whereas LPP to fearful faces predicted negative/withdrawal emotion dysregulation. Results suggest dysregulation of positive/approach-related emotions in ADHD is driven by bottom up over-reactivity, whereas dysregulation of negative/withdrawal-related affect reflects a decrease in top-down control. These findings help clarify pathophysiological mechanisms of emotion dysregulation in ADHD, which is essential for developing interventions that directly target mechanisms of impairment.

B35

THE PARIETAL BRAIN ACTIVATION IN PROCESSING FACIAL EXPRESSION AND EMOTIONAL PROSODY

Shih-Tseng T. Huang[1,2], Ming-Chun Lee[1]; [1]Department of Psychology, National Chung-Cheng University, Taiwan, [2]Center for research in Cognitive Science, National Chung-Cheng University, Taiwan — Twenty young adults participated in an ERP experiment measuring the brain activation in processing acoustic emotional prosody and facial expression. Congruous and incongruous of angry and sad face and voice were presented. In each congruous pair, an angry (or sad) voice fragment accompanied with a congruous angry (or sad) facial expression. Each incongruous pair contained an angry voice prosody was paired with a sad face, or a sad face paired with an angry voice. In each run there were two kinds of percentage in combinations of the congruous and incongruous trials. Five runs contained 85% congruous trials (as standard pairs) and 15% incongruous trials (as deviant pairs). The other five runs contained 85% incongruous trials and 15% congruous trials. The results found both P120 and N170 at Pz were higher than Fz and Cz and N170 at Cz was higher than Fz. It was found that higher mean amplitudes (MAs) of P300-500 at Fz, Cz, and Pz on incongruous trials when presented as standard. It was also found higher activation of P300-500 at Fz on congruous trials when presented as deviants. Similar results were found in P500-800 at Fz and Pz. And, right hemisphere with higher activation in P300-500 at P4 than at P3. The Results suggested higher activation in processing emotional information at parietal lobes from early stage. Furthermore, a higher activation in the frontal lobes and at right parietal lobe in the integration the emotional information of face with voice of P300-500.

B36

WHEN NEUTRAL TURNS SIGNIFICANT: BRAIN DYNAMICS OF RAPIDLY FORMED ASSOCIATIONS BETWEEN NEUTRAL STIMULI AND EMOTIONAL CONTEXTS

Mathias Weymar[1], Carlos Ventura-Bort[1], Andreas Löw[2], Julia Wendt[1], Florin Dolcos[3], Alfons O. Hamm[1]; [1]University of Greifswald, [2]University of the Federal Armed Forces Hamburg, [3]University of Illinois at Urbana-Champaign — The capacity to associate neutral stimuli with affective value is an important survival strategy. In the present study we used event-related potentials (ERPs) to investigate brain dynamics of associative emotional learning when participants were confronted with multiple heterogeneous information. Thirty-one participants viewed 144 different objects (e.g., household objects, tools) in the context of 144 different emotional and neutral background scenes. During each trial, neutral objects were shown in isolation and then complemented by the background scene. All 144 pairings were presented once and repeated in a second block (random order), to compare ERPs in response to neutral objects before and after single association. Our results showed clear differences in the ERPs at early and late stages of processing. After single pairing, neutral objects previously encoded in the context of emotional scenes, evoked a larger P100 over occipital electrodes in the time range between 140 and 180 ms, compared to objects previously paired with neutral scenes (second block). Likewise, larger late positive potentials (LPP) were observed over centro-parietal electrodes (400-700 ms) for objects from emotional contexts, relative to neutral contexts. The data provide evidence for fast associative learning even when confronted with heterogeneous information. Our electrophysiological results indicate heightened perceptual and sustained elaborative processing for neutral information when previously encoded in emotional context, which could assist in understanding binding mechanisms in anxiety and stress.

B37

STRUCTURAL BRAIN CORRELATES OF CALLOUS-UNEMOTIONAL TRAITS AND/OR AGGRESSION IN TYPICALLY-DEVELOPING ADOLESCENTS

Nora Maria Raschle[1], Willeke Martine Menks[1], Lynn Valérie Fehlbaum[1], Iyad El Qirinawi[1], Graeme Fairchild[2], Stephane de Brito[3], Beate Herpertz-Dahlmann[4], Christine Freitag[5], Christina Stadler[1]; [1]Psychiatric University Clinics Basel, CH, [2]University of Southampton, UK, [3]University of Birmingham, UK, [4]RWTH Aachen, DE, [5]J.W. Goethe University Hospital Frankfurt, DE — Conduct disorder (CD) characterized by severe aggressive and antisocial behaviour in youth displays distinct behavioural and neuronal characteristics. However, callous-unemotional (CU) traits are suggested to delineate a meaningful subtype within CD as indicated by genetic, behavioural and neuroimaging research (e.g., structural changes within amygdala, prefrontal cortex, insula). To date, CU traits have been almost exclusively studied in clinical samples displaying additional problems (e.g., aggression). It is thus not possible to know whether the observed alterations in brain structures are associated with the CU traits per se or a combination of CU traits and corresponding CD symptoms. We collected structural neuroimaging in 223 typically developing children as part of the ongoing FemNAT-CD project (FP7no602407). Participants were characterized using standardized clinical interviews/testing, including assessments targeting CU traits/aggression. Individuals were assigned CU status according to the presence/absence of CU traits (CU+/CU-) and aggression. Restricted by the smallest group (CU-/aggression) voxel-based morphometry was performed in 78 individuals using an extreme-groups approach (mean 13y; each subgroup N=18; gender, age, site-matched). Analysis using standard pre-processing and DARTEL normalization/smoothing preceded a 2-by-2-full-factorial analysis (with/without callousness/aggression). Significant main effects of callousness (bilateral amygdala, anterior/middle cingulate) and aggression (inferior parietal/occipital) were identified as well as an interaction effect within areas including right insula, cingulate and frontal cortices ($p<0.005$, $k=10$). Post-hoc two sample-T-tests and ROI analyses provide further indication for the direction and effect within each subgroup (with/without CU traits/aggression). We provide evidence that there are both unique and common effects of CU traits and aggression on adolescent brain structure.

B38

SEROTONERGIC MODULATION OF AMYGDALA CONNECTIVITY DURING VIRTUAL AGGRESSION

Martin Klasen[1], Dhana Wolf[1], Patrick Schelenz[1], Krystyna Mathiak[2], René Weber[3], Mikhail Zvyagintsev[1], Florian Zepf[4], Klaus Mathiak[1]; [1]RWTH Aachen University, Department of Psychiatry, Psychotherapy, and Psychosomatics, [2]RWTH Aachen University, Department of Child and Adolescent Psychiatry, Psychotherapy, and Psychosomatics, [3]University of California Santa Barbara, Department of Communication, [4]University of Western Australia, School of Paediatrics and Child Health — Neural transmission in serotonergic amygdala projections have been discussed as contributing to the emergence of aggressive behavior. In a previous study (Klasen et al., 2013), the serotonergic antipsychotic quetiapine modulated functional amygdala connectivity during virtual aggression. Changes in amygdala connectivity were accompanied by changes in state aggression. However, it remains unclear whether these brain-behavior effects can be attributed to the modulation of serotonergic projections. The present fMRI study investigated the selective serotonin effects on the neural correlates of aggression in 39 healthy male participants in a double-blind and placebo-controlled cross-over design. On three separate days, serotonergic transmission was enhanced by the selective serotonin reuptake inhibitor (SSRI) escitalopram, reduced via acute tryptophan depletion (ATD), or unaltered in a placebo condition. In accordance with previous studies (Mathiak and Weber, 2006; Weber et al., 2006; Klasen et al., 2013), virtual violence during a video game served as model for aggression during the fMRI measurements. To study cortico-limbic connectivity, the amygdala served as anatomically a priori defined seed region. Serotonin modulation effects (SSRI, ATD, and placebo) on functional amygdala connectivity were calculated in a repeated measures ANOVA and subsequent post-hoc tests. Connectivity between amygdala and bilateral Nucleus accumbens increased linearly with higher available serotonin. Conceivably, the transmitter synchronizes the amygdala with the brain reward system and may thus enhance the rewarding value of aggressive acts.

B39

MOBILE MOOD TRACKER (MMT): A MOBILE HEALTH APP TO ASSESS MOOD STATES IN DEPRESSION

Mor Nahum[1], Tom Van Vleet[1,2], Vikram Rao[3], Julie Mirzabekov[3,4], Vikaas Sohal[3], Deanna Wallace[3], Morgan Lee[3], Alit Stark-Inbar[1,4], Heather Dawes[3], Michael Merzenich[1], Edward Chang[3]; [1]Posit Science Corporation, San Francisco, [2]Veterans Administration, Martinez, [3]UC San Francisco, [4]UC Berkeley — Depression is characterized by a range of emotional, cognitive and behavioral symptoms. Lack of inter-treatment patient-provider continuity contributes to the high relapse rate in depression, emphasizing the need to develop tools that facilitate patient monitoring outside the clinic. To this end, we developed a Mobile Mood Tracker (MMT) application, designed to provide remote ecological momentary assessment of emotional and cognitive states using a combination of validated questionnaires (PHQ-9, GAD-7), a novel immediate mood scaler (IMS; a 22-item rating scale), and the Emotion Matcher (EM), a behavioral assessment to implicitly capture attention biases in depression using emotional faces. 86 participants (age: 34.5±12 years), with depression levels ranging from minimal (n=22) to severe (n=23) completed the MMT assessments. The results indicated that both GAD-7 ($r=0.76$, $p<.0001$) and IMS ($r=0.61$, $p<.001$) scores were correlated with PHQ-9. A hierarchical linear regression model predicting PHQ-9 score (n=29) showed that 51% of the variance was accounted for by a model combining IMS and EM, confirming the validity of these two measures to predict depressed mood. In addition, in the 52 participants that completed two or more MMT sessions, IMS variability across sessions showed an interesting pattern of correlation with depression level: minimal-to-mildly depressed individuals showed positive correlation (n=27, $r=.43$; $p<.03$), moderately depressed individuals showed no correlation (n=16; $r=.28$), and severely depressed individuals showed negative correlation (n=10, $r=.85$; $p<.002$) with level of depression. Together, these data provide evidence for the effectiveness of MMT as a remotely-deployed tool to assess current mood state and mood changes over time.

B40

INTOLERANCE OF UNCERTAINTY IS ASSOCIATED WITH RESPONSE DISINHIBITION DURING ANTICIPATION OF PUNISHMENT, NOT REWARD

Jessica Lake[1], Zachary Infantolino[2], Laura Crocker[3], Jeffrey Spielberg[4], Cindy Yee[1], Wendy Heller[5], Gregory Miller[1,5]; [1]University of California, Los Angeles, [2]University of Delaware, [3]VA San Diego Healthcare System, [4]VA Boston Healthcare System, [5]University of Illinois at Urbana-Champaign — Intolerance of uncertainty (IU) is associated with excessive worry and increased activation in regions implicated in emotion processing. Although high IU is typically assumed to have maladaptive consequences, particularly for the anticipation of aversive outcomes, its modulation of performance has rarely been examined, and differential effects during the anticipation of positive versus negative outcomes have yet to be explored. This study investigated whether IU differentially affects performance and neural activity during the anticipation of uncertain negative and positive outcomes contingent on performance and explored whether IU effects were driven primarily by the prospective or inhibitory anxiety subscale, which are thought to reflect anxiety about future events and how uncertainty inhibits behavior, respectively. During fMRI, participants performed a modified monetary incentive delay task during which they were motivated by possible reward and/or punishment contingent on reaction time. Greater IU was associated with faster reaction time and reduced activation in regions associated with response inhibition on punishment-possible relative to no-punishment-possible trials. Given that response disinhibition was associated with higher inhibitory anxiety scores, the subscale may be better conceptualized as a measure of the degree to which uncertainty influences behavior, rather than how much it specifically inhibits behavior. In contrast, reward anticipation did not modulate performance or neural activity. Activity in right inferior frontal gyrus partially mediated the relationship between IU and reaction time during punishment anticipation. These findings suggest that in nonclinical populations IU modulates motivated behavior via the disinhibition of responding during punishment but not reward.

B41

AN ERP STUDY OF FRONTAL AND RIGHT PARIETAL ACTIVATION IN PROCESSING FACE AND VOICE

Ming-Chun Lee[1], Shih-Tseng Huang[1,2]; [1]Department of Psychology, National Chung-Cheng University, Taiwan, [2]Center for research in Cognitive Science, National Chung-Cheng University, Taiwan — Congruous and incongruous faces and voices of angry and sad emotion were presented. In a congruous angry (or sad) pair, an angry (or sad) face was presented with an angry (or sad) tone. The incongruous angry pairs contained an angry face presented with a sad tone, or a sad face with an angry tone. Similarly, the incongruous sad pairs contained sad face with neutral tone or neutral face with sad tone. Twenty young adults participated. In the event-related potential procedure, in half of the runs, congruous emotional pairs trials were presented in 85% and the incongruous pairs were in 15% of the trials. In the other half, congruous trials were presented in 15% and incongruous pairs were in 85% of the trials. The results found higher mean amplitudes (MAs) of P300-500 on congruent than on incongruent pairs. It was also found a significant interaction of emotion and sex on P300-500 at F3 and F4, suggesting male participants performed higher activation on the incongruent trials than on the congruent trials. Higher activation was found at right parietal lobe of P4 than at left of P3 in P300-500. When 85% of the trials were congruous, higher activation was found at right (P4) than of left parietal (P3) lobe in P500-800. The results suggested that males tended to perform higher activation of P300-500 on the incongruent trials than females and compared to the left parietal lobe, a higher activation of right parietal lobe was found.

B42

THE PROCESSING OF MORAL SALIENCE DURING A SEMANTIC ASSOCIATION TASK

Gunes Sevinc[1,2], Nathan Spreng[1]; [1]Cornell University, Ithaca, [2]Yildiz Technical University, Turkey — The neural correlates of morality have been associated with the default network for its role in mental simulation. However, little is known about how the moral content of a stimulus is initially processed, and how this processing is influenced by moral valence. To investigate this relationship, we examined neural correlates of detecting

moral salience and the consecutive processing of moral content with fMRI in 22 young adult participants. In this task, participants read a brief vignette, then completed the vignette by selecting one of two related sentences. The correct, most semantically related sentence, and the incorrect sentence options involved immoral, moral or neutral statements . The processing of moral salience was implicit to the task. Analysis of RT data revealed that semantically correct neutral statements were the fastest to process and immoral statements were the slowest. Neuroimaging data were analyzed with partial least squares. The first latent variable dissociated both the moral and immoral conditions from the neutral. Moral and immoral response selection engaged dorsal anterior cingulate, medial prefrontal and posterior cingulate cortex, the temporoparietal junction, and anterior insula. A second latent variable dissociated the immoral from moral conditions. For the immoral condition, the temporal unfolding of neural activity engaged the temporoparietal junction and right superior temporal sulcus at the initial phases; and anterior insula and medial frontal regions later. These results suggest a contribution of the salience network to moral processing, in addition to the default network, and emphasize studying moral cognition within the framework of dynamic network interactions.

B43

PRESTIMULUS BRAIN ACTIVITY ENHANCES THREAT PERCEPTION

Tamara Sussman[1], Akos Szekely[1], Aprajita Mohanty[1]; [1]Stony Brook University — Research on the perceptual prioritization of threatening stimuli has focused primarily on the physical characteristics and evolutionary salience of these stimuli. However, perceptual decision-making is strongly influenced by prestimulus factors such as goals, expectations, and prior knowledge. Using functional magnetic resonance imaging (fMRI), we test the hypothesis that prior threat-related information and related increases in prestimulus activity play a key role in subsequent threat-related perceptual decision-making. After viewing threatening and neutral cues, participants detected perceptually degraded threatening and neutral faces presented at individually pre-determined perceptual thresholds in a perceptual decision-making task. Threat cues improved both perceptual sensitivity and the speed of detection. In anticipation of threatening faces, threat cues were associated with greater activity in superior temporal sulcus (STS), a key brain region involved in emotional face processing. Threat cues were also associated with subsequent increases in activity in the fusiform gyrus for all faces and in the amygdala specifically for threatening faces. Finally, threat cue-related STS activity predicted subsequent improvement in the speed and precision of perceptual decisions. Present findings establish the importance of top-down factors and prestimulus neural processing in understanding how the perceptual system prioritizes threatening information.

B44

DOES CONTEXT LEARNING GUIDE THREAT DETECTION: A COMPARISON OF THREAT AND NON-THREAT TARGETS

Akos Szekely[1], Suparna Rajaram[1], Aprajita Mohanty[1]; [1]Stony Brook University — It is hypothesized that threatening stimuli are detected better due to their salience or physical properties. However, these stimuli are typically embedded in a rich context, motivating the question whether threat detection is facilitated via learning of contexts in which threat stimuli appear. Learning of regularities within visual contexts is known to guide faster detection of embedded targets (Ls and Ts in contextual cueing effect). Using a variant of the contextual cueing paradigm in Experiment 1, we presented new or old spatial configurations consisting of schematic faces and established that context learning facilitates detection of non-threatening schematic faces. In Experiments 2 and 3, we used threatening and non-threatening schematic faces as embedded targets within each experiment and found that when participants are required to detect both types of stimuli within one sequence of learning experiences, detection of threatening faces is facilitated through context learning, while this effect reverses for non-threatening faces. Present findings establish context learning for threat detection and show that this learning obstructs context learning for non-threatening targets. These findings show that, in addition to the importance of stimulus salience shown in the literature, learning of context facilitates threat detection. This detection is driven not only by stimulus properties as theorized traditionally but also by the learning of contexts in which threatening stimuli appear. Further work may focus on how context learning of threat may contribute to the development and maintenance of PTSD and anxiety disorders.

EXECUTIVE PROCESSES: Development & aging

B45

ADHD INTERACTS WITH AGE TO PREDICT THETA RELATIVE POWER IN YOUNG CHILDREN (AGES 3-7 YEARS)

Jenna Snyder[1], Margaret Sheridan[1]; [1]University of North Carolina, Chapel Hill — Resting electroencephalogram (EEG) in children diagnosed with ADHD (8 years and older) is characterized by elevated theta, decreased beta, and elevated theta/beta ratios compared to peers (Loo 2012). Few studies have examined resting EEG in children with and without ADHD younger than 7 . Because early childhood is an important one for the stabilization of symptoms of ADHD (Law, 2014) learning more about the neural correlates of ADHD in this age range is of primary importance. Participants (N= 174) ages 3 y – 7 y 3m participated in eyes-open resting (EEG). Recordings were acquired using a EGI 128 HydroCel Sensor Net in NetStation (250Hz sampling, 0.1 to 100.0 Hz bp filter) and the power density spectrum was extracted using EEG Lab in Matlab. Participants (N=96; 74 Male) did and did not (N=78; 45 Male) meet criteria for ADHD. There was no main effect of diagnosis on relative power in any frequency band (theta[5-8Hz], alpha [9-11Hz], beta [12-30Hz]) for any electrode. However, there was a significant age x diagnosis interaction for relative power in theta and beta over right parietal ($p=0.001$; $p=0.025$ respectively); in theta power over occipital ($p=0.004$) and in beta power over left parietal ($p=0.037$) and for the theta/beta ratio over left frontal ($p=0.026$), right parietal ($p=0.001$), and occipital ($p=0.043$) scalp cites. Children who met criteria for ADHD had larger changes in EEG power with age than controls. The presence of an age by diagnosis interaction likely reflects the extensive developmental change in this population in early childhood.

B46

SLEEP DISTURBANCE IS ASSOCIATED WITH LOWER EXECUTIVE CONTROL NETWORK AND DEFAULT MODE NETWORK CONNECTIVITY IN OLDER ADULTS

Kristine Wilckens[1], Helmet Karim[1], Howard Aizenstein[1], Daniel Kay[1], Daniel Buysse[1]; [1]University of Pittsburgh School of Medicine — Disturbed sleep is commonly associated with poor executive function in older adults. Sleep involves neural synchrony over the frontal cortex. Disruption of this process may weaken connections of the executive control network. Alternatively, sleep may indirectly affect executive function through the salience network which allocates attentional resources and initiates switching between executive control and default mode networks. Using subjective sleep disturbance assessed with the Hamilton Depression Questionnaire and resting-state functional connectivity in 42 older adults with depression, we assessed whether sleep disturbance was associated with connectivity in the executive control network, default mode network, and salience network. Each subject-specific region-of-interest to region-of-interest connectivity matrix was thresholded at $r<0.19$ to target the strongest functional connections. Sleep disturbance measured by the summed sleep disturbance score was significantly associated with lower connectivity in the left executive control network, rho = -0.35, $p=0.02$, and the default mode network rho = -0.24, $p=0.02$. The relationship in the executive control network remained significant after controlling for age, sex, and depressive symptoms. Sleep disturbance was not significantly associated with the right executive control network or the salience network; nor did the salience network mediate relationships between sleep disturbance and the executive control or default mode network. We conclude that older adults' self-report sleep is associated with lower connectivity in networks commonly associated with executive function. Future work will investigate whether specific sleep features, such as slow-wave sleep generated by the frontal cortex, may drive the putative effect of sleep on connectivity of the executive control network.

B47

NEURAL CORRELATES OF EXECUTIVE FUNCTION INDEX MEMORY PRESERVATION IN OLD AGE

Kelly Polnaszek[1], Nicole Dosamantes[1], Sina Malekian[1], Robert Morrison[1]; [1]Loyola University Chicago — While preservation of the ability to learn new information is critical for successful aging, relatively little is known about the factors contributing to its variability in old

age. Likewise, deficits in long-term memory abilities are a diagnostic factor in Alzheimer's disease and its precursor, Amnestic Mild Cognitive Impairment. Research has suggested that executive function may be a critical factor in determining memory function, particularly when medial temporal lobe experiences degeneration. To investigate this interaction we recruited 39 older adults from the Northwestern University Cognitive Neurology and Alzheimer's Disease Center Clinical Core and divided them into three groups based on age and long-term memory ability as measured using the RAVLT Delay (Memory-Matched Controls: 65-79 YO, RAVLT M=11.5; Age-Matched Older Controls: 80-89 YO, RAVLT M = 5.7; Super-Agers: 80-91 YO, RAVLT M = 11.5). All participants completed a mutli-task testing session including completing a visual Go-No-Go task while recording their brain waves using scalp electroencephalography (EEG). The groups did not differ in either trial accuracy or RT; however, No-Go accuracy was significantly correlated with RAVLT score across groups (r=.50). Event-related potentials (ERPs) demonstrated distinct patterns of neural activity across groups. Specifically, Super-Agers showed an enhanced left-frontal P2 ERP relative to age matched and younger controls. Super-Agers show a similar No-Go/Go subtraction P300 ERP relative to younger memory-matched controls, but greater than their age matched peers. Together these results suggest that executive function and the corresponding cognitive control network may be an important factor in preserving memory function in old age.

B48

AGE-RELATED DIFFERENCES IN THE NEURAL CORRELATES OF TRIAL-TO-TRIAL VARIATIONS OF REACTION TIME

Nancy Adleman[1], Gang Chen[2], Richard Reynolds[2], Anna Frackman[3], Varun Razdan[4], Daniel Weissman[5], Daniel Pine[2], Ellen Leibenluft[2]; [1]Catholic University of America, [2]National Institute of Mental Health, NIH, [3]Harvard Medical School, [4]Virginia Tech Carilion School of Medicine, [5]University of Michigan — Intra-subject variation in reaction time (ISVRT) is a developmentally-important phenomenon that decreases from childhood through young adulthood in parallel with the development of executive functions and networks. Prior work has shown a significant association between trial-by-trial variations in reaction time (RT) and trial-by-trial variations in brain activity as measured by the blood-oxygenated level-dependent (BOLD) response in functional magnetic resonance imaging (fMRI) studies. It remains unclear, however, whether such "RT-BOLD" relationships vary with age. Here, we determined whether such relationships vary with age in a cross-sectional design. Replicating prior findings, we observed strong RT-BOLD relationships in many brain regions including the fronto-parietal association cortex and thalamus. In addition, some of these relationships were negative (increased BOLD associated with decreased RT) at around the time of stimulus presentation and positive several seconds later. Finally, greater peak activation in fronto-parietal cortex and other key brain regions in trial N was associated with faster RT in trial N+1. Critically for present purposes, all RT-BOLD relationships increased with age. Thus, RT-BOLD relationships may serve as "biomarkers" of development.

B49

TYPICAL DEVELOPMENT OF ASSOCIATIVE LEARNING: GREATER CONTRIBUTION OF STIMULUS SALIENCY IN ADOLESCENCE.

Alaina Pearce[1], Kathleen Farr[1], Chandan Vaidya[1,2]; [1]Georgetown University, [2]Children's Research Institute — Associative learning (AL) involves acquisition of predictive relationships between two stimuli, which depends upon stimulus saliency (e.g, novelty), a bottom-up attentional process. AL also requires flexible updating of associations through processes dependent on top-down executive function such as unlearning associations and learning associations with previously irrelevant stimuli. The Learned Irrelevance (LIrr) paradigm examines these processes by manipulating cue-target associations in a letter detection task. Cue-target pairing is either random or predictive, with predictive associations cued by either a novel or previously irrelevant letter. Faster responses for predictive than random associations indicates AL, with more AL observed for novel than previously irrelevant cues indicating LIrr, reflecting updating processes. While executive processes mature progressively in typical development, adolescence is marked by heightened sensitivity to novelty, providing a useful model for examining bottom-up and top-down processing in AL. Three groups (children: n=24; 7-10.5 years; adolescents: n=24; 11-14.5 years; young adults: n=26) completed the LIrr paradigm and a neuropsychological measure of executive function, the Dellis-Kaplan Executive Function System. We hypothesized that heightened sensitivity to novelty in adolescents would result in a larger LIrr effect, indicated by a greater difference between AL for novel and previously irrelevant cues. Indeed, we observed better AL and more LIrr for adolescents. Executive function was associated with AL, with a step-wise regression model indicating cognitive flexibility was most predictive. Thus, AL is differentially sensitive to stimulus saliency through the time course of typical development.

B50

ASSOCIATION OF DEMENTIA RISK FACTORS AND EX-GAUSSIAN REACTION TIME COMPONENTS OF THE STROOP TASK.

Dhawal Selarka[1,2], Lynn Hasher[1,2], Larry Leach[2], Kelly Murphy[1,2], Gillian Rowe[2], Malcolm Binns[2], Brian Levine[1,2], Angela Troyer[1,2]; [1]University of Toronto, [2]Rotman Research Institute, Baycrest Health Sciences — It has been well documented that subjective memory complaints and a family history of Alzheimer's disease can be associated with neurological pathology well before diagnosis. Detecting cognitive changes at this early stage can be difficult. Recent research with reaction time (RT) tasks has begun to focus on the tau parameter, that is, the elongated tail of the ex-Gaussian distribution, as a measure of response time inconsistency. Previous studies using the Stroop task have found that the RT tau statistic (on the incongruent condition only) can be used to differentiate between participants who later go on to develop dementia and those who do not, whereas the mean RT is not sensitive to these subgroup differences. We examined tau estimates on the incongruent condition of an internet-administered Stroop task in a sample of 400 middle age and older adults, and found these were associated with the dual presence of memory complaints and family history of dementia. This effect was not found when analyzing the other features of the RT distribution (i.e. the mean or standard deviation), or in any of the other Stroop conditions (i.e. neutral or congruent). Therefore, measures of RT inconsistency can be sensitive to subtle cognitive changes associated with subjective memory complaints and a family history of dementia; future work will focus on examining how the tau parameter relates to brain function.

B51

TASK-SPECIFIC CONNECTIVITY AND RESPONSIVENESS OF DISTRIBUTED FUNCTIONAL BRAIN NETWORKS PREDICT PERFORMANCE AND MEDIATES AGE-RELATED COGNITIVE DECLINE ACROSS TASKS

David Samu[1], Karen L Campbell[2], Meredith A Shafto[1], . Cam-CAN[3], Lorraine K Tyler[1]; [1]University of Cambridge, [2]Harvard University, [3]Cambridge Centre for Ageing and Neuroscience (Cam-CAN), University of Cambridge — Ageing is accompanied by cognitive decline in some domains, such as long-term memory and fluid intelligence, while cognition is preserved in others, like language comprehension or crystallised intelligence. Performing a complex cognitive task is thought to require the orchestrated co-activation and suppression of specific neural networks across distributed regions of the brain. In the present study, we tested the hypothesis that decline in task-evoked responsiveness and coupling of domain-specific and domain-general brain networks is one of the functional mechanisms responsible for age-related cognitive decline. Using a population-derived sample from the Cambridge Centre for Ageing and Neuroscience (www.cam-can.org) project (N=98, aged 23-87), we carried out an Independent Components Analysis on fMRI data from 3 different cognitive tasks. Cognitive performance was related to responsivity and functional connectivity of task-relevant brain networks for two tasks exhibiting age-related cognitive decline (fluid intelligence and picture naming) and for a cognitively preserved task (syntactic comprehension). Our results indicate that 1) task-specific responsiveness and functional connectivity predict cognitive performance in all three tasks, 2) age-related change in the two declining tasks is significantly mediated by strong concurrent decline in the responsiveness of task-relevant networks, and 3) preserved cognition during syntactic comprehension is associated with the lowest degree of age-related change in network responsiveness and connectivity. Collectively, these results point to task-evoked responsiveness and connectivity of distributed

brain networks, required for successful cognition throughout the adult lifetime, as potential functional markers of cognitive decline in age-affected cognitive domains.

EXECUTIVE PROCESSES: Goal maintenance & switching

B52

WHITE MATTER AND TASK-SWITCHING: A DIFFUSION TENSOR IMAGING STUDY

Antonino Vallesi[1], Eleonora Mastrorilli[1], Alessandra Bertoldo[1]; [1]University of Padova, Italy — The capacity to flexibly switch between different task rules has been previously associated with distributed fronto-parietal networks, predominantly on the left hemisphere but with an additional right prefrontal recruitment with non-verbal rules. It is thus likely that the white matter connectivity between these regions is critical in sustaining the flexibility required by task-switching. Thus, this study examined the relationship between white matter microstructure and task-switching performance in different paradigms: classical color-shape, spatial-only and verbal-only tasks. The main results showed a role of anterior portions of the corpus callosum (genu and body) in sustaining better task-switching performance. In particular, a higher fractional anisotropy and a lower radial diffusivity in these white matter regions were associated with smaller mixing costs both in the spatial task-switching paradigm and in the color-shape one. No association was found with behavioural measures obtained in the verbal version. The results are interpreted by suggesting that a more efficient inter-hemispheric connectivity is especially necessary, within the frontal lobes, when the task-switching capacity has to be applied to tasks with non-verbal components, which are likely to recruit right prefrontal regions together with left prefrontal regions classically involved in task-switching.

B53

NEURAL SYNCHRONY FOR COGNITIVE CONTROL: A COMPUTATIONAL MODEL

Tom Verguts[1]; [1]Ghent University — A core aspect of cognitive control is how arbitrary task rules are rapidly implemented (e.g., within the time frame of a typical psychology experiment). Despite the broad empirical research interest in this question over recent years, it lacks a compelling theoretical account. I propose a neural synchrony model for cognitive control, combining the concept of binding-by-synchrony that is familiar from visual perception and attention (Fries, 2005; Gray & Singer, 1989) with earlier learning models for the implementation of instructions (Ramamoorthy & Verguts, 2012). The model implements "binding by random bursts", in which a prefrontal area (medial frontal cortex; MFC) enhances the strength information transmission to a cortical processing area from just one of its afferent projection areas by transient, synchronizing, input to both areas. This input is a random and unselective theta-frequency (approx. 5 Hz) burst. The choice of posterior areas that are affected is determined by interaction between the MFC and the lateral frontal cortex (LFC). I test model performance on a classical problem for cognitive control – the Stroop task. I demonstrate that greater MFC theta power causes better (behavioral) performance, along with greater gamma-frequency (approx. 40 Hz) power in posterior processing areas, stronger gamma-frequency synchrony between posterior processing areas, and stronger theta-gamma phase-amplitude coupling both within and between areas. Thus, the model solves the central computational problem for cognitive control of rapidly implementing arbitrary task rules, whilst making rich contact with extant behavioral and neurophysiological data.

B54

ANTICIPATED TEMPORAL DELAY TRIGGERS DISTINCT TYPES OF PROACTIVE CONTROL: DOUBLE DISSOCIATION WITH EEG

Jacqueline Janowich[1], James F. Cavanagh[1]; [1]University of New Mexico — AX-CPT (AX) is a standard task used to assess expectancy in cognitive control, but task timing varies between studies and correlates with systematic differences in performance. This timing- behavior interaction suggests that task timing may instantiate distinct control processes. Here, we investigate how proactive (preparatory) control is instantiated based on known timing delays between an informative cue and its paired test probe. We recorded EEG (n=33) in AX with separate blocks of short and long cue-probe delays. Behavioral Shift Index (BSI), indexing use of proactive vs. reactive control, was compared between short and long delay. Supporting the significant delay length - cue likelihood interaction in accuracy, we found a double dissociation in EEG markers of proactive control. In Short delay, mid-frontal (FCz) P2 amplitude, a marker of task switching, was significantly elevated for rare cues. Further, P2 amplitude was significantly (positively) correlated with BSI for Short delay, suggesting elevated proactive control with greater P2. Posterior parietal sites (P3/4) also showed elevation of task-switching P1 amplitude for rare cues only during Short delay. In Long but not Short delay, delta power was dynamically enhanced for rare cues, and delta enhancement significantly correlated with BSI only in Long delay, indicating a selective link between delta enhancement and an increase in reactive control. EEG double dissociation suggests that delay latency guides instantiation of distinct control processes, and prompts consideration that AX no longer be conceived as a unitary task across timing parameters.

B55

FRONTAL AND PARIETAL BETA-BAND OSCILLATIONS TRACK CONTEXT-RELEVANT REWARD PROCESSING

Vincent Man[1], William A. Cunningham[1]; [1]University of Toronto — Approach and avoidance describes two motivational systems respectively characterized by reward-seeking or loss-aversive behaviours (Gray, 1990). These systems have been delineated across levels of complexity, whereby the flexibility of motivational mechanisms increase when considering higher-order processes on top of immediate responses to stimuli (Elliot, 2006). We examined flexibility in gain versus loss-prevention processing with a novel monetary reward task that incorporates a contextual manipulation. Healthy adults (n = 96) were instructed to match one of three shapes to a sample shape while we simultaneously recorded 64-channel EEG data. Upon a successful response, one shape was associated with monetary gain, another shape was associated with the prevention of monetary loss, and the third was associated with neither gain nor loss. To manipulate context, in one block of trials more monetary reward could potentially be gained than lost whereas in another block the potential outcomes were reversed. Time-frequency analyses on the neural data revealed a neural signature in the beta frequency band (12.5-30 Hz) for context-appropriate cue processing. When it was more adaptive to focus on loss-prevention, frontopolar electrodes (Fp1) exhibited greater beta power for loss-prevention cues compared to gain cues 180ms following cue presentation for ~390ms. In the context where it was more adaptive to focus on gains, parietal electrodes (Pz) exhibited greater bursts of beta power for gain cues compared to loss-prevention cues upon stimulus onset until the next trial. The results demonstrate an interaction between context, stimulus, and brain space, providing evidence of context-relevant reward processing in the brain.

B56

SEQUENCE COMPLEXITY AND CONTEXT: THE ROLE OF EXPECTATION IN PLANNING AND EXECUTION OF TASK SEQUENCES

David Braun[1], Starla Weaver[2], Catherine Arrington[1], Kaitlin Reiman[1], Glenn Wylie[3]; [1]Lehigh University, [2]Oklahoma City Univerity, [3]Kessler Foundation — Successful completion of action plans involves memory processes, such as encoding and retrieval of tasks within the plan, interleaved with cognitive control processes needed to coordinate performance of specific tasks. The task span paradigm (Logan, 2004) captures these processes by requiring subjects to study a task sequence, then execute the tasks in the appropriate order on a series of bivalent stimuli. The present research examines how the expectation of difficulty influences the recruitment of cognitive control through manipulations of sequence complexity and context. Sequence complexity varied parametrically as a function of the number of task switches within the list: 1, 2, or 3 switches in a sequence of six tasks. Context varied through the presentation of sequences drawn from "decks" biased toward either easy (1- and 2-switch) or hard (2- and 3-switch) sequences. Analyses of behavioral (Experiment 1) and neural (Experiment 2) data showed effects of expectation on performance measures and recruitment of neural activity. As expected, RTs at encoding and retrieval vary systematically as a function of complexity, but this effect is influenced by expectation. Specifically, equivalent 2-switch sequences elicit longer RTs when appearing in the easy deck compared to the hard deck. Additionally, pupilometry suggests increased cognitive effort during performance of these sequences within

the easy context. Preliminary analyses of fMRI data suggest greater inhibition of the default network during sequences that are expected to be more difficult. These data speak to the roles of expectation and preparation in the planning and execution of task sequences.

B57

FRONTOPOLAR CORTEX CONNECTIVITY SUPPORTS INTEGRATION OF EXTERNAL INFORMATION WHEN VALID FOR SUBSEQUENT DECISIONS

Yoonjin Nah[1], Scott Huettel[2], Jihyun Cha[3], Ian G Dobbins[3], Sanghoon Han[1]; [1]Yonsei University, [2]Duke University, [3]Washington University in St. Louis — The functional contribution of frontopolar cortex to various executive functions remains a matter of debate. We conducted fMRI studies to investigate the role of networks including frontopolar cortex in the updating of an initial stimulus-driven judgment as a function of intermediate external information. On each trial, participants viewed a briefly presented face image, made a gender judgment about that image, viewed a recommendation about the gender of the face, and then had the option to change or maintain the initial judgment (i.e., using or ignoring the recommendation). The key manipulation between two groups (Predictive, n = 19; Anti-predictive, n = 20) was the predictability of recommendation's correctness (85% valid versus invalid). Evidence for updating previous decisions based on external information was found in frontopolar, anterior cingulate, insula, and other regions; from these, we created regions of interest (ROIs) from which time-series were extracted. Pairwise cross-correlation coefficients between ROIs were analyzed using functional connectivity multivariate pattern analyses (fcMVPA) with a linear support vector machine algorithm. The analyses revealed that patterns of functional connectivity can consistently discriminate how the Predictive and Anti-predictive groups differentially utilized the recommendation for revising decisions, with accuracy of 82 to 97% across 6 runs. To directly explore the role of frontopolar, seed-based fcMVPA were also conducted and showed again significant group classification accuracy (66~82%) relative to random permutation testing. These findings demonstrate that revising a previously executed judgment based on an external recommendation recruits frontopolar network computations when predictability of the recommendation is reliable.

B58

MULTIVARIATE DOUBLE DISSOCIATION OF FRONTOSTRIATAL COMPONENTS OF TASK CONTROL

Angie A Kehagia[1], Rong Ye[1], Orla M Doyle[1], James B Rowe[2,3,4], Trevor W Robbins[4,5]; [1]Department of Neuroimaging, Institute of Psychiatry, Psychology and Neuroscience, King's College London, UK, [2]Department of Clinical Neurosciences, University of Cambridge, UK, [3]MRC Cognition and Brain Sciences Unit, Cambridge, UK, [4]Behavioural and Clinical Neuroscience Institute, University of Cambridge, UK, [5]Department of Psychology, University of Cambridge, UK — Cognitive control has traditionally been associated with the frontal lobe, based on observations of control deficits in patients with frontal lesions. However, evidence from patients with Parkinson's disease (PD) indicates that the basal ganglia also contribute to control, depending on the abstraction of the rules that are switched. To date, neuroimaging studies have focused on frontoparietal regions but failed to address subcortical contributions. We scanned 17 healthy volunteers while they performed a task switching paradigm that previously dissociated frontal lesion from PD patients. Data were processed in SPM8, a general linear model was fitted and parameter estimates for task-related activation for each condition were extracted from distinct masks of the frontal lobe and basal ganglia. We applied Gaussian process classification (GPC) using a linear kernel within PIPR (http://www.kcl.ac.uk/ioppn/depts/neuroimaging/research/imaginganalysis/Software/PIPR.aspx) in order to discriminate between switch-repeat conditions. To visualise the regions driving the classification performance, we estimated the weights of the forward (generative) model from the discriminative model weights. At 1000 permutations, switch-repeat classification accuracy for concrete rules was significant at 88% in the basal ganglia, but not in the frontal lobe (58%). The inverse pattern was obtained for abstract rules, whereby the conditions were successfully discriminated in the frontal lobe (82% classification accuracy) but not in the basal ganglia (47%). The results of this neuroimaging study thus demonstrate a strong double dissociation between the frontal lobe and basal ganglia in cognitive control and highlight the utility of multivariate approaches in investigations of functions that rely on distributed and overlapping neural substrates.

B59

AN EYE-TRACKING INVESTIGATION OF CUE AND TARGET PROCESSING IN TYPICAL DEVELOPMENT

Annie Zheng[1], Joshua McBride[1], Joel E. Martinez[2], Lauren Deschner[1], Jessica A. Church[1]; [1]University of Texas at Austin, [2]Princeton University — Large differences between adults and children have been observed in behavior and neural control networks during task switching performance. We assessed eye movements of adults (ages 18-27 years) and children (ages 8-16 years) during task switch processing under variable working memory demand. During the first 1500ms when the task cue was presented, children fixated significantly longer than adults on the cued rule ($t=19.84$, $p<0.01$), whereas adults looked longer at response choices ($t=16.9$, $p<0.01$). While adults fixated significantly longer on choices than cued rules ($t=44.52$, $p<0.01$), children spent the same amount of time on rules and choices ($t=1.25$, $p=0.8$). When the target stimulus appeared, children spent significantly more time fixating on response choices ($t=4.29$, $p<0.01$), but a similar amount of time as adults on the target ($t=2.53$, $p=0.13$), leading to overall slower responses ($t=34.92$, $p<0.01$). We used 250ms time bins to assess dwell times spent in competing stimulus areas: rule, response choices, and target. Under a 'winner-take-all' strategy, the data revealed a delayed and unstable fixation pattern in children, relative to adults, with longer initial rule fixation and more shifting between the choices and target when responding. Overall, the eye movement differences described above at both the rule loading and response selection stages provide insights into how preparatory control processing may influence lower child performance during cued task switching.

EXECUTIVE PROCESSES: Working memory

B60

INTERPLAY OF FRONTOPARIETAL CONTROL NETWORKS FOR UPDATING AND PROTECTING THE CONTENTS OF VISUAL WORKING MEMORY

Nicholas Myers[1], Mark G Stokes[1], Anna C Nobre[1]; [1]University of Oxford — When retaining items in working memory (WM), we can update new information to the currently held set. This ability comes at the expense of what is already in WM – we tend to forget previously encoded memories. For optimal behavior, new information should only be encoded if it is behaviorally relevant. Frontal and parietal cortex has been shown to make contributions to the flexible control of WM, but whether identical areas are invoked for different control operations is poorly understood. We explored strategic updating in working memory with functional magnetic resonance imaging (N=19) as observers performed a cued visual WM precision task. Observers encoded orientation information from a first display into working memory. After a delay, a cue indicated whether the previously encoded item (protect condition) or a concurrently presented new item (update condition) would be probed. After a further memory delay, observers recalled the remembered angle. Both protecting and updating activated a dorsolateral fronto-parietal network. In addition, protect cues activated cingulo-opercular areas, possibly reflecting the retrieval of previously encoded information. Update cues activated lateral occipital cortex that could indicate a sustained visual response to a WM-relevant object. While lateral prefrontal and parietal regions showed comparable response amplitudes to both update and protect cues, multivariate pattern analysis in these regions reliably separated the two cue types. The fronto-parietal network could therefore act as a flexible hub for various forms of control over WM, influencing which WM contents are represented in visual cortex.

B61

CAUSAL PARIETAL CONTRIBUTIONS TO DUAL-TASK WORKING MEMORY AND VISUAL ATTENTION PERFORMANCE

Anastasia Kiyonaga[1], John Powers[1], Yu-Chin Chiu[1], Tobias Egner[1]; [1]Duke University — We constantly need to keep information temporarily in mind, but this working memory (WM) must also compete with variable demands for our attention in the environment. In a recent fMRI study from our lab, areas of left

and right posterior parietal cortex (PPC) displayed a robust interaction between working memory and visual attention demand levels. Activity in these respective regions presented distinct relationships with behavioral measures, however, in that the left PPC related uniquely to WM recognition, and the right PPC related instead to visual search speed. Here, we took a causal approach to examine how the brain manages the competition between WM and attention demands. Participants remembered one or two images for a later test, then searched for a target among either similar or distinct distractors during the delay. We delivered 10Hz trains of transcranial magnetic stimulation (TMS) during the WM delay, over left and right parietal targets determined by fMRI activation foci. Visual search performance was disproportionally affected by left PPC stimulation when WM load was high, and by right PPC stimulation when WM load was low. The results suggest that participants may engage in distinct visual attention strategies—and rely differentially on left and right PPC—depending on the concurrent level of WM load. The PPC, therefore, plays a causal role in coordinating WM and visual attention demands.

B62

NEURAL CORRELATES OF ENCODING, RETRIEVAL, FOCUS SWITCHING, AND UPDATING PROCESSES

Savannah Cookson[1], Gregory Colflesh[2], Eric Schumacher[1], Paul Verhaeghen[1]; [1]Georgia Institute of Technology, [2]University of Maryland — Working memory refers to the space in the mind in which information is temporarily stored and manipulated during cognition. Cowan (1995, 2001) proposed a two-tiered structure for working memory distinguishing a capacity-limited zone of immediate access, labeled the focus of attention, from a larger, "activated" portion of long term memory (LTM) which is available and capacity-unlimited but not immediately accessible. Behavioral research has previously demonstrated distinctions between the operations of new item encoding, simple retrieval of a single item, switching focus between items, and updating existing representations with new information. The current experiment aimed to understand the differences in the neural correlates of these processes using fMRI. Participants completed blocks of 5 types of tasks. In the single item retrieval task, participants encoded a single stimulus and determined if subsequent targets matched that first stimulus. In the 3-item retrieval task, participants made the same judgments, but had to switch between three different comparator stimuli. In the updating task, participants again switched between three comparator stimuli, but were instructed to update the comparator stimuli with the most recently presented targets. By contrasting 3-item with 1-item retrieval, we attempted to isolate activity specific to focus switching. By contrasting updating with 3-item retrieval, we attempted to isolate activity specific to updating. Despite all three block types showing significant activity versus baseline during both the initial stimulus encoding and subsequent retrieval/updating processes, the difference in activity between block types was minimal at both time-points, suggesting equivalent recruitment of neural structures across conditions.

B63

AGE OF FIRST EXPOSURE TO FOOTBALL AFFECTS WORKING MEMORY AND DEFAULT MODE NETWORK CONNECTIVITY DURING WORKING MEMORY TASK PERFORMANCE

Eleanna Varangis[1], Kelly Giovanello[1], Stephanie Lane[1], Michael Clark[1], J.D. DeFreese[1], Kathleen Gates[1], Kevin Guskiewicz[1]; [1]The University of North Carolina at Chapel Hill — Past studies on concussion in samples of retired athletes have focused on the effect of number of concussions on cognitive function decades after injury. However, recent research has suggested that timing of first exposure to concussive and subconcussive impacts may also be a risk factor for cognitive deficits later in life. While results indicated differences in cognitive function based on age of first exposure to football, it is unclear whether concussion history or later-life football exposure may have also affected results, and what neural mechanisms might underlie such impairment. The present study examined the effect of age of first exposure to football on standard cognitive task performance (RBANS), in-scanner n-back task performance, and measures of functional neural connectivity in fronto-parietal and default mode networks during performance of an n-back working memory task. Number of concussions sustained and exposure after high school were controlled for at each level of analysis to ensure no contamination by these variables. Results showed no differences in cognitive or n-back task performance between the three groups, however they did indicate disrupted patterns of functional connectivity based on age of first exposure. These findings indicate that, independent of the effects of concussion history and later-life exposure, age of first exposure to football may affect neural circuitry underlying cognitive processing. While the present study did not show any cognitive deficits in this sample, such functional inefficiency during task performance may indicate elevated risk for cognitive deficits later in life.

B64

THERAPEUTIC EFFECT OF AEROBIC EXERCISE, REPETITIVE TRANSCRANIAL MAGNETIC STIMULATION, AND ENRICHED ENVIRONMENT ON CHEMOTHERAPY-INDUCED COGNITIVE IMPAIRMENT IN RATS

Se Hee Jung[1,2], Woo Hyung Lee[1]; [1]Seoul National University College of Medicine, Seoul, South Korea, [2]Seoul National University Boramae Medical Center, Seoul, South Korea — Goals To investigate whether the chemotherapy-induced cognitive impairment (CICI) can be reversed by therapeutic interventions and which therapeutic intervention would be effective in patients with CICI Methods We used 9-week old male Sprague-Dawley rats. Doxorubicin (DXR) was administered with a single intravenous injection (10 mg/kg) via a tail vein. Rats were divided into 4 difference groups; (1) aerobic exercise (AE), (2) repetitive transcranial magnetic stimulation (rTMS), (3) enriched environment (EE), and (4) control group. All the therapeutic interventions started day 4 after DXR injection and continued for 2 weeks. We evaluated rats with behavior tests including rotarod test, radial arm maze test, novel object recognition test, elevated plus maze test, and tail suspension test at day 0, 3, 7, 14, and 21. Western blot was performed at day 21 with β-amyloid, amyloid precursor protein (APP), total tau, phosphorylated tau, and postsynaptic density protein-95 (PSD-95). Results Spatial working memory was significantly improved in AE group at day 14 and day 21($p<0.05$). Depression was significantly improved in rTMS group and EE group at day 21. Western blot showed that β-amyloid expression was significantly decreased in the prefrontal cortex of EE group and in the hippocampus of rTMS group. However, there was no significant difference in the expression of APP, phosphorylated tau and PSD- between groups in the prefrontal cortex, the hippocampus and the cerebellar cortex. Conclusion We suggested that AE can ameliorate deficits in spatial working memory and rTMS and EE are specifically effective in depression developed after systemic chemotherapy.

B65

MIND-READING WITHOUT THE SCANNER: BEHAVIORAL DECODING OF WORKING MEMORY CONTENTS

Emma Wu Dowd[1], John M. Pearson[1], Tobias Egner[1]; [1]Duke University — Sophisticated machine learning algorithms are increasingly applied to functional neuroimaging data to characterize internal cognitive states. But can we "mind-read" without the scanner? While multivariate pattern classification has successfully decoded the contents of working memory (WM) from neural activity, the current study aimed to classify mental representations in WM from behavior—specifically, by capitalizing on the robust finding that active maintenance of visual items in WM biases visual attention toward memory-matching objects. In a dual-task paradigm, participants held one of four colors in WM while performing a series of visual searches for slanted line targets among vertical line distractors. The WM color could reappear in the subsequent search displays as a task-irrelevant stimulus feature that either coincided with the location of a target ("valid") or a distractor ("invalid"), or could fail to reappear ("neutral"). Compared to neutral trials, response times were faster on valid searches and slower on invalid searches, replicating the classic effect of attentional capture by WM. We used linear support vector machine and logistic regression methods to classify the four WM colors, based on normalized response times from the intervening visual searches. WM representations were successfully decoded from behavior alone, both within individuals and between individuals, such that a classifier trained on data from a group of individuals could predict single-trial WM content in another, new individual. The current study provides proof-of-concept for applying machine learning techniques to simple behavioral outputs to decode information about specific internal cognitive states, even so far as to be generalizable across individuals.

B66

WORKING MEMORY PROVIDES A COGNITIVE INTERFACE BETWEEN EPISODIC MEMORY AND FUTURE THINKING

Paul F. Hill[1], Rachel A. Diana[1]; [1]Virginia Tech — In recent years, investigators have become increasingly interested in the common neurocognitive basis of episodic memory and future thinking. Working memory (WM) may provide the cognitive workspace necessary to temporarily maintain and organize disparate episodic details into a coherent future event; however, this hypothesis has not been systematically tested. In this fMRI study, 25 young adults were cued to imagine future events while simultaneously performing a modified Sternberg task. This dual-task interference paradigm was designed to parse the respective contributions of maintenance and manipulation demands on future event construction. Data were analyzed using psychophysiological interaction analyses to identify brain regions demonstrating disrupted functional connectivity in response to increased WM demands. Both maintenance and manipulation trials were associated with disrupted functional coupling between dorsal medial prefrontal cortex, left temporal pole, and right temporoparietal junction. These regions have been observed to represent a distinct default network subsystem supporting retrieval of conceptual information about oneself. Manipulation trials were further associated with disrupted coupling between the right anterior hippocampus and ventromedial and lateral prefrontal regions related to retrieval monitoring and inhibitory control. Our results suggest that distinct WM components support the interplay between episodic memory and future event construction. Access to an autobiographical knowledge base likely provides the contextual framework for imagining detailed events. Executive retrieval processes may aid in verifying the relevance and subsequent integration of constituent episodic and sensory details into a unitary event depiction.

B67

PHYSIOPATHOLOGICAL MECHANISMS OF INTENTIONAL AND INCIDENTAL WORKING MEMORY BINDING IN SCHIZOPHRENIA

David Luck[1,2], Stéphanie Grot[1,2], Isabelle Soulières[1,3], Olivier Lipp[1]; [1]Institut Universitaire en Santé Mentale de Montréal - Research Centre, [2]dpt psychiatry, Université de Montréal, [3]UQAM — Working memory is particularly affected in schizophrenia. However, some processes are more affected than others. Patients with schizophrenia have more difficulties to hold in memory the association between multiple pieces of information than information itself. This type of associative process is commonly referred to as memory binding. Recent results from our lab showed that incidental binding, without conscious effort to associate information, are preserved in patients. By contrast, intentional binding, with conscious effort to associative information, is altered in patients. This fMRI study attempted to demonstrate that specific deficits for intentional binding rely on prefrontal hypoactivity in schizophrenia. Twenty patients with schizophrenia and 20 matched controls were scanned while memorizing three coloured words and three coloured ellipses. In the intentional binding condition, the three words were central and separated from the three ellipses. Participants had to mentally link the verbal and spatial information sharing the same color (e.g. the word in red must be associated with the position defined by a red ellipse). In the incidental binding condition, words were directly presented in ellipses. Behavioural analyses revealed lower performance in patients for intentional, but not incidental, binding relative to controls. FMRI analyses showed that deficits for intentional binding in patients were related to lower activity in the right prefrontal cortex. No between-group differences were significant for incidental binding. The present results suggest specific deficit for intentional binding in schizophrenia. We expect our research to contribute to the elaboration of therapeutic tools that may improve cognition in schizophrenia.

B68

DECODING HIERARCHICAL REPRESENTATIONS OF COMPLEX SEQUENCES IN EEG OSCILLATORY ACTIVITY

Atsushi Kikumoto[1], Caitlin Corona[1], Tessafay Samejima[1], Ulrich Mayr[1]; [1]University of Oregon — Performing a series of complex actions requires task-relevant information to be organized in a hierarchical manner, where higher-level plans specify the order of subplans/chunks, which in turn specify the order of basic elements. Currently, little is known about how hierarchical representations are coded and what their demands are for working-memory (WM). Participants remembered 9-element sequences of orientations constructed from three chunks of three elements each (e.g., abc-bca-cab), and had to make serial match/mismatch decisions to presented probes. Error patterns reflected the hierarchical structure with increased error rates at chunk transitions, an effect that was particularly large for individuals with low WM capacity. To assess the neural codes underlying hierarchical control structures, we applied multivariate decoding analysis to the pattern of oscillatory EEG activity. The scalp distribution of theta and alpha-band activity coded independently not only the identity of basic elements, but more importantly also the order within chunks, the chunk identify, and the order across chunks. In principle, WM limitations could affect either all representational codes in a uniform manner, or selectively constrain higher-level representations. Interestingly, we found a clear representation of the chunk identity only in high WM individuals, but not in individuals with low WM capacity. Same patterns of results were replicated with self-paced sequences to account for the retrieval difficulty effect covering with positions. These results suggest that EEG oscillations tracks the current position within a complex sequence and can be used to pinpoint the source of WM constraints during when operating with hierarchical control structures.

LANGUAGE: Lexicon

B69

AN INVESTIGATION OF BEHAVIORAL CROSS-LANGUAGE NEIGHBORHOOD DENSITY EFFECTS IN EARLY AND LATE BILINGUALS

Giordana Grossi[1], Amanda Lane[1], Maria Talloni[1]; [1]State University of New York, New Paltz — Psycholinguists have asked how words from different languages are organized in the bilingual lexicon and whether words from one language are unconsciously activated when bilinguals read in the other language. This seems to be the case. Cross-language neighborhood density effects have been found in both progressive demasking and lexical decision tasks (van Heuven et al., 1998). These effects were stronger when participants read in their second compared to the first language. Electrophysiological experiments with late bilinguals reported a modulation of the N400 amplitude that followed this asymmetric pattern; however, early bilinguals did not show such modulation (Grossi et al., 2012; Midgley et al., 2008). In this study, we tested the hypothesis that these participants might have been able to block interference from the other language during single word reading. Late and early English-Spanish bilinguals performed a progressive demasking task with English and Spanish words, presented in counterbalanced order. High and low cross-language neighbors were matched on relevant orthographic and lexical variables, both within and across languages. No effects of cross-language neighborhood density were observed for Spanish words. However, an inhibitory effect was found for English words in both groups of bilinguals. This effect did not reflect cross-language activation, as it was present in a group of control participants as well. Studies using non-factorial designs have also failed to provide evidence for behavioral effects of cross-language neighborhood density; therefore, the finding that such variable influences bilinguals' performance in progressive demasking tasks still awaits replication.

B70

NEUROPHYSIOLOGICAL CORRELATES OF FREQUENCY AND ICONICITY IN AMERICAN SIGN LANGUAGE

Karen Emmorey[1], Zed Sevcikova Sehyr[1], Katherine Midgley[1], Phillip Holcomb[1]; [1]San Diego State University — Event-related potentials (ERPs) were used to investigate the neural dynamics of single sign recognition, identifying electrophysiological components associated with lexical frequency and iconicity. The study capitalizes on a database of ~1000 signs rated for frequency and iconicity. We recorded ERPs from deaf signers (N = 38) and hearing nonsigners (N = 22) while they watched video clips of 400 ASL signs. Deaf signers performed a semantic categorization task, monitoring for rare signs (10% of trials) that referred to persons (e.g., DOCTOR, GIRL). Hearing nonsigners monitored for a rare repeated sign (10% of trials). The results indicate a clear effect of frequency for deaf signers. Low frequency signs produced a more negative ERP response compared to high frequency signs, starting 100-200 ms after sign onset with a broad distribution across the scalp. This frequency effect was not observed for hearing nonsigners. The polarity and time course

of the ASL frequency effect parallels what has been observed for spoken words, indicating that the neural response to lexical frequency is independent of language modality. For deaf signers, highly iconic signs elicited a more negative response that was right lateralized over frontal sites, starting 300-400 ms after sign onset. For hearing non-signers, iconicity did not modulate neural responses at frontal sites. For both groups, iconic signs elicited a more negative response at posterior sites, although this response began later for hearing nonsigners. These data are beginning to suggest a distinct neural signature for iconic signs, which is different for signers and non-signers.

B71

A TIME-COURSE ANALYSIS OF THE FACTORS THAT MAY AFFECT THE FEED-FORWARD REPRESENTATION IN SPEECH-MOTOR CONTROL

Noriko Tanigawa[1], Srikantan S. Nagarajan[2], John F. Houde[2]; [1]University of Oxford, [2]University of California, San Francisco — In speech-motor control, it is hypothesized that a feed-forward representation is generated and incoming signals are compared against it to issue correction commands. To identify the factors to which it might be sensitive and the distinctive time-courses in which their influences might manifest, the present study analyzed voice responses to feedback perturbation between [i:] and [u:] in California English, where phonological, socio-phonetic, cognitive, and neural models make differential predictions. 11 participants (128 Latin-squared trials each) read aloud a prompt word (heed or who'd) displayed on a screen, as they heard individualized online playback of their own voice in which F1 and F2 of the vowel of the prompt word were unaltered or shifted to those of the counterpart. Adaptation was calculated in mels every 3ms for 400ms as the ratio of the projection of the response's displacement vector onto the shift vector to the magnitude of the shift vector. 30ms-step mixed-effects multiple regression removed predominant participants' idiosyncrasy and identified place-feature perturbation as the primary factor causing shift-following responses for [i:] and compensatory responses for [u:] (0-400ms) (time-windows in parentheses). California-native Caucasians followed shifts whereas other groups compensated (120-360ms). Subthreshold shift-following responses developed (270-400ms) as the number of trials increased. Contrarily, shift-following responses decreased (0-400ms) as vowel onset latencies increased and (300-360ms) as right-handedness scores increased. In speech-motor control, modifiable feed-forward representation may sequentially target asymmetric phonological features, socio-indexical phonetic information, and iterated contextual input, following the minimal effort principle. Compensatory responses may require extra preparedness and greater left-hemisphere dominance.

B72

WAS THAT A PIBU I JUST SAW? USING AN ARTIFICIAL LEXICON TO CHARACTERIZE THE LINK BETWEEN PHONOLOGICAL ABILITIES AND READING DEFICITS IN CHILDREN

Jeffrey Malins[1], Jan Frijters[2], James Magnuson[1,3], Candice Goerger[4], Bonnie Buis[1], W. Einar Mencl[1], Rose Sevcik[4], Kenneth Pugh[1,3,5], Robin Morris[4], Stephen Frost[1]; [1]Haskins Laboratories, [2]Brock University, [3]University of Connecticut, [4]Georgia State University, [5]Yale University — We assessed the extent to which reading ability in children is associated with individual differences in phonological competition effects as well as the dynamics of word learning. A group of children with a range of reading abilities weighted toward the lower tail of the typical distribution (N = 37; 13 female; mean age 11;2 with a range of 8;4- 15;5; mean Woodcock-Johnson Broad Reading score of 83 with a range of 53-110) learned an artificial lexicon consisting of pseudowords associated with pictures of novel animals. In each trial, subjects were presented with two pictures on a computer screen and subsequently heard a spoken pseudoword. Children were asked to click on the animal associated with the pseudoword, after which they were given feedback. Importantly, in each trial the names of the pictures overlapped one another in either word-initial phonemes (cohort competitors; e.g., /pibu/ vs. /pibo/), word-final phonemes (rhyme competitors; e.g., /pibu/ vs. /dibu/), or were unrelated (e.g., /dibo/ vs. /bupa/). Subjects completed six learning blocks; within each block, each of the eight items was presented in each of the three competitor conditions. Compared to children with higher reading scores, children with lower reading scores showed (1) exaggerated competition effects for cohort competitors; (2) reduced rhyme effects, especially in initial learning blocks. This latter finding is consistent with previous studies showing a lack of rhyme sensitivity in children with reading impairment. These findings provide some insights into the mechanisms underlying the long-established link between phonological abilities and reading skill.

B73

THE TIMING OF SPONTANEOUS DETECTION AND REPAIR OF NAMING ERRORS IN APHASIA

Julia Schuchard[1], Erica Middleton[1], Mackenzie Stabile[1], Myrna F. Schwartz[1]; [1]Moss Rehabilitation Research Institute — This study examined the timing of self-detected naming errors in people with aphasia to illuminate mechanisms of error monitoring in speech. Twelve participants with aphasia completed a 615-item naming test twice over the course of two weeks. For each trial in which an error was produced, trained experts coded the type of response (e.g., semantic error, phonological error), the presence of error detection (indicated by a changed or overtly rejected naming attempt), and whether the error was repaired to the correct response. For each detected error, latencies of the error onset, error offset, onset of overt detection, and onset of a repair (if present) were measured. Mixed-effects regression models indicated a significant effect of error type (semantic vs. phonological) on the time from error offset to repair onset, with a median repair time of 1937 ms for semantic errors and only 394 ms for phonological errors. However, for trials in which the first evidence of error detection was not a repair, time from error offset to error detection was statistically comparable for the two error types; median detection time was 877 ms for semantic errors and 947 ms for phonological errors. Fast repair times for phonological errors align with views that speech is monitored prior to articulation (e.g., inner speech monitor or production-based monitor). In contrast, slower repair (but not slower detection) times for semantic errors may reflect increased time required to program a correction, starting with the semantic concept.

B74

THE FUNCTIONAL CONNECTIVITY OF MULTIMODAL OCCIPITOTEMPORAL CORTEX DURING READING COMPREHENSION

Yi-Hui Hung[1,2], W. Einar Mencl[1,2], Jason D. Zevin[3], Stephen Frost[1], Peter Molfese[4,1], Jay Rueckl[4,1], Kenneth Pugh[1,2,4]; [1]Haskins Laboratories, [2]Yale University, [3]University of Southern California, [4]University of Connecticut — It has been shown that occipitotemporal cortex not only responds to visual words but also is sensitive to speech. It is unclear what neural mechanisms underlie the change from visual-specific to multimodal in occipitotemporal cortex. Possibly, occipitotemporal cortex becomes multimodal because it connects to phonological areas (e.g., supramarginal gyrus (SMG) and inferior frontal gyrus (IFG)). Alternatively, occipitotemporal cortex connects to semantic areas (e.g., middle temporal gyrus) which are also connect to speech areas, and thus becomes multimodal because it receive activation from the phonological areas via shared connection with semantic regions. In the present study, neural connectivity was compared between occipitotemporal areas which respond to print only and which respond to both print and speech. During fMRI recording, participants were presented with single words and non-linguistic stimuli either visually or auditorily. The same participants then read stories presented in multiple one-minute blocks. Fifty seed voxels in the occipitotemporal cortex which responded to words more than non-linguistic stimuli visually were selected to be the print-only area. Another 50 seed voxels which responded to words more than non-linguistic stimuli visually and auditorily were selected to be the print-and-speech area. Connectivity was defined by correlations between the time series of the seed voxels and other voxels in the whole brain during story reading. The result showed that the print-and-speech area connected to the bilateral IFG and the bilateral SMG more strongly than the print-only area. This suggests that occipitotemporal cortex becomes multimodal because it couples with the IFG and SMG for phonological decoding.

B75

PROACTIVE AND REACTIVE CONTROL DURING BILINGUAL LEXICAL ACCESS IS DRIVEN BY DIFFERENT PORTIONS WITHIN THE PREFRONTAL CORTEX

Francesca Martina Branzi[1], Pedro Paz-Alonso[1], Clara Martin[1,2], Manuel Carreiras[1,2]; [1]Basque Center on Cognition, Brain and Language, [2]IKERBASQUE, Basque Foundation for Science — Both "proactive" and "reactive" control is at play during bilingual lexical access (Wang et al., 2009).

However, the exact neural mechanisms are still relatively unexplored. Here we investigate whether during bilingual language production (1) proactive control would be driven by the anterior ventrolateral prefrontal cortex (vlPFC, BA47), pre-activating the target language, and (2) reactive control would be driven by the mid-vlPFC (BA45), supporting post-retrieval control processes. To that end we conducted an fMRI study wherein bilinguals named pictures in two languages. We manipulated: (1) the cue-picture time interval (long and short to engage or prevent proactive control (Czernochowski, 2015); and, (2) the cognate status, to capture the presence of selective pre-activation of the target language (non-cognate versus cognate words). If reactive and proactive control is supported by different portions within the PFC (Badre & Wagner, 2007), enhanced responses are expected in the BA45 when conditions rely on reactive control (short versus long intervals) and enhanced responses are expected in the BA47 when conditions rely on proactive control (long versus short intervals). This dissociation was found. In addition, during short intervals, we observed a cognate effect in the BA47, reflecting the parallel activation of the two languages. In contrast, during long intervals, the cognate effect was not present, suggesting the pre-activation of the target language. Together, these data suggest that (1) proactive and reactive control is driven by different portions within the PFC and (2) that selective pre-activation of the target language is supported by the BA47 (Bar et al., 2006).

B76

THE NATIVE LANGUAGE TUNES PREDICTION PROCESSES ACROSS MULTIPLE LANGUAGES

Nicola Molinaro[1,2], Francesco Giannelli[3], Sendy Caffarra[1], Clara Martin[1,2]; [1]BCBL, Basque center on Cognition, Brain and Language, [2]Ikerbasque, Basque foundation for science, [3]University of Milano-Bicocca — Language production abilities in young children depend on learning to predict. As a consequence, prediction processes could be tuned to the properties of the language learned first. We tested this hypothesis by studying language prediction of high proficient Spanish speakers who have been exclusively exposed either to Spanish (N=24) or Basque (N=24) before the age of three. Participants were involved in a Spanish sentence reading task. Prediction was studied recording ERPs time-locked to gender marked determiners that could be followed by either highly expected "gender transparent" (whose "–a/–o" ending is gender informative) or "gender opaque" nouns (uninformative ending). The target determiner was either consistent with the gender of the expected or the unexpected noun. Spanish natives revealed a similar ERP prediction effect for both the opaque and the transparent conditions, i.e., a negative going effect for unexpected determiners starting ~250 ms in posterior scalp regions. We interpret it as evidence for similar prediction strategies based on lexically encoded gender information. Basque natives showed the same pattern for both opaque and transparent words. Crucially, transparent determiners showed an earlier prediction effect starting ~170 ms in central-anterior scalp regions, evidence for prediction strategies relying on gender information encoded at the sub-lexical level. We conclude that language prediction is tuned to the properties of the native language. Basque, compared to Spanish, presents a more reliable one-to-one mapping of sub-lexical units onto specific linguistic features. This induces Basque speakers to predict based on sub-lexical information (when available) even in their non-native language.

LANGUAGE: Other

B77

MANIPULATING MENTAL WORKLOAD DURING AUDITORY WORD PROCESSING: N400 REPETITION EFFECTS

He Pu[1], Phillip J. Holcomb[1,2], Katherine J. Midgley[2], Marianna Eddy[1,3]; [1]Tufts University, [2]San Diego State University, [3]U.S. Army Natick Soldier Research, Development, and Engineering Center — Previous ERP research looking at the effect of mental workload on cognitive processing has mainly utilized dual-task paradigms involving a primary task where mental workload is manipulated, and a secondary oddball task. Mental workload has been shown to influence the P300 component to secondary task oddball stimuli with increasing workload attenuating and delaying the P300. However, the oddball task is arguably an artificial paradigm and usually involves unnatural stimuli. Therefore, workload effects with this task lack ecological validity making it less suitable for many real world situations. In the current study we used a more naturalistic paradigm (auditory word comprehension) as the secondary task in a dual-task paradigm. Specifically, we were interested in whether changes in mental workload would impact N400 repetition priming effects, a well-studied measure sensitive to lexico-semantic processing (e.g. Rugg, 1990; Holcomb & Grainger, 2006). Native English monolinguals (n=24) played a video game (primary task) with three difficulty levels while listening to a stream of English words (secondary task) containing repeats on average every fourth item. In one condition, participants passively listened to the words and in another they pressed a foot-pedal to repeats while they played the video game. Results indicated that N400 repetition effects were larger in the active than passive condition. Importantly, across workload levels, N400 repetition effects decreased as workload increased. These findings extend earlier work using less naturalistic stimuli and paradigms and suggest that the N400 can be used as a sensitive measure of mental workload in many real world contexts.

B78

A FUNCTIONAL TRANSCRANIAL DOPPLER SONOGRAPHY (FTCD) STUDY OF HEMISPHERIC DOMINANCE DURING SILENT SPEECHREADING PROCESSING.

Eva Gutierrez-Sigut[1], Rachel Wayne[2], Heather Payne[1], Mairead MacSweeney[1]; [1]University College London, [2]Queen's University — Perceiving a speaker's articulatory movements plays an important role in spoken language comprehension (McGurk & MacDonald, 1976). fMRI studies have shown that left hemisphere activation for silent speechreading is modulated by speechreading skill and hearing status (deaf vs. hearing; Capek et al., 2008). fTCD is reliable in establishing hemispheric dominance during cognitive tasks (Deppe et al., 2004) and is sensitive to task difficulty (Payne et al., 2015). However, in fTCD studies, laterality indices (LIs) are often stronger for language generation than for receptive tasks (Buchinger et al., 2000). Here we aimed to determine whether a receptive silent speechreading task elicits measurable lateralization in the TCD signal, and whether the strength of such an effect relates to a word's intelligibility. Nineteen right-handed hearing English speakers performed a semantic judgment task using silent speechreading. We measured LIs for nonsense mouth movements (gurns) and English words. We also tested the effect of word intelligibility (easy vs. difficult). Results show stronger LIs for words than gurns, 67% of participants had negative LIs (right dominance) for gurns while 60% had positive LIs (left dominance) for words. No differences related to word intelligibility were observed. There was no correlation between LI and speechreading skill. Our findings contribute to our understanding of which task difficulty factors contribute to the fTCD signal. The results show that fTCD is sensitive to the distinction between linguistic and non-linguistic mouth movements and therefore may be useful to study hemispheric language dominance in special populations such as those born deaf.

B79

NEURAL CORRELATES OF EARLY-STAGE VISUAL PROCESSING DIFFERENCES IN DEVELOPMENTAL DYSLEXIA

Lisa Levinson[1], Karen Froud[1]; [1]Teachers College, Columbia University — Reading requires the successful recruitment and coordination of brain networks in order to translate visual symbols into phonemes. It is poorly understood however, whether disrupted low-level visual analysis contributes to reading disabilities such as dyslexia. Some research has suggested that within the visual system, deficiencies in one of the pathways – the magnocellular pathway – may contribute to reading difficulties (Stein, 2003). Studies of the development of these visual pathways suggest the magnocellular pathway follows a protracted course of development (Mitchell & Neville, 2004; Coch et al., 2005; Gunn et al., 2002; Sherman, 1985; Hickey, 1977), which raises the possibility that it is more vulnerable to pathological change during development and has the potential for greater plasticity. The current study examined group response differences to stimuli tailored to the unique parameters of the magnocellular and parvocellular pathways using P1, N1, P2 components of the event-related potential waveform to index early-stage visual processing. To understand potential maturational confounds, this study examined groups of children (ages 9-10) and adults, with and without dyslexia. These data provide support for early-stage-visual processing differences between individuals with dyslexia and controls for the magnocellular biased stimulus condition but not the parvocellular biased stimulus condition. Given

that dyslexia manifests in so many ways necessitates a more nuanced understanding of the neural mechanisms that underpin reading disorders. Due to the compounding impact of small disruptions on learning, refining our knowledge of these underlying mechanisms will foster earlier identification and potentially more focused interventions that could yield better outcomes.

B80

ROLE OF THE MOTOR SYSTEM IN PERCEPTUAL CATEGORIZATION OF AMBIGUOUS SPEECH SOUNDS

Yue Sun[1,2], Sharon Peperkamp[1]; [1]Ecole Normale Supérieure (PSL Research University), [2]Max Planck Institute (MPIEA) — The role of sensorimotor interaction during speech perception is a long-standing research topic in neurobiology of language. Recent studies suggested a modulatory role for the motor system in speech perception, particularly in aiding perceptual categorization of speech sounds in adverse perception conditions (e.g., D'Ausillo et al., 2009). In the current study, we examined whether the involvement of the motor system is enhanced during the perception of non-native speech sounds that are acoustically ambiguous between two native sound categories and are hence more difficult to identify than prototypical exemplars of these categories. Participants were asked to perform different tasks on auditory stimuli that contained either a prototypical or an ambiguous vowel. Electroencephalogram was recorded during the experiment and the activation of the motor system was measured with event-related-desynchronization (ERD) of the mu rhythms (8-12 Hz and 14-20 Hz) at sensors over premotor cortices and supplementary motor areas. Our results show that listening to stimuli with ambiguous vowels induces larger mu-ERD over left motor cortices than those with prototypical vowels. Moreover, the effect of ambiguity is greater in tasks that require explicit access to the vowel categories than tasks that do not. These findings demonstrate that the activation of the motor system during speech perception is modulated by the perceptual difficulty that is due to the sound inventory of listeners' native language; specifically, they suggest an involvement of the motor system in the perceptual mapping of ambiguous, non-native, speech sounds onto native categories.

B81

LATERALITY AND UNILATERAL DEAFNESS: PATIENTS WITH CONGENITAL RIGHT EAR DEAFNESS DO NOT DEVELOP ATYPICAL LANGUAGE DOMINANCE

Lise Van der Haegen[1], Frederic Acke[2], Guy Vingerhoets[1], Ingeborg Dhooge[2], Els De Leenheer[2], Qing Cai[3], Marc Brysbaert[1]; [1]Ghent University, Belgium, [2]Ghent University Hospital, Belgium, [3]East China Normal University, China — Auditory speech perception, speech production and reading lateralize to the left hemisphere in the majority of healthy right-handers. In this study, we investigated to what extent sensory input underlies the side of language dominance. We measured the lateralization of the three core subprocesses of language in patients who had profound hearing loss in the right ear from birth and in matched control subjects. They took part in (1) a semantic decision listening task involving speech and sound stimuli that were contrasted against noise (auditory perception) (2) a word generation task in which subjects had to mentally generate words beginning with a target letter or repeat a nonword (speech production) and (3) a passive reading task in which words were contrasted against chequerboards (reading). The results show that a lack of sensory auditory input on the right side, which is strongly connected to the contralateral left hemisphere, does not lead to atypical lateralization of speech perception. Speech production and reading were also typically left lateralized in all but one patient, contradicting previous small scale studies. Other factors such as genetic constraints presumably overrule the role of sensory input in the development of (a)typical language lateralization.

B82

BLENDING SOCIAL INTERACTION IN DIGITAL INSTRUCTION FACILITATES THE PERCEPTION LEARNING IN MANDARIN TONE: EVIDENCE FROM A MEG STUDY

Rose Ru-Whui Lee[1,2], Kevin Chun-Hsien Hsu[2], Sheng-Kai Lin[2], Yao-Ting Sung[1], Kuo-en Chang[1], Denise Hsien Wu[3], Ovid Jyh-Lang Tzeng[1]; [1]National Taiwan Normal Univerity, [2]Academia Sinica, [3]National Central University — Many studies on bilingualism suggested that extended period of bilingual experience reorganized the language network and the cognitive control areas in the brain. Besides, there is much evidence on learning effect induced by digital game/instruction for different kinds of cognitive tasks. Most studies evaluated the learning effect induced through human-computer interaction. But little has paid attention to efficacy of the digital instruction blended with social interaction in person. This study explored the role of social interaction in digital language learning and found that human interaction was critical. This study used MEG neuroimage data to show the difference of activation in the brain areas responsible for cognitive functions after an intensive short-term digital training program for learning Chinese as a second language, especially when lexical tones were included in encoding and were perceived in processing the learning materials. Participants of the experiment were foreign graduate students learning Chinese as their second language. In the MEG experiment of the multi-deviant oddball paradigm for discrimination of Mandarin tones, the magnet mismatch field (MMNm) activity between acoustically dissimilar contrast (T3/T1) and acoustically similar contrast (T3/T2) were measured in the course of pre-learning and post-learning. We map out the specific source of activation by ROI (Region of Interest) method. The results showed that the underlying neuron activation changed dynamically in response to the degree of perceived linguistic features embedded in the auditory stimuli, especially when the stimuli were driven by social interaction.

B83

RECOVERY FROM CONDUCTION APHASIA DEPENDS ON CONTRIBUTIONS FROM THE RIGHT HEMISPHERE: A CASE STUDY

Alex Teghipco[1], Frank Garcia[1,4], Madalina Tivarus[3], Sue Smith[2], Webster Pilcher[2], Bradford Mahon[1,2,4]; [1]Department of Brain & Cognitive Sciences, University of Rochester, USA, [2]Department of Neurosurgery, University of Rochester Medical Center, USA, [3]Department of Imaging Sciences, University of Rochester, Rochester, NY, [4]Center for Language Sciences, University of Rochester, USA — Conduction aphasia is a language deficit characterized by impaired speech repetition and spared productive and receptive language, and is associated with damage to the left arcuate fasciculus, a white matter tract connecting Broca's and Wernicke's areas. We used functional Magnetic Resonance Imaging (fMRI), diffusion tensor imaging (DTI) and cognitive neuropsychological testing to longitudinally evaluate a 26 yr old male (AE) who underwent an awake neurosurgical procedure to remove a left temporoparietal tumor that was infiltrating the arcuate fasciculus. Preoperative fMRI revealed left hemisphere dominance for language, and preoperative DTI revealed an intact left arcuate fasciculus. During the awake procedure to remove the tumor, AE developed a pure conduction aphasia. Consistent with AE's intraoperative conduction aphasia, postsurgical DTI revealed that the posterior section of the left arcuate fasciculus had been removed along with the tumor. Over a period of three months after surgery, AE progressively recovered from his conduction aphasia. A series of whole-brain functional connectivity analyses were conducted on resting fMRI data acquired preoperatively and at multiple time points postoperatively. Two findings emerged: 1) consistent with the destruction of the arcuate fascilusus, there was a reduction in functional connectivity between left Wernicke's area and left Broca's area postoperatively (compared to preoperatively), and 2) there was an increase in functional connectivity of the right hemisphere homologue of Wernicke's area to left Broca's area postoperatively (compared to preoperatively). This suggests the intriguing possibility that AE's recovered repetition abilities after surgery depend on the recruitment of homologous structures in the undamaged right hemisphere.

B84

DEGREE OF FOREIGN ACCENT IN BILINGUAL CHILDREN PREDICTS SURFACE AREA OF THE BILATERAL SUPERIOR TEMPORAL GYRUS

Pilar Archila[1], David Vasquez[2], Arturo Hernandez[1]; [1]University of Houston, [2]University of California, Riverside — Accurate and efficient processing of second language (L2) speech sounds has been associated with different characteristics of brain anatomy (Golestani et al., 2007, 2011). The goal of the present study was to evaluate the effect of foreign accent, age, and age of acquisition (AoA) on the anatomy of the bilateral superior temporal gyrus (STG). Spanish-English bilingual children between the ages of 6 and 10 and an AoA mean of 5 yrs participated in this study (N = 32). Participants' speech samples were recorded while reading a list of 168 English words. Their foreign accent was judged on a 9-point scale by English monolin-

guals. High-Resolution whole-brain T1-weighted images were acquired in a 3T Siemens scanner (192 slices, 1x1x1 voxel size, 87.5% FoV Phase). Two multiple regressions were conducted, one for each outcome variable: the left hemisphere STG and the right hemisphere STG. The predictor variables were foreign accent, age, and AoA. Results showed that in bilingual children, foreign accent predicted surface area of the bilateral STG independent of age and AoA. That is, children with native-like accents in L2 had larger surface areas of the bilateral STG, independent of the age of the child and when the child learned the L2. These results indicate that foreign accent, which significantly correlated with L2 proficiency ($r = -.66$, $p < 0.001$), better predicts the size of the STG bilaterally than actual age or AoA. It appears that abilities in speech perception, as measured by foreign accent, influence the anatomy of the STG.

B85

NATURE AND TIMING OF PERILESIONAL ACTIVATION IN POST-STROKE LANGUAGE RECOVERY

Anika Stockert[1], Julian Klingbeil[1], Max Wawrzyniak[1], Katrin Wrede[1], Dorothee Saur[1]; [1]Leipzig University Hospital, Germany — Poststroke aphasia recovery evolves in time. Increased perilesional activity associated with treatment-related language improvements has been confirmed in the chronic phase (Fridriksson et al., 2012), but has not yet been systematically demonstrated during the early phases of stroke recovery. The pathophysiology of stroke suggests that perilesional reorganisation evolves within days, lasting for months after stroke, while increased neuronal excitability might provide a basis for perilesional neuroplasticity (Schiene et al., 1999). We compared fMRI BOLD response to speech (SP) and reversed speech (REV) using an auditory comprehension paradigm administered repeatedly (acute (t1)≤1 week, subacute (t2)=1-2 weeks, chronic (t3)>6 months post-onset) to patients with stroke affecting left frontal (FC, N=17) or temporoparietal cortex (TPC, N=17). Language activation (SP>REV) obtained from three perilesional ROIs expanding stepwise to 39mm beyond the lesion (DISTANCE) was compared across TIME and to the improvement of language comprehension/production. An ANOVA revealed a significant TIME x DISTANCE interaction ($F(4)=2.9$, $p=.025$) with increased activation from t1 to t3 and t2 to t3 ($p<0.05$) in perilesional regions far from the lesion site. While a re-activation from t1 to t2 ($r=.44$, $p<0.05$) and from t2 to t3 ($r=.46$, $p<0.05$) contributed to an early improvement of language comprehension in TFC, improved language production was predicted by a later increase in activation from t2 to t3 ($r=.42$, $p<0.05$) in FC. To conclude, a remapping of cortical language representations in undamaged left cortices is likely to commence during subacute phase of recovery and improvements of specific language functions differentially involve frontal or temporal perilesional areas.

B86

AESTHETIC EXPERIENCE IN CHINESE POEMS: COMBINING COMPUTATIONAL LINGUISTICS AND NEUROPHYSIOLOGY

Xiangbin Teng[1], Min Ma[2], David Poeppel[1,3], Xing Tian[4]; [1]New York University, [2]The City University of New York, [3]Max Planck Institute, [4]New York University Shanghai — Poetry is deeply rooted in many human cultures and often elicits intense aesthetic experiences. Recently, cognitive neuroscientists have begun to study the neural mechanisms that underpin aesthetic experience. Here we generated poems using computational procedures from natural language processing and employed magnetoencephalography (MEG) to investigate the neural correlates of making aesthetic judgments. Artificial poems that mimic the highly structured format of traditional Chinese poems were generated using recent implementations of recurrent neural networks. All poems are comprised of four sentences, with five monosyllabic words in each sentence. Each auditory word was individually synthesized to eliminate coarticulation cues. Native Mandarin speakers listened to the poems that were presented as an isochronous sequence of syllables. Listeners' subjective evaluations of aesthetic pleasure were collected and MEG concurrently recorded. We argue that the artificial poems evoked a sense of beauty depending on the parameters used in the generation algorithms. Moreover, the neural oscillations in the lower frequency bands (theta, 4-8 Hz and delta, < 4 Hz) correlated with poems that were evaluated as more pleasing. These results suggest that the methods from computational linguistics, neurophysiology, and crowdsourcing can be combined to investigate the complex and still somewhat underspecified issues surrounding aesthetic experience.

LANGUAGE: Semantic

B87

WORD-PAIR PRIMING WITH BIASED HOMONYMS: N400 AND LPC EFFECTS

Gabriela Meade[1,2], Donna Coch[1]; [1]Dartmouth College, [2]San Diego State University & University of California, San Diego — Biased homonyms are words that have the same lexical form and at least two different meanings, one of which occurs more frequently than the other(s). In an event-related potential investigation of the effects of meaning frequency in biased homonym processing, we used a lexical decision task with a 250 ms stimulus onset asynchrony. Isolated homonym primes (e.g., ruler) preceded targets that were associated with the dominant meaning of the homonym (e.g., inch), associated with the subordinate meaning (e.g., king), unrelated words (e.g., claw), or nonwords (e.g., smole). Both dominant and subordinate associates elicited smaller amplitude N400s and LPCs than unrelated targets (i.e., were primed). The N400 priming effect was greater for dominant than subordinate associates, reflecting automatic processing of meaning frequency. In contrast, the LPC priming effect was similar for dominant and subordinate associates. This pattern of differential effects of meaning frequency is consistent with theories that posit an initial processing advantage for the dominant meaning of biased homonyms. However, these data suggest that subsequent cues provided by even a single word context can boost activation of the subordinate meaning to the extent that it becomes similar to the level of activation of the dominant meaning.

B88

UNDERSTANDING HYPOTHETICAL EVENTS IN DISCOURSE

Veena Dwivedi[1]; [1]Brock University — In a self-paced reading study, 48 participants read 32 2-sentence discourses, followed by comprehension questions. Our previous ERP work showed that sentences containing modal auxiliaries were sensitive to previous context. In the current work, we extend this finding to investigate whether sensitivity to context is modulated by type of modal auxiliary. Context sentences (S1) were either Hypothetical or (S1') Control (factual), and the subsequent continuation sentence (S2) contained one of two modal auxiliaries, either should or would. S1: The reporter is daydreaming about a possible interview question. S1': The reporter regrets the interview question. S2a/b: It should/would cause a public uproar. We hypothesized the reading times for would vs. should sentences would differ when they followed Control contexts, since would is known to require a hypothetical context (Stump, 1985; Dwivedi, 1996). This is not the case for should, e.g, Jane would buy that car (if she had the money) vs. Jane should buy that car--the latter sentence does not require a hypothetical scenario to be interpreted. No evidence of differences in reading times at continuation sentences between different contexts was found. However, question-answer response accuracy did pattern as expected along the semantic requirements of would vs. should. Participants were less accurate in answering questions for would when it was preceded by a Control vs. Hypothetical context; this was not the case for questions in response to should sentences. We interpret these findings as consistent with a language processing model that is heuristic first, algorithmic second.

B89

THE N400 COMPONENT OF THE EVENT-RELATED BRAIN POTENTIAL REFLECTS IMPLICIT SEMANTIC PREDICTION ERROR: EVIDENCE FROM A CONNECTIONIST MODEL OF SENTENCE COMPREHENSION

Milena Rabovsky[1], Steven Hansen[1], James McClelland[1]; [1]Stanford University — The N400 component of the event-related brain potential is widely used in research on language and semantic memory, but the specific cognitive functions underlying N400 amplitudes are still unclear and actively debated (Kutas & Federmeier, 2011). Recent simulations with a connectionist model of word meaning suggest that N400 amplitudes might reflect implicit semantic prediction error (Rabovsky & McRae, 2014) in line with early discussion by McClelland (1994). Here, we extend these simulations to sentence comprehension, using a connectionist model of sentence processing (McClelland et al., 1989) to simulate a number of N400 effects obtained in empirical research. In the model, sequentially incoming words update the representation of sentence meaning and, important for present purposes, this representation not only reflects sentence meaning as apparent from the constituents presented so far, but also reflects the model's best

guess interpretation of the meaning of the sentence as a whole, predicted based on the statistical regularities in the model's environment. As each new word comes in, the representation of sentence meaning is updated and this update reflects the implicit prediction error contained in the previous representation. Simulating influences of semantic congruency, cloze probability, a word's position in the sentence, semantic and associative priming, repetition, and interactions between repetition and semantic congruency, we found that this update of the predictive representation of sentence meaning consistently patterned with N400 amplitudes. These results yield further support to the idea that N400 amplitudes reflect implicit semantic prediction error (McClelland, 1994; Rabovsky & McRae, 2014).

B90

NEURAL BASIS OF CONFLICT RESOLUTION IN ENCODING AND RETRIEVAL INTERFERENCE

Andrew Jahn[1], Hannah Jones[1], Clinton Johns[1], Dave Kush[1], Morgan Bontrager[1], Stephen Frost[1], Julie Van Dyke[1]; [1]Haskins Laboratories — Recent evidence points to retrieval interference from semantic distractors as a primary source of difficulty during thematic integration, while interference from phonological distractors plays a role only at encoding (Kush et al., 2015; Van Dyke & McElree, 2006). The current study used an event-related fMRI design to examine the neurological basis of these effects. An analysis of subdivisions within the left lateral prefrontal cortex revealed that only encoding interference was associated with significant activation in BAs 47 and 44/45, while both encoding and retrieval interference elicited significant activations within the left dorsolateral prefrontal cortex (DLPFC). These results suggest that the DLPFC responds to resolution of verbal conflict regardless of the type of interference that is processed. Inferior frontal areas show greater specificity to phonologically-based encoding interference, while medial regions are associated with selection of the necessary object in order to complete filler-gap dependency.

B91

COGNITIVE CONTROL ABILITY INFLUENCES PREDICTION DURING COMPREHENSION FOR OLDER ADULTS: EVIDENCE FROM ERPS

Megan Zirnstein[1], Janet G. van Hell[1], Judith F. Kroll[1]; [1]Pennsylvania State University — Young adult comprehenders tend to form expectations for upcoming input, especially when the meaning of the text or utterance is strongly constrained (Federmeier, 2007; Van Berkum, 2008). When expectations are met, this often results in a reduced N400 ERP response to expected words (Federmeier et al., 2002; 2007). However, when expectations are not met, and unexpected input is encountered, costs arise, often in the form of a late, frontally distributed positivity. Although younger adults typically predict during reading, older adults are less likely to do so, especially if they perform more poorly on tasks of executive function (i.e., category fluency task; DeLong et al., 2012; Federmeier et al., 2010). In a recent study (Zirnstein et al., under review), better inhibitory control was associated with a reduction in the frontal positivity when predictions were disconfirmed, suggesting that control plays a role in determining how readers mediate this type of conflict. In the current study, older adults read sentences of varying semantic constraint while their EEG was recorded and completed measures of cognitive control ability. Our results replicated prior work (Wlotko et al., 2012), where some but not all older adults exhibited a frontal positivity ERP effect. In particular, how older adults balance between proactive goal maintenance and correctly suppressing irrelevant information influenced (1) whether they were likely to predict and (2) the level of cost when those predictions were not fully realized. We discuss these findings in the context of cognitive decline and its effect on comprehension and executive function.

B92

STRUCTURAL AND FUNCTIONAL DYNAMICS OF BILINGUAL READING AS A FUNCTION OF THE AGE-OF-ACQUISITION

Myriam Oliver[1], Manuel Carreiras[1,2], Pedro Paz-Alonso[1]; [1]BCBL.Basque Center on Cognition,Brain and Language. Donostia-San Sebastian,Spain, [2]IKERBASQUE, Basque Foundation for Science, Bilbao, Spain. — Neuropsychological and neuroimaging research have extensively demonstrated the involvement of left-lateralized perisylvian regions in reading processes. Recent evidence has suggested that, compared to monolinguals, bilingual readers may exhibit a weaker left-lateralized pattern of regional activations and a more extensive engagement of left perisylvian and right-hemisphere homologous regions (Park et al., 2012). Here, we sought to investigate lateralized patterns between bilinguals as a function of age-of-acquisition using a multimodal neuroimaging approach, with fMRI, cortical thickness and DTI data. A total of thirty-six right-handed bilinguals with Spanish as their L1, who learned Basque as their L2 before age 3 (early bilinguals; n = 18) or after age 6 (late bilinguals; n = 18), participated. Region-of-interest analysis revealed a similar recruitment of left and right language-related regions in both early and late bilinguals except for the left and right pars triangularis. Moreover, functional connectivity analyses confirmed a tighter coactivation among left and right pars triangularis in early but not in late bilinguals for reading in L1 relative to reading in L2. Importantly, structural analysis revealed increased cortical thickness in right pars triangularis for early relative to late bilinguals. Diffusion MR tractography of the anterior part of the corpus callosum connecting left and right pars triangularis revealed differences between early and late bilinguals. Altogether, these findings provide strong converging evidence of structural and functional changes involving left and right triangularis as a function of AoA of the L2.

B93

EVENT PROCESSING IS AFFECTED BY AN INTERACTION BETWEEN ACTUAL AND CANONICAL EVENT PROPERTIES AND LANGUAGE: A VISUAL ERP STUDY

Annika Andersson[1], Marianne Gullberg[1]; [1]Lund University — Languages differ in how events are described, but little is known about how language interacts with online event processing. To explore this question we examined placement events in Swedish. Swedish has three obligatory placement verbs, sätta, 'set', ställa 'stand', lägga, 'lay', and lacks a superordinate general term like English put (Gullberg & Burenhult, 2011; Viberg, 1999). Every placement event in Swedish must be labeled by one of the three verbs, whose choice depends on object properties, and the object's relationship to the ground. The current study investigates how sensitive Swedes are to the relationship between event properties and verb labels. Native speakers (N = 20, 18-35-years) watched images of a hand placing an object on a table followed by visually presented sentences that were either congruent or incongruent with the images while event-related potentials were recorded and time-locked to the placement verbs. We varied object properties such as ± base (e.g., glass/orange), spatial extension (e.g., tall/short glass), and orientation (vertical/horizontal). The three verbs were combined with each image in a cross-subject design. The results showed that, as expected, incongruent picture-verb combinations elicited an increased centro-medial N400 modulated by verb appropriateness. Congruent picture-verb combinations also elicited an N400 when objects were placed in non-canonical positions (e.g. laying a glass on its side), suggesting that native placement event processing may depend on an interaction between actual and canonical event properties and language. A follow up study presenting auditory sentences simultaneously with images will explore this hypothesis further.

B94

A PIECE OF CKAE: NEUROCOGNITIVE INDICES OF PREDICTION AND SENTENTIAL CONSTRAINT DURING VISUAL WORD RECOGNITION

Nyssa Z. Bulkes[1], Darren Tanner[1]; [1]University of Illinois at Urbana-Champaign — Visual word recognition in context requires rapid extraction of information from multiple sources. During reading, top-down information (e.g. semantic context) can facilitate bottom-up (e.g. visual input) processing (e.g., Balota, et al., 1985). Processing is impeded, however, when the expectations of bottom-up information conflicts with top-down expectations. Previous ERP research has found the visual system to be sensitive to top-down semantic information, as semantically-supported pseudowords ("ceke", expected "cake") elicit a different pattern of early visual ERPs than semantically-unsupported pseudowords ("tont": Kim & Lai, 2012). Using ERPs, we investigated whether sentential constraint can mitigate an impoverished visual input and more heavily weight top-down information when resolving unexpected input. We additionally investigated how the nature of the visual impoverishment impacts early cortical potentials associated with visual word recognition by contrasting semantically supported pseudowords ("ceke") with words containing letter transpositions ("ckae"). Behavioral work on lexical access has shown that letter transpositions are less disruptive than misspellings or letter substitutions during reading; however, no work has yet contrasted early visual ERPs elicited

by transposed letters versus semantically-supported pseudowords in sentence context. ERPs were recorded while participants read either high- or low-constraint sentences, where target words were either correct ("cake"), contained a letter transposition ("ckae"), or a semantically-supported pseudoword ("ceke"). Results expand on earlier work to further demonstrate how predictive processes are modulated by the level of sentential constraint and, in turn, how interactions between top-down and bottom-up information while reading affect linguistic prediction. Results are discussed with respect to current models of visual word recognition.

B95

SCALING UP TO A SENTENCE: THE TEMPORAL UNFOLDING OF CONCEPTUAL SPECIFICITY AND SENTENTIAL POLARITY EFFECTS IN LEFT ANTERIOR TEMPORAL AND MEDIAL PREFRONTAL CORTEX

Linmin Zhang[1], Liina Pylkkänen[1,2]; [1]New York University, [2]NYUAD Institute (NYU Abu Dhabi) — Research on both single words and minimal two-word phrases has implicated the left anterior temporal lobe (LATL) as a site of conceptual integration with robust sensitivity to conceptual specificity. However, this research has not yet been scaled up to a sentence and thus the impact of conceptual specificity on natural sentence comprehension is unclear. Here we embedded phrases varying in featural specificity into the subject position of full sentences, and additionally, modulated determiner polarity (a vs. no), with the aim of introducing a more grammatical source of variation in the information specificity of the expression. In all, the design contained three factors, determiner polarity (a vs. no), adjectival modification (with vs. without) and noun specificity (specific vs. general), leading to following types of sentences: a/no-(green)-reptile/lizard-is-resting. MEG analyses covered each word and based on prior literature, targeted the LATL and ventromedial prefrontal cortex (vmPFC). The results showed that (i) both the LATL and the vmPFC were sensitive to determiner polarity at the determiner, (ii) adding an adjectival modifier caused more activity during the presentation of the noun in both the LATL and the vmPFC and (iii) in the LATL, adjectivally modified sentences elicited increased activation not only at the noun, but also at the auxiliary and the verb. In all, our results suggest that the LATL's role in semantic processing is not limited to conceptual features (given effects of determiner polarity) and that effects of semantic composition within a noun phrase can still be seen several words after the noun.

LONG-TERM MEMORY: Episodic

B96

THE PSYCHOLOGY OF EVERYDAY THINGS: HOW PERCEPTUAL AND CONCEPTUAL FEATURES INFLUENCE MEMORY FOR OBJECTS.

Simon Davis[1], Benjamin Geib[1], Rosalie Cichinelli[1], Marty Woldorff[1], Roberto Cabeza[1]; [1]Duke University — The explosion of fMRI-based representational similarity analyses (RSA) have helped to elucidate the functional correlates of object representation at both coarse and fine-grained levels. What is less clear is the role of these complex representational structures in forming lasting episodic memories. Here we show for the first time how complex feature similarity predicts distinct forms of episodic memory performance. Subjects named everyday objects during fMRI and returned a day later to make old/new judgments on either conceptual (old/new words) or perceptual information (same/exemplar images). RSA analyses using representational dissimilarity matrices (RDMs) representing the overlap of visual features, category membership, and conceptual features were compared with brain RDMs representing neural similarity in regions along the ventral stream. Replicating previous visual object recognition studies, visual feature RDMs showed the strongest overlap with brain RDMs in early visual cortices, while semantic feature RDMs showed strong relationships with brain RDMs in anterior temporal regions (perirhinal, anterior temporal pole). As expected, the hippocampus showed greater pattern similarity for subsequently remembered than subsequently forgotten trials regardless of memory type. However, we observed that while perceptually remembered trials showed greater pattern similarity earlier in the ventral stream, conceptually remembered trials demonstrated greater pattern similarity in perirhinal cortex. These results help to link perceptual and conceptual accounts of object encoding, and describe the importance of characterizing the representation of everyday things in predicting how these objects will later be remembered.

B97

THE NEURAL MECHANISM SUPPORTING POST-RETRIEVAL MONITORING IS SENSITIVE TO THE PRECISION OF RECOLLECTION

Jamie Murray[1], David Donaldson[1]; [1]University of Stirling — Episodic memory (i.e., memory for events) is supported by post-retrieval processing that operates on the contents of retrieval in service of specific retrieval goals. Although post-retrieval processing has been a useful construct for understanding memory related deficits following brain lesions, the functional significance of the neural mechanisms associated with these processes remains unclear. One possibility is that post-retrieval processing reflects the monitoring and evaluation of information, with greater monitoring required when the quality of information is low. To date, however, studies of retrieval monitoring have not separated the rate of retrieval (i.e., the probability that one will remember) from the quality of retrieval (i.e., the precision of successfully remembered information). Here, we aimed to directly assess whether post-retrieval processes were sensitive to the quality of retrieved information. A continuous source task was used, requiring participants to remember words paired with a location marked around a circle, allowing trials to be subsequently separated according to the level of source precision (i.e., the radial distance between the target location and the remembered location) rather than just subjective confidence or old/new discrimination. By measuring the Right Frontal Old/New Effect (a commonly reported electrophysiological correlate of post-retrieval processing) we found that only information retrieved with the highest precision elicited a significant effect. We discuss the theoretical implications of the current findings, which clearly contradict the prediction that monitoring processes should be engaged when retrieval provides low quality information – suggesting instead that post-retrieval processing is sensitive to the retrieval of high quality information.

B98

PREDICTING EPISODIC AND SPATIAL MEMORY FROM RESTING-STATE CONNECTIVITY: A FUNCTIONAL DISSOCIATION BETWEEN THE ANTERIOR AND POSTERIOR HIPPOCAMPUS

Jonas Persson[1], Eva Stening[1], Kristin Nordin[1], Hedvig Söderlund[1]; [1]Uppsala University — While the anterior (aHPC) and posterior (pHPC) hippocampus have been found to differ in their resting-state functional connectivity (RSFC), whether they reflect functionally distinct networks is still largely unknown. Converging evidence from lesion studies and task-related fMRI suggest that pHPC enables spatial memory and navigation while aHPC is central to non-spatial episodic memory. To investigate potential relationships between hippocampal RSFC and hippocampus dependent memory, we used Relevance Vector Regression (RVR), a machine learning approach to predicting continuous outcome measures from patterns of neuroimaging data, with the hypothesis that patterns of whole-brain RSFC associated with aHPC predict episodic memory performance, while patterns of whole-brain RSFC associated with pHPC predict spatial memory performance. Spatial memory was assessed with a virtual Water Maze task and episodic memory was measured with a two-dimensional object-location task, using item and location memory as outcome measures. Memory assessment and magnetic resonance imaging took place at two separate occasions. The anterior and posterior RSFC largely corresponded with previous findings, and showed no effect of laterality. Supporting the hypothesis, RVR produced accurate predictions of episodic performance from RSFC associated with aHPC, but not pHPC, and accurate predictions of spatial performance from pHPC, but not aHPC, RSFC. This pattern was confirmed with an ANOVA, showing a significant interaction between hippocampal axis and memory type. The results lend support to a functional dissociation between the anterior and posterior hippocampus, and suggest a connection between intrinsic functional networks and cognitive performance within specific domains, that is relatively stable over time.

B99

INTERACTIONS OF CONCEPTUAL FLUENCY AND EPISODIC FAMILIARITY AS REFLECTED IN EVENT-RELATED POTENTIALS

Regine Bader[1], Axel Mecklinger[1]; [1]Saarland University, Saarbrücken, Germany — Event-related potential (ERP) old/new effects have been associated with different sub-processes of episodic recognition. While the link between recollection and the left-parietal old/new effect seems to be uncontroversial, the relationship between familiarity and the mid-frontal old/new effect has been debated. It has been argued that the mid-frontal effect reflects differences in conceptual fluency between old and new items and is related to episodic familiarity only when conceptual fluency co-varies with familiarity – a tempting notion as the N400, which is reduced when conceptual processing is facilitated, occurs in the same time window. However, a third possibility is that the mid-frontal effect under most circumstances reflects the interaction of familiarity and conceptual processing. To test this, we manipulated conceptual fluency and episodic familiarity orthogonally in an incidental recognition test: visually presented old and new words were preceded by either conceptually related or unrelated auditory prime words. If ERP old/new differences are functionally indistinguishable from conceptual priming effects, the ERP contrast reflecting only priming (new words in the related vs. unrelated condition) and the contrast reflecting priming plus familiarity (old words in the related vs. new words in the unrelated condition) should differ in magnitude but not in scalp distribution. Contrary to this prediction, the priming contrast had a typical N400 distribution with a right-parietal maximum whereas the priming plus familiarity contrast was significantly more frontally accentuated. This implicates that old/new effects in this time window not merely reflect differences in conceptual processing but an interaction of episodic familiarity and conceptual processing.

B100

AN ERP STUDY OF ADULT AGE DIFFERENCES IN THE USE OF SELF-DIRECTED CONCEPTUAL COMBINATION TO CONSTRUCT UNITIZED MEMORY REPRESENTATIONS

Heather D. Lucas[1], Resh S. Gupta[1,2], Ryan J. Hubbard[3], Kara D. Federmeier[4]; [1]University of Illinois at Urbana-Champaign, [2]Vanderbilt University — When meaningful stimuli such as words are encountered together (e.g., "elephant-ferry), they can be processed either separately or as a combined concept ("an elephant ferry"). Prior research suggests that associations subject to conceptual combination are represented in a more unitized or holistic manner relative to separately-processed associations, and may show less susceptibility to age-related associative memory decline. However, little is known about how aging can influence the conceptual combination process itself, which may affect its utility as a memorization strategy. We recorded ERPs while older and younger adults studied pairs of sequentially-presented, unrelated nouns using a strategy that either did or did not involve attempting to generate plausible definitions. To examine the role of imagery in conceptual combination, we included both concrete-concrete ("blanket-clay") and abstract-concrete pairs ("irony-shield"). We found that during the conceptual combination task, younger adults showed evidence of compositional imagery, or differences in imagery-related ERPs evoked by second nouns according to the concreteness of the preceding first nouns. By contrast, older adults only showed item-level concreteness effects, suggesting reduced compositional language processing. Although both groups showed similar benefits of conceptual combination on subsequent associative recognition memory, older adults showed reduced evidence of unitization following the conceptual combination task when memory was tested via free recall. Together, these findings raise the possibility that age-related decreases in the use of compositional imagery may limit older adults' ability to employ conceptual combination as a unitization strategy.

B101

HYPOTHALAMIC-PITUITARY-ADRENAL AXIS ACTIVATION IS NECESSARY FOR THE PREFERENTIAL CONSOLIDATION OF EMOTIONAL MEMORY TRACES

Tony Cunningham[1], Michelle M. Wirth[1], Jessica D. Payne[1]; [1]University of Notre Dame — Stress activates the Hypothalamic-Pituitary-Adrenal (HPA) Axis, leading to the release of the stress hormone cortisol. Emotional experiences produce robust memory traces in the brain, and increased cortisol concentration has been linked to enhanced memory for emotional content, but impaired consolidation for neutral information. The Trier Social Stress Test (TSST) is a psychosocial stressor that has been shown to generate increased cortisol in a large proportion of participants. Here, participants encoded scenes consisting of negative or neutral objects on neutral backgrounds, followed by the TSST (n=39) or a control condition (n=26). The next day, recognition memory was tested for objects and backgrounds separately. The stress group was divided into high (n=20) and low (n=19) responders to explore how increased cortisol would affect the selective consolidation of emotional content. For high responders, mixed ANOVA analysis revealed a three-way interaction among Condition (stress/control), Scene Component (object/background), and Valence (negative/neutral) [$F1,44=4.2,p=0.047$], driven by an increase in memory for negative objects [$t(44)=2.1,p=0.043$]. Thus, there was a significantly larger emotional memory "tradeoff effect" in the high responder group than in the control group [$t(44)=2.3,p=0.025$]. Stress low responders, however, performed identically to the control group [$F1,43=0.063,p=0.8$]. This suggests that a physiological stress response leading to an increased concentration of cortisol is necessary to produce these memory effects. We theorize that HPA axis activation "tags" emotional objects as especially important, enabling mechanisms active during consolidation to selectively enhance emotional memory processing while continuing to suppress neutral information.

B102

PSYCHOLOGICAL STRESS DISRUPTS THE NEURAL CORRELATES OF ASSOCIATIVE MEMORY RETRIEVAL

Stephanie A. Gagnon[1], Michael L. Waskom[1], Anthony D. Wagner; [1]Stanford University — We continually retrieve information about prior experiences to guide decisions and actions in the present. The process of recollecting specific, associative details about past events involves engagement of the hippocampus and, in part, frontoparietal control mechanisms. However, when faced with a stressful situation, hippocampal processing can be disrupted. Further, acute stress may impair function in frontoparietal networks critical for controlled processing. Here, we examined whether acute anticipatory stress, operationalized by threat of unpredictable shock, disrupts memory retrieval processes. To the extent that associative retrieval requires engagement of the medial temporal lobe (MTL) and controlled processes, we hypothesized that performance will be vulnerable to interference under conditions of stress relative to safety. During encoding, words were paired with either indoor or outdoor scene associates while participants were in a neutral state. At retrieval 24 hours later, participants were placed into a stress group or control group, and viewed old and new word cues while we measured salivary cortisol and recorded neural activity with functional MRI. If participants recognized the word as old, they were asked to recollect the paired associate. Stress during retrieval impaired hippocampal-dependent memory performance. Further, stress disrupted MTL and frontoparietal activity, and interfered with cortical reinstatement of associated information.

B103

NEURAL RECAPITULATION DURING RETRIEVAL OF EMOTIONAL FACES AND SCENES

Holly Bowen[1], Elizabeth Kensinger[1]; [1]Boston College — Memory is best when the processes engaged during encoding overlap with those engaged at retrieval. One marker of such overlap is neural recapitulation. Previous work has revealed content specific reactivation of fusiform and parahippocampal cortex during retrieval of previously encoded faces and scenes, respectively. No studies have examined how this reactivation might be influenced by the valence of the content. The current fMRI study examines neural recapitulation during retrieval of neutral memoranda previously encoded in an emotional context. Participants intentionally encoded neutral words paired with a positive, negative or neutral face or scene. They then completed a recognition judgment for the words; the emotional face and scene context was not re-presented at retrieval. Conjunction analyses replicated previous evidence of encoding-retrieval overlap for content specific regions associated with processing faces and scenes. Furthermore, recapitulation of emotional context was stronger for remembered negative scenes compared to negative faces.

B104

STABILITY ENHANCES RELATIONAL BUT NOT ITEM INFORMATION AND INFLUENCES MEMORY ORGANIZATION AS INDEXED BY EYE MOVEMENTS

Yi-Chieh Chiu[1], Michael Dulas[1], Patrick Watson[1], Rachel Gonzalez[1], Neal Cohen[1]; [1]University of Illinois at Urbana-Champaign — Remembering daily events involves integrating items, locations, and the relationships between them. Some item-location relationships are stable across experiences (e.g. rooms in a building) while others are more frequently changing (e.g. people in the building). We hypothesized that the presence of stable relationships could aid in the organization of memory, thereby improving memory performance. Participants studied pairs of object images in various positions on the screen. Some of the item-position relationships were constant (stable) across trials while other item-position relationships were trial-specific (non-stable). At test, participants reconstructed the study configurations by selecting individual items from an array and placing them in the appropriate positions, thus recreating studied pairings. Eye movement data were also collected to provide an additional measure of memory and to capture implicit organization in the reconstruction. Results showed a dissociation between item and relational memory performance. Stability did not affect item memory performance, however, relational reconstruction accuracy was enhanced by stability. Furthermore, eye movements revealed that spatial positions that were part of stable relationships received more fixations over positions that were not. In contrast, fixations did not differ between items, regardless of whether or not they were part of a stable item-position relationship. This experiment provides evidence that stable information enhances memory, specifically for relations, and suggests a tendency for information in memory to be anchored around positional relationships.

B105

REAL-WORLD SPATIAL CONTEXTUAL CUES ELICIT SPONTANEOUS RETRIEVAL OF AUTOBIOGRAPHICAL AND SEMANTIC MEMORIES DEPENDING ON FAMILIARITY

Jessica Robin[1,2], Luisa Garzon[1], Sara Pishdadian[1], Morris Moscovitch[1,2]; [1]University of Toronto, [2]Rotman Research Institute, Baycrest — Previous studies of involuntary autobiographical memory retrieval are mostly naturalistic diary studies or laboratory-memory studies based on learned associations between simple stimuli (Berntsen, 2009). One such study revealed that cues with fewer associations are more likely to prompt involuntary memories than cues with several associations (Berntsen, Staugaard, & Sorenson, 2012). In this study we developed a novel paradigm for eliciting spontaneous autobiographical memory retrieval based on real-world locations varying in familiarity, to test ideas derived from theories of memory representation in hippocampal or extra-hippocampal structures. Participants viewed scenes of real-world locations under the guise of a visual memory task, and indicated if they experienced spontaneous thoughts. These were classified by content, and their rate of incidence was compared based on the location's familiarity. Familiar locations were more likely to lead to spontaneous thoughts than unfamiliar locations. Consistent with predictions, we found that the incidence of spontaneous autobiographical episodic memories was highest for locations only visited once or twice. In contrast, for locations visited the highest number of times, participants were more likely to report retrieving a combination of semantic information and more general autobiographical memory. This study demonstrates that real-world spatial context serves as an effective cue for spontaneousmemories. Furthermore, it suggests that contexts with fewer associations may be more likely to trigger spontaneous retrieval of a specific autobiographical episode, while cues with more associations lead to the retrieval of more general autobiographical and semantic memory, consistent with theories related to their representation in hippocampal or extra-hippocampal structures.

B106

NEURAL SPATIOTEMPORAL DYNAMICS UNDERLYING EMOTIONAL INVOLUNTARY MEMORIES IN PEOPLE WITH AND WITHOUT POSTTRAUMATIC STRESS DISORDER

Shana Hall[1], Kaitlyn Brodar[1], Dorthe Berntsen[2], David Rubin[1,2]; [1]Duke University, [2]Aarhus University — One of the hallmark symptoms of posttraumatic stress disorder (PTSD) is intrusive memories about the traumatic experience. In the context of PTSD, these memories are highly emotionally distressing. Here, we compare the neural substrates of emotional involuntary memories to non-emotional involuntary memories in people with and without PTSD. To do this, during encoding sounds are presented with pictures that range from emotionally neutral to negative. This pairing is presented five times to create a strong sound-picture link. During retrieval, in the scanner, participants hear the sounds and do a sound localization task unrelated to memory. After the scan, participants hear the sounds again and report whether they had a memory of the picture when the sound was presented in the scanner and how hard they tried to remember the picture. Neural activity was separated into early (occurred while the sound was playing), and late, (occurred immediately after the sound was played). We found that both groups showed activity in regions typically associated with memory retrieval but that this occurred early for the control group and late for the PTSD group. Conversely, when comparing high emotion trials to low emotion trials, both groups showed activity in regions associated with emotion and emotion regulation but this occurred early in the PTSD group and late in the control group. This suggests that people with PTSD have a delayed neural response to involuntary memory cues but an early emotional response to highly emotional involuntary memories.

B107

EXAMINING THE ROLE OF SCHEMAS IN RETRIEVAL SUCCESS

Christina E. Webb[1], Nancy A. Dennis[1]; [1]The Pennsylvania State University — Schemas act as memory mechanisms that allow one to build frameworks in order to support memory through the use of gist information. The current study sought to use naturalistic scenes in order to investigate changes in the neural basis of veridical memories for information that was inherently tied to the scene's schema (schematic) compared to that which was not directly related to the schema (non-schematic). During encoding, participants viewed schematic scenes (e.g., Christmas, bathroom, camping) and were tested on their memory for the content of the scene, including targets that were related (e.g., toilet) and unrelated to, but not inconsistent with its theme (e.g., vase). Behavioral results showed that schematic items elicited higher recollection rates than non-schematic items, suggestive of greater attention to and memory for the gist of items. Successful recollection of both schematic and non-schematic items was associated with increases in neural activity in the core recollection network, including visual and fronto-parietal regions. Compared to non-schematic retrieval, schematic retrieval showed greater activity in bilateral occipitotemporal regions, including left hippocampus, indicating conscious, detailed retrieval of items in the scene along with their surrounding schematic contexts. In contrast, non-schematic retrieval was mediated by greater activation in medial prefrontal cortex and inferior parietal regions associated with increased decision-making, evaluation and attentional mechanisms required for this more difficult retrieval process. Additionally, schematic retrieval exhibited greater connectivity between parietal and semantic processing regions in left inferior prefrontal cortex, whereas non-schematic retrieval exhibited greater parietal-occipitotemporal connectivity, indicating differences in engagement of retrieval support.

B108

DETAILED VISUAL SPATIAL MEMORY PRODUCES RETINOTOPIC ACTIVITY IN EARLY VISUAL REGIONS

Jessica Karanian[1], Brittany Jeye[1], Scott Slotnick[1]; [1]Boston College — Previous work has demonstrated that encoding-related sensory activity is reinstated during explicit long-term memory retrieval. This has been shown for all the sensory modalities and, within the visual modality, for specific features (i.e., spatial location, motion, color, and shape). For instance, memory for items previously presented in the left visual field reactivated the right early visual regions, while memory for items previously presented in the right visual field reactivated the left early visual regions. In the present fMRI investigation, we assessed whether encoding-related retinotopic activity would be reinstated during memory for items presented in different quadrants of the visual field. During encoding, participants viewed abstract shapes presented in one of four visual field quadrants (upper-left, lower-left, upper-right, lower-right). During retrieval, old shapes were presented at fixation and participants indicated whether each shape was previously presented in the "upper-left", "lower-left", "upper-right", or "lower-right" quadrant. Data were acquired at 3T with a 32-channel head coil. A preliminary random-effect general linear model analysis revealed that memory for items in each

quadrant of the visual field reinstated encoding-related retinotopic activity. Specifically, memory for the upper-left quadrant preferentially activated the ventral right early visual regions, memory for the lower-left quadrant preferentially activated dorsal right early visual regions, memory for the upper-right quadrant preferentially activated ventral left early visual regions, and memory for the lower-right quadrant preferentially activated dorsal left early visual regions. The present results provide the most detailed evidence to date that memory for spatial information can activate the corresponding retinotopic early visual regions.

B109

ASSOCIATIVE MEMORIES BENEFIT FROM DISTINCTIVENESS AT ENCODING, WHILE FEATURE-BASED INTEGRATION EMERGES OVER TIME

Alexa Tompary[1], Lila Davachi[1]; [1]New York University — Theories of systems-level consolidation propose that the neural traces of episodic memories are gradually distributed across cortical regions. While it has been suggested that pattern separation benefits episodic memory, the extraction and later representation of regularities across episodes is critical for semantic knowledge. We developed an fMRI study to investigate how representations of memories change with time, from encoding to long-term retrieval. In the first scan session, subjects encoded object-scene pairs, where each object was paired with one of four repeating scenes and presented three times. Encoding was followed by memory tests for half of the pairs. In a second scan a week later, subjects completed the same memory tests on the other half of the pairs. We focused on the hippocampus and a region in vmPFC known to be increasingly involved in memory retrieval over time (Takashima et al 2006). We found that during cued recall, the similarity of overlapping memories increased relative to non-overlapping memories in the right hippocampus and vmPFC. Critically, this relationship only emerged after one week of consolidation. During encoding, however, all memories grew more distinct with repeated presentations. Furthermore, in right hippocampus, we found greater subsequent memory for pairs that became more distinct from other pairs across the repeated presentations at encoding. Together this suggests that with consolidation, the representation of a memory might reflect stronger associations with other relevant memories, despite increased separation of successfully encoded items. Future analyses will aim to understand the relationship between encoding processes and consolidation-dependent integration.

B110

CA3 SUBFIELD VOLUME PREDICTS ANTEROGRADE AUTOBIOGRAPHICAL MEMORY LOSS IN ORGANIC AMNESIA

Thomas D. Miller[1,2], Penny A. Gowland[3], Trevor T.-J. Chong[4], Tammy W.C. Ng[5], Anne M. Aimola Davies[1], Michael R. Johnson[6], Sarosh R. Irani[1], Angela Vincent[1], Masud Husain[1], Chris Kennard[1], Clive R. Rosenthal[1]; [1]University of Oxford, [2]Royal Free Hospital, London, [3]University of Nottingham, [4]Macquarie University, [5]University College Hospital, London, [6]Imperial College London — Advances in ultra-high field anatomical MRI have renewed interest in the structure and function of human hippocampal subfields, but these methods are seldom applied to lesion studies of chronic amnesia due to challenges in defining anatomical borders within the hippocampus. Here we segmented and quantified five principal hippocampal subfields (subiculum, cornu ammonis 1, 2, 3, and dentate gyrus) at 7.0-Tesla MRI in 14 healthy adults and in 12 participants with chronic amnesia following limbic encephalitis. Hippocampal volumes were acquired using three-dimensional fast-spin echo imaging, at an in-plane resolution of 0.39 x 0.39 mm2 and a slice thickness of 1.0 mm. Behavioural sequelae associated with hippocampal pathology were examined by assessing the link between the five subfield volumes on a test of anterograde episodic memory, the Autobiographical Interview (AI). The results revealed that the amnesic group had significantly impaired anterograde autobiographical memory (internal details) – as operationalized by point score on the AI relative to controls – but not for the personal semantic component (external details). Bilateral CA3 volumes were significantly reduced in the amnesic group relative to the age-matched control group. Critically, CA3 volumes in both groups significantly predicted performance on the anterograde internal detail point score of the AI. No other subfield volumes predicted performance on either the AI. We discuss the implications of these results in terms of computational neuroanatomical accounts that identify CA3 with a role in binding elements from episodes or associations.

B111

EPISODIC MEMORY AND AGING: THE EFFECT OF PERCEPTUAL PROCESSING FLUENCY ON RECOGNITION MEMORY PROCESSES

Christine Bastin[1], Sylvie Willems[2]; [1]Cyclotron Research Center, University of Liège, Belgium, [2]Psychology and Speech Therapy University Clinic, University of Liège, Belgium — Normal aging is characterized by decreased recollection, but better preserved familiarity. Memory tasks that facilitate the use of familiarity should allow attenuating age-related differences in memory. The study tested two hypotheses: (1) can the reliance on familiarity during recognition memory be promoted by increasing the difference in perceptual processing fluency between old and new items; (2) can this manipulation reduce age-related difficulties in episodic memory? Twenty-four young and 24 older adults performed two verbal recognition memory tasks. In the No-Overlap task, target words and new words did not share any letter. Prior exposition to the target words thus induced increased processing fluency of the words and letters, so that fluency difference was a salient and reliable cue to discriminate between old and new words. In the Overlap task, target and new words had letters in common, so fluency cues were less useful. Recollection and familiarity was assessed with the Remember/Know/Guess paradigm. The results showed an age effect on recollection but intact familiarity. Moreover, (1) memory performance was better in the No Overlap than the Overlap task, with a greater hit rate and a smaller false alarm rate associated with familiarity. And, (2) age-related differences in recognition accuracy (hits – false alarms) were significantly attenuated in the No Overlap task compared to the Overlap task. These findings suggest that minimizing the perceptual similarity between targets and distractors, and thus increasing processing fluency differences, allowed to reduce the effect of age on recognition memory performance by facilitating the use of familiarity.

B112

STRATEGICALLY ORIENTING RETRIEVAL ATTEMPTS TOWARD THE AGE OF A MEMORY: AN ELECTROPHYSIOLOGICAL STUDY DISSOCIATING DIFFICULTY

Emily K. Leiker[1], Anna K. McGhee[1], Jeffrey D. Johnson[1]; [1]University of Missouri — It is well-established that the probability of successful episodic retrieval is affected by the 'age' (the duration of the encoding-retrieval interval) of the targeted memory. Although this finding is traditionally interpreted in terms of decay or interference of the memory trace, recent evidence suggests that retrieval success may also depend in part on how participants strategically orient search attempts to memory age. One challenge to investigating strategic orienting to memory age is the increased difficulty associated with retrieving remote compared to recent memories. By concurrently manipulating difficulty and memory age, the present study aimed to further dissociate their respective effects on retrieval orientation. Participants (N = 15) encoded lists of pictures during two laboratory visits separated by one week. Items within each encoding session were presented either one or four times to manipulate the associated difficulty of retrieval. Participants then completed a series of memory tests based on an exclusion procedure in which pictures from only one week-repetition condition at a time were targeted, while new pictures and those from the other conditions were rejected. Consistent with previous results, event-related potentials (ERPs) elicited by new items were more positive over posterior scalp when items from the recent compared to remote encoding session were targeted. Additionally, these differences were evident even when comparing remote items presented four times to recent items presented once, which gave rise to matched behavioral performance. The findings provide further evidence indicating that the age of a memory leads to differential adoption of retrieval orienting strategies.

LONG-TERM MEMORY: Semantic

B113

DO THE MEDIAL TEMPORAL LOBES PLAY THE SAME ROLE IN EPISODIC AND SEMANTIC MEMORY? UNIVARIATE AND GRAPH THEORY ANALYSES OF FMRI DATA

Wei-Chun Wang[1], Matthew L Stanley[1], Benjamin R Geib[1], Nadia M Brashier[1], Elizabeth J Marsh[1], Roberto Cabeza[1]; [1]Duke University — The question of whether medial temporal lobe (MTL) regions make similar or different contributions to episodic and semantic memory has persistently remained a fundamental issue in cognitive neuroscience of memory. To shed new light on this issue, we fMRI-scanned participants while they were retrieving factual statements from episodic or semantic memory. We computed not only local MTL activity using standard univariate analyses but also MTL connectivity with the rest of the brain using multivariate graph theory measures. Univariate analyses showed that episodic and semantic retrieval activated similar MTL regions, with additional activity for episodic retrieval. In contrast, graph theory analyses showed clear laterality differences in MTL connectivity between episodic and semantic retrieval conditions. MTL regions in the left hemisphere exhibited higher global efficiency for semantic compared to episodic retrieval, and this change in global integration was partly facilitated by a dramatic re-organization of immediate connections. In summary, whereas univariate results showed greater activity in MTL and surrounding regions for episodic compared with semantic retrieval, graph theory analyses revealed greater capacity for global integration of information for MTL and surrounding regions for semantic compared with episodic retrieval.

B114

FEATURE-BASED INTEGRATION OF CONCEPTUAL AND PERCEPTUAL OBJECT INFORMATION IN VENTRAL TEMPORAL CORTEX

Chris Martin[1], Louisa Man[1], Rachel Newsome[1,2], Danielle Douglas[1], Morgan Barense[1,2]; [1]University of Toronto, [2]Rotman Research Institute — Neuropsychological and fMRI research has firmly established a link between aspects of the anterior temporal lobes, including perirhinal cortex (PrC), and the abstraction of conceptual information pertaining to objects. For example, representational similarity reflected in patterns of PrC BOLD activity is predicted by conceptual similarity between objects. However, these results remain challenging to interpret as most studies confound conceptual and perceptual similarity; conceptually similar objects tend to be perceptually similar (e.g., lion and tiger) and conceptually dissimilar objects are typically perceptually dissimilar (e.g., lion and apple). Interpretation is further complicated by the fact that a substantial body of research also points to a role for PrC in support of perceptually-based discriminations of semantically meaningless complex objects. In the current study, we used representational similarity analyses of fMRI data to examine the extent to which the processing of conceptual and perceptual object properties is related in different aspects of ventral temporal cortex (VTC), including PrC. Participants completed a property verification task that encouraged either conceptual or perceptual processing of objects. Importantly, we independently manipulated perceptual and conceptual overlap across items. Preliminary results suggest that conceptual and perceptual object properties were represented similarly in anterior aspects of VTC, even after controlling for stimulus similarity along these dimensions. By contrast, corresponding conceptual and perceptual information in more posterior regions was represented in a more independent manner. These results suggest that conceptual and perceptual object properties become integrated as information progresses rostrally through VTC.

B115

BECOMING A MARTIAN ARCHEOLOGIST: A TOOL TRAINING STUDY INVESTIGATING EMBODIED REPRESENTATIONS

Heath Matheson[1], Sharon L. Thompson-Schill[1]; [1]University of Pennsylvania — GOALS: Theories of embodied cognition propose that we recognize tools by reactivating sensorimotor representations of tool use. It is thought that these activations underlie the potentiation effect, the finding that people are faster to respond, in a number of cognitive tasks, with the hand that is compatible with the location of an object's handle. However, recent research suggests that the potentiation effect could be due to visual attention and not motor representations. We sought to test the hypothesis that the potentiation effect is due to embodied motor representations by directly manipulating the embodied experience of participants who are learning a set of novel tools. METHODS: We trained one group to use a set of novel, 3-D printed tools under the pretense that they were preparing for an archeological expedition to Mars; we trained a second group to report declarative information about how the tools are stored. With this design, familiarity and visual attention to different object parts was similar for both groups, though their qualitative interactions differed. After learning, participants made semantic and perceptual judgments of visually presented tools and reported via button press. RESULTS: We showed that regardless of specific experience, attention to the visual shape of an object potentiates motor responses; potentiation only weakly depends on embodied representations. CONCLUSION: These results are the first to directly show that embodied experience only weakly shapes the potentiation effect. Future research will explore the effects of embodied vs. declarative experience with other tasks aimed at testing embodied hypotheses.

B116

DECODING CONTRIBUTIONS OF PREFRONTAL AND SENSORY-SPECIFIC CORTICES TO THE RETRIEVAL OF PERCEPTUAL KNOWLEDGE

Samuel A. Nastase[1], Adam E. Green[2], Emily S. Cross[3,4], Yune S. Lee[5], Yaroslav O. Halchenko[1], James V. Haxby[1,6], David J. M. Kraemer[1]; [1]Dartmouth College, [2]Georgetown University, [3]Bangor University, [4]Radboud University Nijmegen, [5]University of Pennsylvania, [6]University of Trento — Semantic memory relies on highly-distributed neural machinery mediating both retrieval operations and perceptual knowledge. The current study leverages multivariate pattern analysis to decode retrieval states under varying task demands. Neural response patterns were recorded with fMRI while 24 participants performed real-world size and sound comparisons for various object pairs. A factorial design crossed visual and auditory retrieval modalities with easy and hard selection difficulty. Univariate contrasts demonstrated an effect of selection difficulty in left ventrolateral prefrontal cortex (vlPFC) and posterior perceptual areas. Auditory retrieval recruited left-lateralized association cortices, while visual retrieval recruited right-lateralized parietal and lateral occipitotemporal cortices. Using a linear SVM classifier, retrieval states were decoded across subjects from distributed whole-brain activity patterns with accuracies exceeding 80%. Significant cross-classification accuracies for retrieval modality and difficulty suggest both factors are encoded partially independently. Both whole-brain sensitivity analysis and searchlight classification were used to localize cortical contributions to task decoding. Several classification analyses were also performed within anatomically-defined ROIs. Selection difficulty impacted response patterns in the precuneus and ventral temporal cortex independently of retrieval modality. Late-stage perceptual areas were modulated by difficulty in both modalities, whereas early sensory cortices were impacted primarily within their preferred modality. Overall, these results indicate that semantic retrieval states can be robustly decoded across participants. Findings also reveal that response patterns in vlPFC encode both modality and difficulty during retrieval, and that selection difficulty impacts processing in both early and late perceptual areas.

B117

OLDER AND RICHER: HIPPOCAMPAL SUPPORT FOR UPDATING AND ENRICHING SEMANTIC REPRESENTATIONS OVER TIME

Nathaniel B. Klooster[1], Melissa C. Duff[1]; [1]University of Iowa — In recent work, we showed that remote semantic memory is impoverished in patients with bilateral hippocampal damage and amnesia (Klooster & Duff, 2015). Specifically, hippocampal patients performed significantly worse on productive and receptive measures of semantic richness and depth of vocabulary knowledge than current-age matched healthy comparison participants. These results challenge the traditional view that remote semantic memory is fully intact in amnesia. Here, we test a possible mechanism for the observed deficits. Impoverished semantic memory in the amnesic group may be a result of failing to update their semantic representations with new information since the onset of their amnesia. Current-aged matched healthy participants have lived with an intact hippocampus for 20 years longer than the patients, and their knowledge may have gotten richer during this time. To test this hypothesis, healthy comparison participants matched to the patients' age of onset were tested on feature and senses-listing tasks and

on the Word Associates Test. While both healthy groups performed significantly better than patients, the healthy participants with a mean age in their 30s, performed significantly lower than current-age matched healthy participants with a mean age in their 50s, across all tasks. This suggests that in the healthy brain, semantic memory becomes richer with age as additional features, senses, and associates of concepts are integrated with existing representations. The hippocampus, through reconsolidation and relational binding, likely supports these processes, and a lack of updating in the group of hippocampal patients may explain (at least some of) the previously observed deficit.

B118

COMMON AND DIFFERENTIAL ELECTROPHYSIOLOGICAL MECHANISMS UNDERLYING SEMANTIC OBJECT MEMORY RETRIEVAL CUED BY FEATURES PRESENTED IN DIFFERENT STIMULUS TYPES

Hsueh-Sheng Chiang[1], Justin Eroh[1], Jeffrey Spence[1], Michael Motes[1], Jihyeon Choi[1], John Hart[1], Michael Kraut[2]; [1]The University of Texas at Dallas, [2]The Johns Hopkins University School of Medicine — How the brain combines the neural representations of features that comprise an object in order to activate a coherent object memory is poorly understood, especially when the features are presented in different modalities (visual vs. auditory) and domains (verbal vs. nonverbal). We examined this question using three versions of a modified Semantic Object Retrieval Test, where object memory was cued by a feature presented as a visual word (VW), an auditory word (AW), or a picture (Pic), followed by a second feature always presented as a visual word. Participants indicated whether each feature pair elicited retrieval of the memory of a particular object. Sixteen subjects completed one of the three versions (N = 48 in total) while their EEG was recorded simultaneously. Power spectrum analysis of EEG data showed a late left fronto-temporal alpha desynchronization (8-12 Hz) that was significantly larger when object memory was retrieved in the auditory (AW) compared to visual (VW) version. Effects common to all three versions included increases in earlier delta synchronization (1-4 Hz), later alpha desynchronization (8-12 Hz) and later beta desynchronization (13-19 Hz) associated with object memory retrieval, indicating selective inhibition of irrelevant information, attentional enhancement, and semantic integration, respectively. A relative increase in later theta synchronization (4-7 Hz) occurred when no object was retrieved, indicating a prolonged search process. Our data shows common neural mechanisms involved in retrieving an object memory and provides evidence for separate semantic subsystems that support object memory retrieval.

B119

SEMANTIC OBJECT MEMORY RETRIEVAL IN TRAUMATIC BRAIN INJURY AS MEASURED BY EVENT-RELATED POTENTIALS

Julie Fratantoni[1], Bambi DeLaRosa[1], John Hart Jr.[1,2]; [1]The University of Texas at Dallas, [2]The University of Texas Southwestern Medical Center at Dallas — Semantic memory retrieval deficits are often found in individuals who have suffered a traumatic brain injury (TBI); however the underlying neural mechanisms of such deficits are yet to be clarified. Previous studies of healthy populations have shown that during a semantic memory retrieval word task there is a 750 ms event-related potential (ERP) divergence, detected at the left fronto-temporal region, between semantically related features compared to unrelated feature word pairs (Brier et al., 2008; Hart et al., 2013; Chiang et al., 2014). In this study, we investigated the neurophysiological correlates of semantic memory retrieval networks in individuals with TBI by recording electroencephalography (EEG) activity while, 20 retried professional athletes with TBI and 19 healthy controls (HC) performed a semantic object retrieval task (SORT). The SORT task included word pairs as stimuli and the participants indicated whether the word pair facilitated the retrieval of an object name or not (non-retrieval). Behavioral results showed that there were no significant differences in accuracy or reaction time between the two groups. EEG analysis on electrode F7, over the left-fronto-temporal region, revealed a significant group by condition interaction, replicating previous findings. The HC group mean amplitudes were significantly different between conditions whereas the TBI group did not show this task related differentiation, suggesting neurophysiological effects of injury. These findings suggest that attenuated ERP amplitudes may be used as a marker of TBI and is a first step toward establishing a biomarker of semantic memory deficit.

LONG-TERM MEMORY: Skill learning

B120

PROBABILISTIC CLASSIFICATION LEARNING WITH AND WITHOUT CORRECTIVE FEEDBACK IS IMPROVED BY INHIBITION OF DLPFC

Leonora Wilkinson[1]; [1]Wassermann lab, NINDS — Non-declarative probabilistic classification learning on the Weather Prediction Task (WPT) with feedback (i.e. rewards and punishments) involves the cortico-striatal circuits. During learning, activity increases an in the dorsolateral prefrontal cortex (DLPFC) and caudate nucleus and decreases in the medial temporal lobe (MTL). This decrease shows that learning on the task does not ordinarily require engagement of the MTL. In contrast, when the WPT is learned in a "paired associate" manner without feedback, emphasizing declarative memory, MTL activity increases. Inhibitory repetitive transcranial magnetic stimulation (rTMS) can be used to create a so called 'virtual TMS lesion' of cortical targets in healthy controls to determine their role during cognitive processes. The aim of the current study was to use the virtual lesion method to study the role of the DLPFC during WPT learning with (FB) and without (PA) feedback. In a parallel, sham-controlled design, we used inhibitory, continuous theta burst (cTBS) rTMS to inhibit the DLPFC iduring WPT learning with and without FB. Participants were assigned to one of two conditions that required completion of 150 trials of the WPT under FB or PA conditions, immediately after real cTBS over the DLPFC or sham cTBS. Real cTBS improved WPT learning under FB and PA conditions, relative to sham. It's possible DLPFC inhibition, allows greater activation of the episodic memory system than normal during both FB and PA learning.

B121

LONG-TERM RETENTION OF IMPLICIT STATISTICAL LEARNING - EVIDENCE FOR ONE-YEAR CONSOLIDATION

Dezso Nemeth[1,2], Andrea Kóbor[1], Ádám Takács[2], Karolina Janacsek[1,2]; [1]Hungarian Academy of Sciences, [2]Eötvös Loránd University — Probabilistic sequence learning (PSL) underlies the efficient processing of statistical patterns in our environment and it is therefore crucial in many day-to-day activities. However, only limited information is available about how PSL contributes to long-term memory formation. The aim of the present study was to investigate whether PSL is resistant to forgetting and to retroactive interference over a longer stretch of time. Healthy young adults (N = 29) performed the Alternating Serial Reaction Time (ASRT) task, which separately measures the sequence-specific and general skill learning component of PSL. Three sessions were administered in the experiment: a learning phase, a testing phase after 24 hours, and a retesting phase after one year. We found evidence for retained PSL and resistance to interference after 24-hour delay. Moreover, results showed retention of sequence-specific knowledge even after the one-year period, indicated by similar performance during the testing and retesting phases. Resistance to interference was also similar in both phases. In contrast, general skills partially decreased after one year. In sum, these results highlight the long-term persistence of probabilistic sequential memories even without further practice, which could be a key mechanism in understanding the computational underpinnings of long-term memory.

B122

SEQUENCE STRUCTURES INFLUENCE THE LEARNING BENEFIT OF INTERLEAVED PRACTICE IN OLDER ADULTS

Chien-Ho Lin[12], Barbara Knowlton[3], Allan Wu[3], Ho-Ching Yang[1], Tan Lee[1], Fang-Ru Fu[1], Ming-Chang Chiang[1]; [1]National Yang-Ming University, Taiwan, [2]Yeong-An Orthopedic and Rehabilitation Clinic, Taiwan, [3]UCLA — Practicing motor sequences arranged in an interleaved manner generally leads to better learning than practicing in a repetitive manner, a phenomenon known as contextual interference (CI) effect. We have previously found that older adults can also benefit from CI learning. Here we investigated whether such CI benefits in older adults would be influenced by the complexity of motor sequences quantified by the sum of repetitions (successive movement of the same finger) and rever-

sals (an "A-B-A" movement pattern for two adjacent fingers A and B). 33 older adults practiced two sets of three sequences arranged in a Repetitive or an Interleaved order over 2 days, followed by a retention test on Day 5 to evaluate learning. Participants were divided into two groups: during the Interleaved practice, 19 participants practiced high-complexity sequences (High, 2 repetitions + 20 reversals), while the other 14 participants practiced low-complexity sequences (Low, 0 repetitions + 10 reversals). Sequence complexity during Repetitive practice was the same between groups. Although performance during practice and retention of the Repetitive practice condition did not differ between the two groups, the CI benefit, defined by the difference in response time (RT) for Repetitive over Interleaved practice conditions, was significantly greater in Low than High groups during retention (Low group: 29.4±43 ms, High group: 7.4±30.5 ms, p= .008). These findings suggest that too-difficult motor tasks (interleaved + high complexity) would compromise CI benefits for older adults, so that motor sequence structures should be carefully designed to achieve desirable difficulty.

B123

CATHODAL TRANSCRANIAL DIRECT CURRENT STIMULATION (TDCS) DELIVERED TO THE CEREBELLUM SLOWS THE RATE OF FINE MOTOR SEQUENCE LEARNING

Renee E. Shimizu[1], Allan D. Wu[1], Jasmine K. Samra[1], Barbara J. Knowlton[1]; [1]UCLA — The aim of the current study was to determine whether cerebellar transcranial direct current stimulation (tDCS) would affect fine motor skill learning or performance. In a version of the serial reaction time task, participants first practiced three keypress sequences in a pseudorandom order. During the practice session, sham, anodal, or cathodal stimulation was delivered to the cerebellum. After the practice session and concurrent tDCS were finished, participants then performed three novel sequences to test for generalization of learning. All response times (RTs) were normalized to the first practice block average RT. An interaction was found, such that the cathodal group learned at a slower rate during practice than the sham and anodal groups (p = .018). Only the anodal group showed a significant decrease in RT over practice (p = .007) as well as significant sequence-specific learning (p = .033). These results agree with previous work (Ferrucci et al., 2013), suggesting that anodal cerebellar tDCS may be a promising way to improve procedural learning. The addition of a cathodal stimulation group demonstrates a polarity-specific decrease of the rate of motor sequence learning.

B124

AGE-RELATED DIFFERENCES IN THE RETENTION OF IMPLICIT SEQUENCE KNOWLEDGE ACROSS HUMAN LIFE SPAN

Karolina Janacsek[1,2], Dóra Juhász[3], Dezso Nemeth[1,2]; [1]Hungarian Academy of Sciences, [2]Eötvös Loránd University, [3]University of Szeged — Recognizing sequential regularities of the environment underlies motor, cognitive and social skill acquisition, and is essential for predictive behavior and decision making in day-to-day activities. Therefore it is crucial to understand how sequence learning occurs and how the acquired information consolidates and stabilizes over time. The ontogenetic changes of these processes, however, are still poorly understood. Here we aimed to characterize age-related differences in the consolidation of sequential memories between 7 and 85 years of age. Participants were clustered into nine age groups. The Alternating Serial Reaction Time (ASRT) task was used to measure implicit sequence learning. Participants were retested 24 hours after the learning phase. Two aspects of learning were analyzed, namely general skill and sequence-specific learning. We found greater variability in the consolidation of both general skill and sequence-specific knowledge after the 24-hr delay period in childhood between 7 and 13 years of age and in the elderly population (60–85 years of age). These results remained stable even after controlling for age-related differences in overall accuracy and reaction time. Our findings suggest that the fronto-striatal circuits mediating sequential memory formation and consolidation undergo marked changes in childhood and in late adulthood, while seem to be well-established in adolescence and adulthood.

B125

POST-LEARNING LOAD IMPAIRS MEMORY CONSOLIDATION

Neil Albert[1], Douglas Johnson[1], Chiara Martignetti[1], Laynie Dratch[1], Brandon Henry[1]; [1]Colgate University — The consolidation of newly learned information is shaped by events that follow said learning. For example, consolidation of recent learning of a motor sequence can be impaired when that motor learning task is closely followed by a word-list learning task. Some have suggested that a primary source of this interference is memory system competition. An alternative model of these findings is that early memory consolidation processes are dependent upon the availability of higher-level cognitive resources. In the current between-subjects study, we independently vary the difficulty (low v. high) and learning demands (learning v. non-learning) of tasks that follow training on an uncued 12-item second order conditional sequence. Participants (n=80) completed training on a visually-cued motor sequence using the serial reaction time task, and one of four potential post-learning tasks. Participants returned after a 12-hour period of wakefulness to test the extent to which the learned sequence was retained. Though sequence learning was comparable across all four groups at the end of training, differences emerged in the data collected when participants returned for a second session, with an effect of load that was greater than the effect of learning. Our findings support the resource competition model and fail to support the learning completion model, indicating that prior findings may have been the result of differences in the difficulty of the learning and non-learning tasks used.

B126

THE ROLE OF NETWORK FLEXIBILITY IN REINFORCEMENT LEARNING

Raphael Gerraty[1], Juliet Davidow[2], Karin Foerde[3], Adriana Galvan[4], Danielle Bassett[5], Daphna Shohamy[1]; [1]Columbia University, [2]Harvard University, [3]New York University, [4]University of California, Los Angeles, [5]University of Pennsylvania — Learning involves the adaptive reconfiguration of brain circuits based on experience. But understanding the changes in brain networks underlying learning and their relation to behavior has been challenging. One substantial roadblock to fully characterizing the role of networks in learning has been the lack of available tools to assess dynamic changes in brain networks and the ability to directly link such changes to specific aspects of behavior. Recent advances in dynamic network neuroscience have begun to allow for time-resolved descriptions of large-scale network coordination. Here we applied such an approach to data from functional magnetic resonance imaging in humans to explore the role of dynamic connectivity in learning from experience during a probabilistic reinforcement task. We found that learning was related to dynamic coupling of the striatum with different networks over time, which we measure with a statistic called network flexibility. Flexibility on each learning block was significantly predictive of optimal choice on the next. Moreover, this flexibility in network dynamics was related to individual differences in participants' learning rates as derived from standard reinforcement learning models. These results suggest that network dynamics play an important role in reinforcement learning. Further, these findings are consistent with the idea that flexible network communication provides a mechanism for information integration during reinforcement learning.

B127

REACTIVATION OF MEMORY-RELATED GAMMA ACTIVITY IN HUMAN SLEEP

Jean-Baptiste Eichenlaub[1], Nicole Rivilis[1], Siddharth Biswal[1], Brandon Westover[1], Eric Halgren[2], Sydney S. Cash[1]; [1]Massachusetts General Hospital, Harvard Medical School, [2]Kavli Institute for Brain and Mind, UCSD — Models of memory consolidation posit a central role for reactivation of cortical activity patterns during sleep. Such 'replay' has been well-demonstrated in rodents, where it is orchestrated by the hippocampus. However, direct electrophysiological evidence of reactivation in human is still largely lacking. By using intracranial electroencephalogram recordings from patients with epilepsy and by employing a neural decoding approach, we tested the reactivation, in human sleep, of patterns of cortical activation specifically evoked by earlier motor learning. Six participants implanted with electrode arrays for long-term epilepsy monitoring learned a sequential finger tapping task which was followed by sleep. Neuronal firing in widespread cortical areas was estimated from high gamma-band [70-120Hz] power. Decoders were first trained to classify between finger-move-

ment and control periods on wake data before being applied during sleep. The trained models classified samples from post-learning sleep as well as from a baseline pre-learning sleep (before the task) as motor- versus rest-classes. For each participant, the proportion of time-period classified as motor-class was higher during post-learning sleep, demonstrating that the gamma-band patterns underlying finger movements were reactivated during sleep following motor learning. In addition, this increase in putative replay during the post-training sleep was highly correlated with performance improvement assessed after sleep. The results were consistent across three different classifiers. These data show the reactivation, in human sleep, of gamma-band patterns linked to task execution in wake and tightly correlated with behavioral evidence of learning, and thus confirm that a basic tenet of the replay theory does occur in humans.

B128

NOVICE AND EXPERT PILOTS DIFFER IN FUNCTIONAL NEURONAL ACTIVITY

Jaehoon Choe[1], Brain A. Coffman[1,2,3], Dylan Bergstedt[1], Matthew E. Phillips[1]; [1]HRL Laboratories LLC, Malibu, CA, USA, [2]Department of Psychiatry, The University of Pittsburgh, Pittsburgh, PA, USA, [3]Psychology Clinical Neuroscience Center, The University of New Mexico, Albuquerque, NM, USA — The development of expert skills requires training and distributed practice in order to consolidate experiences into learned abilities. Though electrophysiological and neuroimaging studies have revealed mechanistic underpinning of skill learning (e.g. working memory), our understanding of the neuronal mechanisms underlying the consolidation of complex procedural skills is lacking. Here, we report functional neuronal activity indicators of novice and expert pilots using a combination of Continuous electroencephalography and functional near infrared spectroscopy. Novice (N=7) and Expert (N=6) subjects consented to participate in single session of flight simulation, working memory, and situational awareness tasks. We found that Novice and Expert pilots showed strikingly different neuronal activation patterns during flight simulator tasks. In the Expert group, we observed increased occipital theta power during flight compared to baseline (0.5 μV2), while in the Novice group, we observed increased midline frontal theta power during flight over baseline (0.3 μV2). The alpha and low-frequency gamma bands in Experts showed increased power in the occipital-parietal region, with lateralization to the right side (0.5 μV2). In Novices, this increase in low-frequency gamma power was seen in a more distributed fashion, with increases of ~3 μV2 in both left and right parietal areas extending to the right lateral prefrontal cortex. Taken together, these results demonstrate distinct neurophysiological signatures of Novice and Expert pilots. These results suggest that major changes in task-evoked activity occur as complex, real-world skills are acquired providing mechanistic insights into skill acquisition and pilot training.

METHODS: Neuroimaging

B129

22Q11.2 DELETION SYNDROME: NOVEL SUBCORTICAL SHAPE ANALYSIS REVEALS SUBTLE VARIATIONS ASSOCIATED WITH IQ AND PSYCHIATRIC DIAGNOSIS

Christopher R. K. Ching[1,2], Boris A. Gutman[2], Artemis Zavaliangos-Petropulu[2], Daqiang Sun[3], Rachel K. Jonas[1,3], Leila Kushan[3], Paul M. Thompson[2,4], Carrie E. Bearden[3]; [1]Graduate Interdepartmental Program in Neuroscience, UCLA School of Medicine, CA, USA, [2]Imaging Genetics Center, University of Southern California, CA, USA, [3]Semel Institute for Neuroscience and Human Behavior and Department of Psychiatry University of California-Los Angeles, CA, USA, [4]Departments of Neurology, Psychiatry, Radiology, Engineering, Pediatrics and Ophthalmology, University of Southern California, CA, USA — 22q11.2 deletion syndrome (22q) is a neurogenetic disorder caused by a microdeletion within chromosome 22 resulting in a wide range of physical and neurodevelopmental abnormalities. Sixty percent of 22q patients meet diagnostic criteria for a neuropsychiatric disorder such as attention-deficit/hyperactivity (ADHD), anxiety (ANX), psychosis (PSY) and autism spectrum disorders (ASD). 22q is the strongest known risk factor for schizophrenia, with roughly 30% of patients developing schizophrenia in their lifetime. Here we applied a novel subcortical shape analysis technique to a large cohort of 22q patients (N=70) and demographically matched healthy controls (CN) (N=57) to investigate variations in brain structure that might be associated with IQ and psychiatric diagnosis. T1-weighted brain MRI data were used to derive two shape metrics of local thickness and surface area across thousands of homologous points for bilateral nucleus accumbens, amygdala, caudate, hippocampus, putamen, pallidum, and thalamus structures. We assessed the relationship between IQ, psychiatric diagnosis (ADHD, ASD, ANX and PSY) and subcortical shape metrics using multiple linear regression, adjusting for age, sex and intracranial volume. For 22q patients, ASD diagnosis was associated with regions of both increased and decreased thickness of the left hippocampus. PSY diagnosis was associated with higher thickness values in the left pallidum for 22q. In CN subjects, higher IQ was associated with increased surface area in subregions of the left pallidum. Our shape analysis technique revealed significant associations between subcortical shape metrics and both IQ and psychiatric diagnosis and may represent a powerful new technique to track 22q-related brain development.

B130

COUNTERING SEX ESSENTIALISM IN NEUROIMAGING STUDIES OF HUMAN SEX/GENDER DIFFERENCES

Vanessa Bentley[1]; [1]University of Cincinnati — Sex/gender differences in the brain remains a popular topic despite suffering a lack of replicability. I assessed the underlying theory and methodology of neuroimaging studies of sex/gender differences in the corpus callosum and in the activation associated with mental rotation processing. I uncovered a number of problems throughout the research methodology that stem from the assumption of sex essentialism. Sex essentialism, a form of biological essentialism, is the view that men and women have different biological essences as a result of their sex. In order to counter sex essentialism's limiting effect, I suggest a new research approach based in feminist philosophy of science. Feminist standpoint empiricism initiates inquiry from the standpoint of the oppressed, neglected, or underrepresented and reveals ignorance gaps. Using feminist standpoint empiricism results in changes all along the research pathway, from the question asked, to the experimental set-up, to data collection and analysis, to the interpretation of results. These changes involve: 1) understanding the difference between sex and gender and clearly identifying what is being studied; 2) identifying how sex/gender of individuals was determined; 3) identifying possible social explanations for purported sex/gender differences; 4) comparing results cross-culturally rather than assuming findings are universal; 5) analyzing groups blind to sex/gender to avoid using sex/gender stereotypes to interpret results; and 6) stop ignoring results that don't fit with the standard view (confirmation bias). This new research approach will be better grounded epistemologically as well as being more socially and morally responsible rather than sex-essentialist and oppressive to women.

B131

NEURAL CORRELATES OF LOSS AVERSION AND LOSS INSENSITIVITY IN BINGE DRINKERS

Laurel Morris[1], Nick Dowell[2], Mara Cercignani[2], Neil Harrison[2], Valerie Voon[1]; [1]Behavioural and Clinical Neuroscience Institute, University of Cambridge, Cambridge UK, [2]Department of Psychiatry, Brighton and Sussex Medical School, Brighton, UK — Binge drinking is a common pattern of alcohol intake amongst college-aged adults, however a subset of these individuals is at subsequent risk of developing more severe alcohol use disorders. Determining early cognitive markers of harmful behavioural patterns is important for the development of accurate and appropriate intervention strategies. We examine loss aversion and loss sensitivity along with their neural correlates in 24 college-aged binge-drinkers and 27 matched healthy controls. Binge drinkers appear insensitive to monetary losses, a behavioural aberrancy that is associated with a computational account of loss aversion. We further use neurite orientation dispersion density imaging (NODDI), a novel diffusion MRI analysis with greater specificity for fine-grained microstructural features such as neurite density and complexity. Sensitivity to loss across groups was associated with neurite complexity in anterior insula. We highlight links between loss sensitivity and a computational neuroeconomical account of loss aversion in binge-drinkers and further detail microstructural correlates of such tendencies across a young population.

B132

DECODING THE INFANT MIND: MULTICHANNEL PATTERN ANALYSIS (MCPA) USING FNIRS

Benjamin Zinszer[1], Lauren Emberson[1,2], Rajeev Raizada[1], Richard Aslin[1]; [1]University of Rochester, [2]Princeton University — We present a multichannel pattern analysis (MCPA) for functional near-infrared spectroscopy (fNIRS), analogous to multivariate analyses used in fMRI. fNIRS is a silent, non-invasive, and relatively motion-insensitive neuroimaging tool, allowing research with populations that cannot be imaged in the MR environment (e.g., infants). Despite these advantages, fNIRS research has often lagged behind fMRI in analytic sophistication, limiting the application of this technology. MCPA uses correlation-based decoding to classify observed neural responses using a group model of response patterns from a training set of infants. These patterns are used to decode the activation patterns associated with a condition or single trial in a new infant. This MCPA method mitigates the common challenge of having few trials per infant by using between-subject regularities to decode individuals. In Experiment 1, 19 infants observed visual or auditory stimuli in an event-related design. For each infant, condition and single-trial data were decoded by leave-one-infant-out cross-validation, using a group model based on the remaining 18 infants. Condition decoding accuracy was 89% ($p<0.001$), and trial-level decoding accuracy was 68% for visual and 66% for auditory (both $p<0.01$). In the Experiment 2, 18 infants experienced two types of audiovisual stimuli (face+music or fireworks+word). For this more challenging discrimination, condition accuracy was 78% ($p<0.05$). Trial-level accuracies were 60% ($p=0.11$) and 57% ($p=0.20$). We find that MCPA provides a promising resource for enhancing fNIRS research. The code for implementing these analyses will be available online to facilitate adoption of MCPA and improve the methodological tools available to fNIRS researchers.

B133

WHITE MATTER MODULATED CHANGES IN EXECUTIVE PROCESSES IN MILD-TO-MODERATE TBI

David Martinez[1], Daniel Krawczyk[1,2], Sandra Chapman[1]; [1]University of Texas at Dallas, [2]University of Texas Southwestern Medical Center — Mild-to-moderate chronic TBI is a highly prevalent condition that can affect cognitive performance, particularly those relating to executive processes. Underlying mechanisms of performance deficits in TBI include white matter damage, which can be imaged using diffusion tensor MRI. Previous research has shown that training can alter cognitive performance and white matter microstructure. The following study examined participants enrolled in a cognitive training program called Strategic Memory Advanced Reasoning Training (SMART). This training was developed to improve cognitive performance in individuals with mild-to-moderate TBI. The experimental program included an emphasis on attention and inhibition, working memory, and executive functioning. Participants in the experimental program were compared to participants in an active control program. Diffusion Tensor Imaging (DTI) and neuropsychological testing were completed at three time points: before training, after training, and at a three month follow-up assessment. Regions of interest (ROI) were selected based on relevance to cognitive processes and included bilateral inferior fronto-occipital fasciculus, uncinate fasciculus, and cingulum. Assessments included D-KEFS Color-Word Inhibition, D-KEFS Trails B, and WAIS Digit Span. Results demonstrated improvements in the SMART condition in cognitive performance, primarily in attention, and changes in white matter, primarily axial diffusivity in the cingulum, over the course of the study. Results suggest training modulated both cognitive ability and influenced white matter plasticity in individuals at the chronic stage of TBI.

B134

EFFECTS OF DISRUPTION IN WHITE MATTER INTEGRITY SHOWN CHRONICALLY IN PEDIATRIC TRAUMATIC BRAIN INJURY

Faisal Rashid[1], Emily L. Dennis[1], Monica U. Ellis[2,3], Sarah D. Marion[2], Talin Babikian[2], Claudia Kernan[2], Richard Mink[4], Christopher Babbit[5], Jeffery Johnson[6], Christopher C. Giza[7], Paul M. Thompson[1], Robert Asarnow[2]; [1]University of Southern California, [2]University of California, Los Angeles, [3]Fuller Graduate School of Psychology, [4]Harbor-UCLA Medical Center & Los Angeles BioMedical Research Institute, [5]Miller Children's Hospital, [6]LAC+USC Medical Center, [7]Mattel Children's Hospital — Diffusion weighted imaging (DWI) allows us to non-invasively examine white matter (WM) alterations in the brain. Here we investigate the chronic effects of traumatic brain injury (TBI) in pediatric patients. Patients underwent high angular resolution diffusion imaging (HARDI) post-acutely (1-5 months post-injury) and again at a later time point averaging 15 months post injury. Their data was processed using Automated Multi-Atlas Tract Extraction (autoMATE), a method developed in our lab that we have shown performs well in TBI analysis (Dennis et al., 2015a,b). AutoMATE provided us with measures of fiber integrity densely sampled across multiple tracts. We used visual event related potentials (ERPs) to record interhemispheric transfer time (IHTT), allowing us to measure the functional integrity of the WM. There was a bimodal distribution of IHTTs within the TBI group: some patients had normal IHTT but others had slow IHTT (group cut-off = 18 msec min). We have previously shown that the functional and structural integrity of the WM are correlated post-acutely. Here we tested for differences between these groups at the follow-up assessment. We found lower FA and higher MD values in IHTT-slow vs. control across large areas of several white matter structures in the brain including the corpus callosum. IHTT was also correlated with neurocognitive outcome; with the IHTT-slow group performing more poorly than the healthy control participants. Our study suggests that a subset of TBI patients continue to have significant alterations in WM integrity for an extended period post-injury.

B135

RELIABILITY AND HERITABILITY OF CHILDREN'S HEAD MOTION DURING FMRI TASKS

Laura E. Engelhardt[1], K. Paige Harden[1], Elliot M. Tucker-Drob[1], Jessica A. Church[1]; [1]The University of Texas at Austin — Head motion confounds fMRI results, and this problem is especially pronounced in pediatric samples. Traditionally, movement data are incorporated into analyses as exclusionary criteria or regressors. Recently, researchers have proposed that head movement constitutes a reliable, meaningful trait among adults. To examine this hypothesis with regard to children's head movement, we analyzed automated data from the functional runs of 61 twins (29 pairs, 3 unpaired individuals; 9 monozygotic pairs; 31 males) ages 7-12 years. Movement was operationalized as framewise displacement (FD) in millimeters. Mean FD varied by age ($b=-.27$, $p<.001$) but not sex ($b=-.03$, $p=.84$). FD didn't increase significantly across runs within the session ($F=1.98$, $p=.07$). Within-person FD was highly reliable across runs (alpha=.86). Mean FD was more highly correlated within monozygotic pairs ($r=.75$) than dizygotic pairs ($r=.41$); genetic factors explained 68% of the variance in head movement. Assessing FD separately for each half of the fMRI session revealed moderate co-twin correlations both within and across session halves (mean $r=.35$). This result varied by zygosity: monozygotic twins exhibited greater similarity than dizygotic twins in movement across and within session halves. These results provide evidence that FD is a reliable and heritable developmental marker of fMRI movement. That magnitude of children's head motion is heritable and consistent across runs suggests that scanner movement represents an individual difference that may correlate with important neurobiological and psychological outcomes. As head movement cannot be assumed to represent unsystematic noise, new methods are needed to control for confounds between fMRI data quality and such outcomes.

B136

EFFECTS OF INCOME AND PARENTAL EDUCATION IN BRAIN STRUCTURE AMONG DIFFERENT AGE GROUPS

Luciane R. Piccolo[1], Natalie H. Brito[1], Kimberly G. Noble[1]; [1]Columbia University — Family income and parental education are commonly used indices of socioeconomic status (SES) and are associated with brain development across the lifespan. Past studies have focused on SES associations with cortical volume, a composite of cortical surface area (SA) and cortical thickness (CT). Recently, we reported that family income was associated with differences in children's SA, with the strongest associations among the most disadvantaged children. In a follow-up analysis, this study aims to investigate the relation between SES and brain structure among different age groups. High-resolution structural MRI of 1099 typically developing children (3-21 years old) from the multi-site Pediatric Imaging, Neurocognition and Genetics (PING) study (http://ping.chd.ucsd.edu/) were analyzed. Adjusting for scanner, sex and genetic ancestry, parental education and family income were associated with SA in early childhood (3-6 years old) (education: $\beta = 0.19$, $p =$

0.027; income: β = 0.185, p = 0.021). Income was also associated with CT in early adolescence (9-12 years old) (income: β = 0.137, p = 0.05) and SA in adolescence (15-18 years old) (β = 0.22, p = 0.003). These results provide evidence that different aspects of children's environments may have specific contributions to structural brain development at particular developmental stages. Funding: NIH Grant RC2DA029475

OTHER

B137

STRONG POSITIVE AND STRONG NEGATIVE RESTING-STATE CORRELATIONS BEST PREDICT AN INDIVIDUAL'S MATURITY IN TYPICAL DEVELOPMENT.

Ashley Nielsen[1], Deanna Greene[1], Steve Petersen[1], Brad Schlaggar[1]; [1]Washington University School of Medicine — Resting-state functional connectivity (RSFC), the intrinsic correlation of fMRI activity between regions in the brain, is thought to reflect a history of co-activation across the lifespan. While the field has primarily focused on the strongest positive relationships, some have suggested that the weakest inter-regional relationships may also provide relevant information about brain organization (Basset et al 2011; Santarnecchi et al. 2014). Weak relationships are thought to act as "local bridges" that serve as critical links between separated functional modules. We aimed to test explicitly the relevance of changes in the weakest resting-state correlations to brain maturity in typical development. Using a developmental resting-state fMRI data set (N = 129; ages 7-31, 69/60 male/female), we divided each individual's set of RSFC correlations into ten separate windows from extreme negative to extreme positive. We used multivariate machine learning to test how well individual RSFC in each of the ten correlation windows predicted an individual's chronological age. To minimize the effects of head motion on resting-state correlations, we used global signal regression and motion censoring to remove artifactual differences in RSFC (Power et al. 2014). We found that patterns of the strongest positive and the strongest negative resting-state correlations, rather than weak correlations, accounted for the most variance related to single subject age prediction (strongest positive, R^2=0.53; strongest negative, R^2=0.35; weak, R^2=0.09). While the role of negative relationships in network organization is not well understood, it appears that strong, negative resting-state correlations contribute to the development of mature functional brain organization.

METHODS: Neuroimaging

B138

CEREBELLAR CONTRIBUTIONS TO LANGUAGE AND WHOLE-BRAIN LANGUAGE NETWORKS: A COMBINED TDCS-FMRI STUDY

Anila M. D'Mello[1,4], Peter E. Turkeltaub[2,3], Catherine J. Stoodley[1,4]; [1]American University, Washington DC, [2]Georgetown University Medical Center, Washington DC, [3]MedStar Rehabilitation Hospital, Research Division, Washington, DC, [4]Center for Behavioral Neuroscience, American University, Washington DC — The right posterolateral cerebellum is functionally and anatomically connected to contralateral language regions of the cerebral cortex. Right Crus I/II is consistently activated during language tasks, and damage to this region can result in language deficits. However, the mechanisms underlying the role of the cerebellum in language are not known. It has been proposed that the cerebellum acquires internal models of mental processes that enable prediction, allowing for the optimization of behavior. Consistent with this, cerebellar disruption impairs performance on predictive language tasks. We hypothesized that transcranial direct current stimulation (tDCS) over the right posterolateral cerebellum would modulate activation both within the cerebellum and in whole-brain language networks during a language task. We anticipated cerebellar activation and behavioral effects of tDCS would be particularly robust during trials requiring predictive processing. We combined 20min of 1.5 mA anodal or sham tDCS over the right posterolateral cerebellum with functional MRI (fMRI) in healthy adults (n=20; μ=24.9 years). Scans were acquired during task and rest, both before and after tDCS. Participants performed a sentence completion task: they viewed a series of four words and then chose a fifth, target word in a forced-choice paradigm. In some sentences the preceding context predicted the target word, while other sentences were non-predictive. Compared to sham tDCS, anodal tDCS altered activation in right posterolateral cerebellum during predictive conditions, and modulated resting-state and task-based functional connectivity in cerebro-cerebellar language networks. These results are consistent with a role for the right posterolateral cerebellum in predictive language processing.

PERCEPTION & ACTION: Motor control

B139

TRY NOT TO THINK ABOUT WHAT YOU'RE DOING: EVENT-RELATED DESYNCHRONIZATION (ERD) IN THE SMA AND EVENT-RELATED SYNCHRONIZATION (ERS) IN THE FRONTAL LOBE REVEALS A DISSOCIATION OF HIERARCHICALLY CONTROLLED OUTER AND INNER LOOP PROCESSES DURING TYPING

Lawrence P Behmer Jr.[1], Matthew J C Crump[1]; [1]Brooklyn College of CUNY — Attention to the details of actions disrupts performance. For example, forcing people to type letters of a word assigned to one hand compared to all letters leads to slower RTs (Logan & Crump, 2009). Given that people are generally fast at normal typing, this suggests that there may be a two-loop control system for skilled actions in which an outer loop is involved in planning, and an inner loop executes kinematic actions, independent of outer loop oversight. Previous EEG studies have focused only on measuring parallel response ordering by the inner loop during normal typing (Logan, Miller, & Strayer, 2011; Pinet et al., 2015). Here, we present behavioral and EEG evidence dissociating outer and inner loop processes. Participants typed four letter words under conditions that varied whether the outer loop closely monitored the details of action execution. Explicit monitoring required that participants type only the letters exclusively assigned to the left or right hand. Normal typing required considerably less monitoring; participants typed all of the letters of the word with both hands. RTs were significantly faster for normal versus monitored typing. Also, alpha-ERD in bilateral clusters of the SMA at about 500 ms prior to the first keystroke was significantly greater during normal versus monitored typing. Finally, during the typing interval, alpha-ERS in the frontal cluster was greater during monitored typing. This suggests outer loop monitoring of the output of the inner loop leads to deficits in performance and an increase in premotor and higher cognitive processing.

B140

INVESTIGATING THE EFFECTS OF COGNITIVE AND ENVIRONMENTAL LOAD ON DYNAMIC POSTURAL CONTROL AND GAIT WITH MOBILE BRAIN/BODY IMAGING (MOBI)

Brenda R. Malcolm[1,2], John J. Foxe[1,2,3,4], John S. Butler[1,4], Sophie Molholm[1,2], Pierfilippo De Sanctis[1,2,5]; [1]Albert Einstein College of Medicine, [2]The Graduate Center of the City University of New York, [3]University of Rochester Medical Center, [4]Trinity College Dublin, [5]Zucker Hillside Hospital, Northshore-LIJ — To maintain postural stability during locomotion, the brain must flexibly adjust to ongoing cognitive and environmental demands. However much remains unknown about the cortical sensorimotor mechanisms associated with increased load during walking. We employed a Mobile Brain/Body Imaging (MoBI) system, which synchronously records EEG and continuous body tracking, to assess the effects of cognitive and environmental demands on walking. Ten participants (mean age = 24 years) walked on a treadmill in front of a full field optical flow display while foot-force sensors and motion capture recorded 3D positions of the head and feet. The effects of cognitive load were gauged by having participants either perform a Go/No-Go task while walking or walk with no additional task. Sensory load was manipulated by presenting three optical flow conditions: moving in accordance with walking speed, moving with periodic mediolateral perturbations, and a static star-field (control condition). Cognitive load affected gait and posture in that participants made shorter but more variable strides when engaged in the task, and reduced head sway in the mediolateral and anterior-posterior directions was also observed. Visual perturbations primarily affected gait in that average step width increased with increasing disruptions to the visual field. Ongoing EEG analysis is investigating heel-strike related spectral perturbations with a focus on intra-stride power changes in the theta (4-7Hz) and beta (15-25Hz) bands previously implicated in dynamic stability. Prelimi-

nary results provide insight into the cortical control of gait, and may be relevant to fall-prone older adults who have difficulty adapting to increased load during locomotion.

B141

THE INTERACTION OF REWARD FEEDBACK AND TRAINING SCHEDULE DURING MOTOR SKILL LEARNING

Michael Freedberg[1], Sara Hussain[1], Eliot Hazeltine[1]; [1]The University of Iowa — Both reward and a training schedule are beneficial for motor learning (Abe et al. 2011; Shea and Morgan 1979), but how these two phenomena interact in terms of motor learning has not been investigated. To test whether the effects of reward and a varied training schedule would induce an additive benefit to learners, we designed a maze-drawing task where participants learned to move their way through different virtual mazes using a computer mouse. All participants practiced three mazes during training, but one half of the participants performed them in a random order and the other half performed them in a blocked fashion. Within each practice schedule, we rewarded half of the participants for successful performance, while the other half performed the task without rewards. Thus, we compared the performance of four different groups: reward+variability, reward+blocked, no_reward+variability, no_reward+blocked. Preliminary results show that reward significantly improves motor skill retention when training under a blocked schedule ($p < 0.05$, $d' = 1.19$), but not under a variable training schedule ($t<1$). These results demonstrate an interactive (rather than additive) relationship between the effects of reward and training schedule and suggest that repetition may be required in order to reap the benefits of reward with respect to motor learning. This suggests that the brain integrates information from reward systems and training context when learning to produce movements.

B142

STUTTERING AND SYNCHRONISED SPEECH

Sophie Meekings[1], Kyle Jasmin[1], Cesar Lima[1], Sophie Scott[1]; [1]University College London — Speaking in synchrony with another person is usually central to activities that emphasise group cohesion- for example, praying or oath-taking. However, in many people who stutter, the most important consequence of synchronised or 'choral' speech is an immediate and often dramatic improvement in fluency. We used functional magnetic resonance imaging to investigate how synchronous speech is processed in fluent speakers and people who stutter (classified using Riley's Stuttering Severity Instrument, 4th ed). Participants heard either a live speaker or a pre-recorded voice. They either listened without speaking, read the same sentence aloud (synchronous speech), or read a different sentence aloud (asynchronous speech). In these conditions, questioning determined that participants were not able to distinguish the live speaker from the pre-recorded voice. There was an additional control condition in which subjects spoke on their own with no second speaker. The stammering group were compared to the controls, in whom synchronous speech resulted in bilateral activation in superior temporal gyrus. The auditory suppression response associated with speech in quiet did not occur when typical speakers synchronised with a live speaker. We discuss the implications for various models of stuttering, such as the EXPLAN model and the theory that stuttering may result from an over-reliance on auditory feedback.

B143

SEX DIFFERENCES IN THE INHIBITION OF AUTOMATIC IMITATION

Emily E Butler[1], Richard Ramsey[1]; [1]School of Psychology, Bangor University — Sex differences are apparent in a variety of cognitive control tasks requiring inhibition. For instance, greater interference to performance has been shown for women than men in social as well as non-social tasks requiring inhibition. The aim of the current study was to investigate whether common or distinct neural circuits subserve sex differences in social and non-social inhibitory control. Two brain circuits were identified as potential candidates for supporting such sex biases: 1) a dorsal frontoparietal circuit, which has been identified across a number of different inhibitory control tasks and; 2) a medial prefrontal cortex and right temporoparietal junction circuit, which has been shown to respond more specifically during the inhibition of imitation. In a behavioural study (n=165), we replicate the prior sex difference in the inhibition of automatic imitation, such that females show more interference than males. Subsequently, in an fMRI study (n=28), we demonstrate that regions in dorsal posterior frontal cortices support the sex difference in automatic imitation more than during a non-social flanker task. Therefore, we show sex- and task-specific responses in what is typically considered a domain-general neural architecture. These findings break from the idea of a neat division of labour between general and specific systems and instead add to evidence for higher complexity within domain-general and domain-specific systems.

B144

A NOVEL PLATFORM FOR AUDIOMOTOR MAP LEARNING AND THE PRODUCTION OF SPEECH AND NON-SPEECH SOUNDS WITHOUT VOCAL TRACT FEEDBACK

Megan Thompson[1,2], Alexander Herman[1], Dameon Harrell[1], John Houde[1], Srikantan Nagarajan[1]; [1]University of California at San Francisco, [2]University of California at Berkeley — Functional imaging studies of sensory feedback in speech production have revealed much about the neural mechanisms mediating the role of feedback in the learning and maintenance of speaking. To study whether such findings generalize beyond control of the actual vocal tract, we developed a novel platform for investigating the role of auditory feedback in learning to generate speech. During magnetoencephalographic (MEG) imaging, subjects learned a novel audiomotor map by listening to a target sound and attempting to reproduce it by touching a touchpad, receiving auditory feedback corresponding to the position of their touch. In two separate experiments, healthy adults stably learned either a map of pure tones (initial mean accuracy amongst learners 24%, final 38%, chance 8.3%) or a map of vowel sounds (initial mean accuracy 5.7%, final 12.8%; chance 8.3%). In the tone-mapping experiment, subjects showed post-training beta/alpha suppression in the auditory cortex for correct responses relative to incorrect responses, analogous to suppression seen in self-produced speech compared to passive listening. This implies an auditory feedback comparison with a developed sensory prediction. In the vowel mapping experiment, subjects showed beta/theta suppression in frontoparietal areas and posterior portions of Wernicke's area in the last training block relative to the first training block. This acquired suppression over the course of learning also implies the development of an internal model for speech sounds not produced by the vocal tract. These results provide evidence for a novel experimental model for investigating auditory-motor map learning and the nature of sensory feedback predictions.

B146

ACQUIRING AND UPDATING IMPLICIT PRIORS IN AUTISM

Owen Parsons[1], Simon Baron-Cohen[1]; [1]Autism Research Centre, Department of Psychiatry, University of Cambridge — Background: The capacity to process statistical regularities implicitly in one's environment is a core aspect of perception and cognition. There have been suggestions that individuals with autism may atypically extract such regularities. Despite this, studies looking at implicit learning (IL) have failed to find significant differences between people with or without autism. However, these studies typically focus on IL under deterministic and stable conditions. Aims: We assessed i) whether differences in IL occur in individuals with autism when underlying regularities are probabilistic; ii) whether individuals with autism show differences in their ability to update priors when underlying regularities change; and iii) whether task performance predicts number of autistic traits in a typical population. Methods: Participants (autism N=20, controls N=20) completed a primary phase of 8 blocks of a probabilistic serial reaction time task. Trial outcomes were predicted by a sequence in 85% of all trials. Participants then completed a secondary phase of 8 blocks in which a novel sequence was introduced. Results: While there were minimal group differences between the two groups in the primary phase, the autism group showed less difficulty adjusting to the novel sequence in comparison to controls. Additionally, task performance was negatively correlated with self-report measures of autistic traits in controls. Conclusions: While IL may be linked to autistic-traits, heterogeneity in the condition may mask these differences from being detected in basic IL paradigms. By looking at IL in non-deterministic and unstable conditions these differences may become more pronounced.

B147

PROACTIVE CONTROL IN A RESPONSE INHIBITION PARADIGM IS MEDIATED BY ATTENTION-RELATED OSCILLATORY ACTIVITY

Matthias Liebrand[1], Inga Pein[1], Elinor Tzvi[1], Ulrike M. Krämer[1]; [1]University of Lübeck — Proactive motor control is a preparatory mechanism facilitating upcoming action inhibition. We investigated the oscillatory mechanisms of proactive motor control using electroencephalography (EEG) in a cued go/nogo task. It has been shown that reactive inhibition (inhibitory control in reaction to an external signal) is accompanied by increased oscillatory activity in the alpha and beta frequency band over frontocentral regions. Here, we asked whether similar mechanisms are implicated in proactive and reactive inhibitory control. Participants performed a cued go/nogo paradigm with cues indicating that the motor response might or might not have to be inhibited. Proactive control was associated with attentional-related mechanisms, namely a decrease of alpha power over occipital regions, a higher amplitude of the contingent negative variation (CNV) over central regions and a larger visual N1. Reactive inhibition was reflected in a modulation of frontocentral beta oscillations. Based on our findings we propose that proactive motor control strongly relies on attentional processes rather than on specific motor dependent proactive inhibitory network nodes.

B148

PERCEPTUAL DECISION-MAKING IN PATIENTS WITH PARKINSON'S DISEASE AND IMPULSE CONTROL DISORDERS

Yu-Ting Huang[1], Dejan Georgiev[1], Dilan Athauda[1], Tom Foltynie[1], Partricia Limousin[1], Maarten Speekenbrink[1], Marjan Jahanshahi[1]; [1]University College London — In a previous study of perceptual decision-making (Huang et al, 2015), patients with Parkinson's disease (PD) had an impaired ability to accumulate sensory information when tested on dopaminergic medication and made more errors compared to off medication. The aim of this study was to further investigate the contributions of dopamine to perceptual decision-making by A) assessing PD patients with impulse control disorders (ICDs) induced by dopaminergic medication and B) evaluating the acute effects of withdrawal of dopaminergic medication in these patients. We tested 11 PD patients with clinical history of ICDs, both ON and OFF medication and 14 age-matched healthy controls (HC) on a motion discrimination task performed under speed versus accuracy instructions. PD patients with ICDs had significantly slower reaction times on error trials when tested ON than OFF medication. The 'fast diffusion' model was fitted to the behavioural data. PD patients with ICDs did not adjust their 'response thresholds' according to task instructions. The patients with ICDs had lower 'drift rates', suggesting a poorer ability to extract sensory information from the stimuli compared to HCs. In conclusion, for patients with ICDs, acute manipulation of dopaminergic medication (testing on vs off medication) had little effect and did not induce impulsive 'fast and errorful' behaviour on the task when acting under speed pressure. However, the inability of the PD patients with ICDs to adjust response thresholds according to speed vs accuracy instructions indicates that the chronically aberrant dopaminergic state influences modulation of decision criteria.

B149

NEURAL REPRESENTATIONS OF MOTOR SEQUENCE LEARNING BY OBSERVATION

Dace Apšvalka[1], Emily S. Cross[1], Richard Ramsey[1]; [1]Bangor University — Learning by observation is a fundamental way in which humans acquire new skills. A large body of research suggests that physical and observational training share a similar neural basis. In a physical training (PT) study, Wiestler and Diedrichsen (2013) demonstrated that execution of physically trained keypress sequences is associated with distinguishable, sequence-specific activity patterns in the brain. Here we investigate whether similar results emerge if the same sequences are trained by watching others perform them. During pre- and post-training functional magnetic resonance imaging (fMRI) sessions, sixteen participants watched videos of four observationally trained (OT) and four untrained keypress sequences. The sequence observation engaged precentral and parietal brain regions, known as the action observation network. In the post-training fMRI session, brain activity decreased in these regions when watching the trained sequences, but did not change when watching the untrained sequences, thus replicating the majority of related OT studies and the above mentioned PT study. Multivariate pattern analysis revealed post-training formation of distinguishable, sequence-specific activity patterns in primary somatosensory cortex and in areas that also showed a post-training increase of brain activity – left pars orbitalis, right superior temporal gyrus, and left middle cingulate gyrus. Compared to the PT study, OT resulted in less distinct sequence-specific representations located in different brain areas. Nevertheless, our results suggest that OT leads to changes in neural representations that may contribute to later physical performance improvement.

B150

TASK AND PARTNER SWITCHING MODULATE REPRESENTATIONS OF OTHERS' ACTIONS DURING JOINT ACTION PLANNING: AN EEG STUDY

Dimitrios Kourtis[1], Günther Knoblich[1], Natalie Sebanz[1]; [1]Central European University, Budapest, Hungary — We investigated the effects of task and partner switching on the representation of a co-actor's task during the planning phase of a joint action. The experiment consisted of three persons planning and performing joint actions (i.e. passing an object) and solo actions (i.e. lifting an object), following the display of visual cues. EEG (electroencephalography) was recorded by one person. The experiment was divided into two halves. In the first half, the EEG participant interacted only with one of the confederates, either "giving" or "receiving" the object. In the second half, the EEG participant switched tasks (e.g. from "giving" to "receiving") and partners (i.e. interacting with the other confederate). The behavioural analysis showed that the 'giver" behaved in a similar way as in the solo action condition, whereas the "receiver" was the one driving the interpersonal coordination. The EEG analysis showed that in the first half of the experiment, the parietal P3 component was larger when the participant was planning to engage in joint action compared to solo action, indicating that the participant represented his/her partner's action irrespective of the particular task. Interestingly in the second half , that was the case only when the partner was the person receiving the object. These results show that representation of a co-actor's action may take place during joint action planning irrespective of task distribution. However, after switching partners and tasks, one represents in advance the co-actor's action only when the co-actor is the person who is driving the interpersonal coordination.

PERCEPTION & ACTION: Other

B151

PERSISTENCE OF BELIEF MODULATES THE MAGNITUDE OF THE NOCEBO RESPONSE: THE ROLE OF PERSONALITY TRAITS

Mirta Fiorio[1], Nicole Corsi[1,2], Mehran Emadi Andani[1,3], Michele Tinazzi[1]; [1]University of Verona, Italy, [2]University of Maryland, USA, [3]University of Isfahan, Iran — Believing in the detrimental effects of a treatment leads to a worse motor performance (nocebo effect). The aim of this study was to investigate whether persistence of belief in the treatment and personality traits could account for individual differences in the magnitude of the nocebo response. Twenty-seven healthy volunteers performed force pressures with the index finger while receiving a visual feedback on their force level. Participants underwent a nocebo procedure, in which a treatment (inert) was applied to the hand together with verbal instructions about its negative effects on force. In a conditioning session, subjects were exposed to the (fake) effects of the treatment, by means of a surreptitious reduction of the visual feedback. Finally, in a test session, subjects received the same treatment and performed the motor task, but without the surreptitious reduction of the feedback. Crucially, when asked to report about the efficacy of the treatment, two different groups emerged: high-responders, (N=15) gave higher scores of treatment efficacy in the test compared to the conditioning session, whereas low-responders (N=12) did the opposite. Results showed that high-responders had a stronger nocebo effect compared to low-responders, as shown by lower force levels, more weakness and sense of effort. Personality questionnaires revealed that high-responders had lower levels of optimism and self-directedness, and higher anxiety trait, harm avoidance and physiological reactivity than low-responders. These findings show that the magnitude of the nocebo response can be modulated by the persistence of subject's belief about the efficacy of the treatment and personality traits.

B152

LOOSING YOUR HEAD ... BUT GRADUALLY

Boris Suchan[1], Denise Soria Bauser[1]; [1]Ruhr University Bochum, Institute of Cognitive Neuroscience, Clinical Neuropsychology — It has been shown in the literature, that the head plays a special role in body processing. Data from EEG experiments suggest that the presence of the head is responsible for the so called inversion effect. Brandmann and Yovel (2010) could show, that this inversion effect is processed by face sensitive areas as measured by fMRI. The present experiment aimed at looking at the modulating brain structures on this effect. The visibility of the head has been varied in steps of 10 percent from absent to fully visible. Subjects had to work on a delayed matching to sample task where they had to decide whether two presented bodies are equal or not. Results suggest a linear increase of activation in face sensitive areas due to the increase in head visibility. Results support findings by Brandmann and Yovel and extend them showing a direct effect of the head visibility.

B153

WHERE DOES 23 GO? REPRESENTING A NUMBER'S POSITION IN SPACE ENGAGES SPATIOTOPIC MAPS IN CORTEX

Frank J. Kanayet[1], Andrew Mattarella-Micke[1], Peter J. Kohler[1], Anthony M. Norcia[1], Brace D. McCandliss[1], James L. McClelland[1]; [1]Stanford University — Mapping numbers onto space is foundational to mathematical cognition. Parietal systems have recently been implicated in a task that requires overt marking of a number line (Vogel et al., 2013), but cognitive neuroscience of number cognition has yet to take advantage of the precise spatiotopic mapping of parietal and occipital cortex (Silver & Kastner, 2009) to examine the relationship between spatial and numerical cognition. We carried out anatomy-based spatiotopic mapping on each subject (Wang et al., 2014), then investigated how these maps were activated in a number line marking task that separated a number encoding phase from a subsequent line-marking phase. We tested both a standard positive number line (0 to 100), and a zero-centered number line (-100 to 100), allowing us to track the mapping of negative numbers onto space. Within regions selected for known spatiotopic organization, the encoding phase – and not the line-marking phase – revealed number-specific activation, consistent with the idea that representations of the spatial positions of numbers are topographically organized in the brain. Behavioral measurements revealed that accuracy and linearity in placing numbers on the standard positive number line correlated with scores on a mathematics test. Finally, we discovered a frame of reference effect: participants tend to 'shrink' their estimates away from the boundaries of the 0-centered line but not the standard positive number line.

B154

MAPPING NEURAL REPRESENTATIONS OF HEADING DIRECTION AND ENVIRONMENTAL CONTEXT DURING IMAGINED NAVIGATION OF LEARNED VIRTUAL ENVIRONMENTS

Nicco Reggente[1], Joey Ka-Yee Essoe[1], Ivana Jevtic[1], Jesse Rissman[1]; [1]UCLA — Constructing a rich egocentric representation of one's movement about an environment is a multi-faceted effort requiring a vast interplay across cortical areas responsible for visual processing, heading direction, and spatial coding. While electrophysiological recordings in rodents have identified robust neural correlates related to distinct aspects of navigation, experimental work with human subjects offers the unique potential to elucidate the mechanisms of navigational mental imagery, a process we frequently engage in when planning a route or giving directions. In the present study, we first familiarized participants with navigational paths about three highly distinctive virtual environments. The next day, while undergoing fMRI scanning, participants viewed a series of first-person videos that indicated either clockwise or counter-clockwise movement around the perimeter of each environment. After several rounds of video viewing, participants performed a new task in which they were covertly cued to imagine themselves walking along each of these same routes. We leveraged support vector machines within a searchlight-mapping approach to identify brain regions whose BOLD patterns coded for information pertaining to the participants' heading direction or environmental context. As anticipated, many visual association regions with significant accuracy for decoding the contents of perceived navigation were also capable of decoding imagined navigation, although imagery classification performance was generally less robust. Interestingly, several frontal and temporal lobe regions showed decoding effects that were specific to mental imagery, and the distribution of these areas differed as a function of gender, potentially indicative of a qualitatively different mental representation of navigational information across males and females.

B155

DEGENERATION OF LOCUS COERULEUS IN PARKINSON'S DISEASE COVARIES WITH SUBJECTIVE FATIGUE SCORE

Alexandre Zénon[1], Oleg Solopchuk[1], Moustapha Sebti[1], Céline Bouvy[1], Etienne Olivier[1]; [1]Institute of neuroscience, UCL, Brussels, Belgium — Fatigue is one of the most disabling symptoms in Parkinson's disease (PD) but bears little relation to the disruption of the dopaminergic system: it evolves independently from the motor symptoms and is poorly treated by dopaminergic replacement therapy. Besides the Substantia Nigra, the Locus Coeruleus (LC), the main source of cortical noradrenaline, is also affected by the disease. We hypothesized that rather than the nigrostriate pathway, LC degeneration and the consequential disruption of the autonomic system would be directly responsible for PD fatigue. PD patients were asked to perform a psychomotor vigilance task (PVT) while different autonomic markers were measured (heart rate, respiratory rate, pupil size). Their level of fatigue, the quality of their sleep, and their degree of depression were evaluated through questionnaires (PFS, PDSS-2, BDI). Finally, we evaluated the degree of LC degeneration with a novel, automated method allowing to isolate the LC from neuromelanin MR imaging. Preliminary results (n=20) showed that LC degeneration correlated with the fatigue scores ($r=-0.51$, $p=0.02$) but not with the degree of depression or the quality of sleep. Surprisingly, we found that LC degeneration failed to correlate with any of the autonomic responses during the PVT. These findings suggest that LC degeneration may be responsible for fatigue in PD. They also suggest that the increase in heart rate, respiratory rate and changes in pupil size induced by target detection during the PVT may not depend primarily on the LC.

B156

CRITICAL SUBSTRATES OF BIOLOGICAL AND NON-BIOLOGICAL ACTION PREDICTION

Matthieu M. de Wit[1], Laurel J. Buxbaum[1]; [1]Moss Rehabilitation Research Institute, Philadelphia, PA, USA — The ability to predict how actions will unfold permits rapid and accurate interactions with a changing environment. Previous research suggests that action prediction depends on action knowledge and action production ability, and on the premotor and parietal cortices. Using a cognitive neuropsychological approach, this study assessed the cognitive substrates and brain regions critical for prediction of both biological and non-biological actions. We studied 27 left-hemisphere stroke patients with a range of impairments in motor strength (hemiparesis), pantomimed tool use (praxis), and action knowledge, together with 13 neurologically-intact controls. A visual occlusion paradigm was employed with videos of pantomimed and real tool use actions, in addition to non-biological actions of comparable complexity. Subjects indicated whether stimulus continuation post-occlusion was congruent with the stimulus pre-occlusion, which required prediction of how the action would unfold during occlusion. Damage to premotor cortex, inferior frontal gyrus, putamen, and intraparietal sulcus, as well as hemiparesis and action knowledge deficits were associated with prediction impairments for both biological and non-biological stimuli. Lesions in inferior frontal gyrus were more strongly associated with prediction of non-biological than biological actions. Overall, the data indicate that a left-hemisphere sensorimotor action network is critical for prediction of movement trajectories in space, largely independent of the biological or non-biological nature of the predicted entities.

B157

BIASING BEHAVIORAL DECISIONS AND BRAIN RESPONSES TO FOOD WITH TRAFFIC LIGHT LABELING

Marie-Laure Bielser[1], Jean-François Knebel[2,3], Micah M. Murray[1,2,3,4], Ulrike Toepel[1,2]; [1]Laboratory for Investigative Neurophysiology, Department of Clinical Neurosciences, University Hospital Center and University of Lausanne, Switzerland, [2]Laboratory for Investigative Neurophysiology, Radiology Department, University Hospital Center and University of Lausanne, Switzerland, [3]EEG Brain Mapping Core, Center for Biomedical Imaging of Lausanne and Geneva, Switzerland, [4]Department of Ophthalmology, University of Lausanne, Jules-Gonin Eye Hospital, Lausanne, Switzerland

— Obesity has reached dramatic proportions over the last decades, notably due to the abundance of tempting foods partially leading to overeating and weight gain. Since the evaluation of hedonic properties of food tend to exceed homeostatic energy needs, new means to attain healthier food choices and resistance to food temptations are needed. Our study investigated the impact of traffic light cues (as used for nutritional value labelling on food packages) on behavioral and brain responses to food images. We recorded visual evoked potentials (VEPs) to color images of foods (high-fat and low-fat) and non-foods from 16 healthy, non-dieting, and normal-weight participants. Images were preceded by either 'green', 'red' or 'off' traffic light cues during a food/non-food categorization task. Additionally, the liking of food items was rated using a 5-point Likert scale. Categorization accuracy was decreased when high-fat foods were preceded by 'green' as compared to 'off' cues. Traffic light cues affected early stages of sensory processing of food images (i.e. 115-160ms), presumably prior to decision-related activity. Estimations of neural source activity and its modulation by traffic light labelling, as well as analyses of correlation between behavioral and brain responses will further delineate the influence of color cues on food perception and appreciation. The results will thus serve to elaborate the utility of traffic light labeling as means to guide food choices, not only in experimental settings, but, in extension, being a potential means to interfere with everyday food choices for the benefit of body weight management.

THINKING: Decision making

B158

ARE METACOGNITIVE JUDGMENTS DOMAIN-SPECIFIC OR DOMAIN-GENERAL?

Lisa Fitzgerald[1], Paul Dockree[1], Mahnaz Arvaneh[2]; [1]School of Psychology & Trinity College Institute of Neuroscience, Trinity College Dublin Ireland, [2]University of Sheffield — Metacognition and awareness are commonly assumed to operate as global capacities supported by frontal lobe function. However, there have been few attempts to test the robustness of this assumption across multiple cognitive domains. To address this question, we assessed the covariance between "on-line" metacognitive processes, as measured by confidence judgments in the domains of perception and memory, and error-awareness in the domain of attention-to-action, by assessing the correspondence between objective performance and subjective ratings of performance. Task differences have limited the ability of previous research to measure metacognition across domains. We directly compared metacognitive accuracy in perceptual and memorial tasks that were closely matched for stimulus characteristics. A signal detection theory analysis confirmed a behavioral dissociation in metacognitive accuracy of perceptual decisions and memorial decisions. Moreover, metacognitive judgments were independent of objective accuracy, which was controlled using a staircase procedure. We found intra-individual variability across specific types of online metacognitive processes, the ability to make judgments of confidence and the ability to monitor errors. Online perceptual metacognitive accuracy was predictive of informant reports of participants daily functioning and the degree of discrepancy between the self and their significant other ratings of everyday functioning. Overall self-metacognitive knowledge and online metacognition were behaviorally dissociated. Together these results suggest that metacognition and awareness while often considered global and domain-general, are supported by domain specific components in the domains of perception, memory and attention-to-action. The clinical implications of these findings will be considered.

B159

SWEET PREFERENCE IS ASSOCIATED WITH ALTERED BRAIN STRUCTURE AND SLOWER PROCESSING SPEED DURING DECISION-MAKING IN ADOLESCENTS

Maysa Jawdat[1], Valerie L. Darcey[1], Emma J. Rose[2], John W. VanMeter[1], Diana H. Fishbein[2]; [1]Georgetown University, [2]Pennsylvania State University — Alcoholic adults have a greater sweet preference (SP) than their non-alcoholic counterparts, but it is unclear whether SP in adolescence is related to factors that precede alcohol use, such as risk-taking. Neurodevelopmental changes during adolescence can increase the propensity for risk-taking and novelty-seeking, which may increase substance use vulnerability. We considered SP, risk-taking and brain structure in drug- and alcohol- naïve male adolescents. Using a food frequency questionnaire, percent of calories from added sugar was used to approximate sweet preference. Participants' SP scores were ranked and split into tertiles and analyses focused on differences between the extremes, i.e., high SP (HSP: n=13,12.6 ± 0.6 years, 19.1 ± 8.4% kcal added sugar) and low SP (LSP: n=13, 12.6 ± 0.8 years, 7.9 ± 1.5% kcal added sugar) groups. A voxel based morphometry analysis of grey matter volume (GMV) was conducted using high-resolution T1-MPRAGE structural brain images, (8 HSP; 11 LSP meeting quality standards). Risk-taking tendency was determined using the "Wheel of Fortune" task. High-risk choice frequency did not differ between groups, yet HSP took longer to deliberate between high- and low-risk options, suggesting slower processing speed during decision-making. Compared to LSP, the HSP group also had greater GMV ($p_{corr} < 0.001$) in the superior parietal lobe (520 mm3) and the precuneus (119 mm3), regions associated with information integration during decision-making. These data suggest that youths with high sweet preference may have a propensity towards abnormalities in decision-making and suboptimal neurodevelopment in related cortical regions.

B160

DISSOCIATING EXPLICIT FROM IMPLICIT STRATEGIES IN TWO-DIMENSIONAL CATEGORY LEARNING.

Ben Reuveni[1], Paul Reber[1]; [1]Northwestern University — Human category learning is driven by at least two qualitatively distinct mechanisms. One is based on pre-decisional stimulus-response mappings which integrate information (II) across stimulus dimensions, are learned gradually through reinforcement, and are associated with implicit learning. This is contrasted by rule-based (RB) category learning that is tied to declarative memory. Category structures elicit II mechanisms by requiring integrating two stimulus dimensions, however, little research has carefully examined participant reports to verify that learning has occurred outside of awareness. Using a novel post-learning interview based on techniques from studies of implicit learning, we present a verbalizability measure for category knowledge that assesses conscious expression of this knowledge. Participants are asked about their strategic approach and indirectly probed for reportable heuristics used to judge category membership. They are then asked to annotate a diagram of the two-dimensional category space to probe for conscious, non-verbal rule knowledge. These reports suggest that a notable subset of participants in II category learning conditions actually explicitly discover a rule for using both stimulus dimensions to predict category membership. These participants exhibit performance that matches simple computational models (e.g., decision-bound theory; DBT) of II choice behavior even though performance is likely driven by conscious rules and MTL-dependent memory. Thus, prior dissociations between category systems underestimates category learning differences because a subset of putatively II learners may be utilizing rule-based strategies. By incorporating assessments of conscious knowledge, future work can more accurately identify specific characteristics of implicit visual category learning by excluding these explicitly-driven participants.

B161

DIFFERENCES IN CONTINGENT NEGATIVE VARIATION (CNV) WHEN USING SOCIAL DILEMMA STRATEGIES

Justin Michael Campbell[1], Alexis Porter[1], Bradley Robinson[1], Allison Hancock[1], Nicholas John Alexander Wan[1], Kerry Jordan[1]; [1]Utah State University — The Prisoner's Dilemma (PD) is a commonly used social dilemma game that when played multiple consecutive times can begin to generate patterns of choice. These patterns of choice can be referred to as a strategy, in which your choice depends on a previous outcome. Two strategies, "tit-for-tat" (TFT) and "win-stay/lose-switch" (WSLS), have been most studied within PD. The differences between the two strategies are very slight but have larger social implications. The connotation of TFT is that it is the most "fair" strategy, as you are only choosing what your partner is choosing, whereas WSLS is a cost-benefit strategy meant to maximize your own score without the consideration of your opponent. We analyze both of these strategies within PD using ERP (specifically contingent negative variation (CNV)) under the hypothesis that WSLS will show a larger negative variation in prefrontal areas as a process of greater reward-expectation than TFT, in which smaller CNV may reflect less cost-benefit analysis and greater social cognitive analysis. Current results indicate a larger CNV during WSLS when compared to TFT for defection choices only. Defection choices during PD contain the safest

choice with the largest possible reward, but with also the largest negative social consequences. It is feasible players choosing WSLS have larger CNV during defect choices as a reflection of expectation of a safe outcome.

B162

PATTERNS OF FUNCTIONAL CONNECTIVITY DURING PREPARATION PERIODS CAN PREDICT THE TENDENCY TO GIVE UP IN FOLLOWING DECISION-MAKING

Jeesung Ahn[1], Yoonjin Nah[1], Sanghoon Han[1]; [1]Yonsei University — Task difficulty expectation engages in different behavioral strategies and also neural patterns across individuals. We conducted an fMRI study to investigate whether cortical functional connectivity during the period of expecting problem difficulty could discriminate whether participants would give up solving it or not. In each trial with limited time, participants estimated whether the number of overlapped circles was odd or even and could use 'Pass' option if the answer was uncertain. Cue (either 'Easy' or 'Hard' indicating the level of difficulty) appeared and was followed by preparation period, the circles and feedback. Although the cues were randomized regardless of actual problem difficulty, behavioral results showed that participants pressed 'Pass' more often in the ostensibly 'Hard' trials. 27 regions were identified as regions of interest during the presentation of cues from which time-series during preparation periods were extracted. Functional connectivity multivariate pattern analyses using linear support vector machine algorithm was conducted to discriminate high-Pass versus low-Pass groups. The results showed that approximately 10 features (pair-wise correlations) including connectivity patterns between the right superior frontal gyrus, mid-cingulate cortex, and other regions discriminated high and low-Pass groups with 88% accuracy in the 'Hard' trials. Likewise, approximately 20 features including patterns between the left medial superior frontal gyrus, amygdala, pre/postcentral, and other regions classified two groups with 92% accuracy in the 'Easy' trials. These findings suggest that functional connectivity patterns of brain regions can be used to classify persons who are sensitive to expected problem difficulty and impulsively give up according to the expectation.

B163

THE SUBTHALAMIC NUCLEUS (STN) AND INTEGRATION OF PROBABILISTIC INFORMATION DURING DECISION-MAKING: EVIDENCE FROM THE EFFECT OF STN DBS IN PD

Friederike Leimbach[1], Vladimir Litvak[1], Dejan Georgiev[1], Patricia Limousin[1], Tom Foltynie[1], Marjan Jahanshahi[1], Rafal Bogacz[2]; [1]University College London, [2]Oxford University — Theoretical works (Mink, 1996; Frank, 2006; Bogacz and Gurney 2007) propose that the subthalamic nucleus (STN) mediates competition between alternative motor programmes, and ensures that once one programme is being selected, others are inhibited. From this it is predicted that decisions that are based on probabilistic information should be ordinarily made on the basis of relative evidence for the two options; and that interruption of STN activity should lead to reliance on just the absolute evidence for the chosen option. Our aim was to test this prediction by using Deep Brain Stimulation of the STN (STN DBS) to manipulate STN activity. We assessed 13 PD patients with bilateral STN-DBS 6 or more months after the surgery, 13 aged-matched controls and 12 young healthy controls. All participants completed a computer-based probabilistic decision-making task twice, the patients with the STN-DBS ON or OFF (order counterbalanced). A short neuropsychological battery was used to screen and exclude dementia, apathy and depression and to assess working memory, executive function, and processing speed. Preliminary results suggest that patients with STN-DBS OFF and healthy controls used diverse strategies, including deciding on the basis of relative or absolute evidence or after a certain amount of time irrespective of evidence. By contrast when STN-DBS was ON patients made decisions primarily on the basis of absolute evidence. These results support the prediction that the STN is critical for mediating competition between alternative choices during decision-making.

B164

RECONSIDERING THE DESCRIPTION-EXPERIENCE GAP: OVERWEIGHTING OF RARE EVENTS IN EXPERIENCED-BASED DECISION UNDER RISK

Shu-Ching Lee[1,2], Shih-Wei Wu[1,3]; [1]Institute of Neuroscience, National Yang-Ming University, Taipei, Taiwan, [2]Taiwan International Graduate Program in Interdisciplinary Neuroscience, National Yang-Ming University and Academia Sinica, Taipei, Taiwan, [3]Brain Research Center, National Yang-Ming University, Taipei, Taiwan — Considerable evidence suggests that when people make risky decisions, their choices do not conform to the standard economic models. When information is explicitly described, people tend to overweight small-probability outcomes. In contrast, when probability is learned through sampling experience, underweighting of small-probability outcomes has been found. Such difference, referred to as the description-experience gap (D-E gap), highlights a context-dependent effect on probability distortion that critically depends on how information is acquired. However, a central feature in most experience-based tasks is that information about probabilities and outcomes in lotteries are not learned independently. In this study, we investigated how this feature contributes to the D-E gap. Two experiments were conducted. In the first experiment, subjects learned probabilities associated with non-monetary events before associating the events with monetary outcomes to make decisions. In the second experiment, subjects learned specific pairings of probability and monetary outcome through experience. We found that irrespective of whether probability was learned independently of outcome, subjects in both experiments (n=75 in Experiment 1, n=15 in Experiment 2) consistently overweight small probabilities. Such pattern persisted even when the actual frequencies of reward experienced by the subjects were taken into account to modeling probability distortion. In addition, subjects exhibited overweighting, albeit to a lesser degree, as they sampled more from the lotteries. The results were in sharp contrast to the underweighting of rare events reported in previous studies and challenge the description-experience gap in decision making.

B165

THE ROLE OF THE ERROR POSITIVITY IN CONFIDENCE-BASED DECISION-MAKING

Kobe Desender[1], Annika Boldt[2], Nick Yeung[3]; [1]Free University Brussels, [2]Cambridge University, [3]Oxford University — A rapidly increasing number of studies are examining the neural correlates of subjective confidence. Using human electrophysiology, it has been shown that the amplitude of the error positivity (Pe), which has previously been linked to error awareness, increases monotonically with our degree of confidence. However, whether this neural correlate of confidence is predictive of actual changes in behavior remains unexposed so far. Mainly, this results from the close association between first-order performance and confidence, which prevents a clear delineation of both variables' contribution. Here, we were able to create conditions that were matched in accuracy but differed in the subjective evaluation of accuracy. In a perceptual decision-making task, human observers could choose to sample more information before making their decision. The data showed that low Pe amplitude, indicating low levels of confidence, was associated with sampling additional information from the environment before making a decision. Crucially, this was found while controlling for differences in accuracy. In sum, our data show that the error positivity, reflectin subjective confidence, serves as a cue that influences subsequent decision-making.

B166

SPONTANEOUS EYEBLINK RATE PREDICTS RECRUITMENT OF MODEL-BASED VERSUS MODEL-FREE LEARNING STRATEGY

Tracey C. Shi[1], Lindsay E. Hunter[1], Johannes H. Decker[1], Catherine A. Hartley[1]; [1]Weill Cornell Medicine — Reinforcement learning theories distinguish two strategies individuals can use to make everyday decisions. A "model-based" strategy creates and recruits a mental model of possible decisions and outcomes to flexibly select actions, whereas a "model-free" strategy simply increments the probability of repeating previously successful actions. Over-reliance on model-free learning, proposed to underlie the formation of habits, is thought to increase susceptibility to disorders of compulsivity (Voon et al., 2015). However, determinants of individual variability in the recruitment of these two strategies are not well understood. Previous studies using PET imaging (Deserno et al., 2015) and pharmacological manipulations (Wunderlich et al., 2012) have shown a link between higher central dopamine levels and model-based choice. Based on previously reported associations between central dopamine levels and spontaneous eyeblink rate (SEBR), we hypothesized that individuals exhibiting higher SEBR would show more model-based choice. To test this hypothesis, we recorded resting SEBR in healthy adults who then completed a two-stage sequential reinforcement learning task designed to dissociate model-free and model-based choice behavior (Daw et al., 2011). We fit a generalized

linear mixed-effects regression model to quantify the degree to which participants' choices reflected model-based and model-free computations. We observed a significant positive correlation between SEBR and model-based choice and a significant negative correlation between SEBR and model-free choice. Our findings corroborate previous evidence that dopamine modulates the recruitment of model-based and model-free learning, and further suggest that resting SEBR may represent a valid measure for examining the relationship between central dopaminergic function and choice behavior.

B167

WEIGHTING THE PAST AND THE PRESENT: ASYMMETRIC INFLUENCES OF PAST AND PRESENT INFORMATION RELIABILITY ON SUBOPTIMAL PROBABILISTIC INFERENCE

Yun-Yen Yang[1], Shih-Wei Wu[1,2]; [1]Institute of Neuroscience, National Yang-Ming University, Taipei, Taiwan, [2]Brain Research Center, National Yang-Ming University, Taipei, Taiwan — Making decisions under uncertainty often requires the estimation of probabilities associated with possible outcomes. Information about probabilities can come from different sources, making source integration a key computational problem. In this study, we investigated how humans combine prior experience and current information to estimate reward probabilities. In particular, we asked how the reliability of these two sources of information affect the weights subjects assign to them. In a probabilistic inference task, on each trial, subjects were presented with two visual stimuli – one associated with past experience on rewards (prior knowledge) obtained in a previous session and the other a new and independent piece of sensory evidence for reward probability (likelihood information). In order to maximize rewards, subjects should integrate both sources of information by taking into account the reliability of each source so as to compute the optimal estimates of probability. We found that subjects (n=25) adjusted the weights assigned to prior knowledge and likelihood as their relative reliability changed in a direction consistent with optimal integration. However, subjects were more sensitive to changes in the reliability of likelihood than prior. Such tendency contributed to a unique pattern of suboptimal performance: When prior knowledge was highly reliable, subjects instead weighted this information significantly less than they should. This is in sharp contrast to near-optimal integration when prior information was less reliable. Together, these results indicated an asymmetry in treating the reliability of past and present information and provided insights into the limitations in human probabilistic inference.

THINKING: Reasoning

B168

THINKING CAP PLUS THINKING ZAP: TDCS OF FRONTOPOLAR CORTEX IMPROVES CREATIVE ANALOGICAL REASONING AND FACILITATES CONSCIOUS AUGMENTATION OF STATE CREATIVITY

Adam Green[1], Adam Weinberger[1], Evan Giangrande[1], Katherine Spiegel[2], Natalie Gallagher[1], Peter Turkeltaub[2]; [1]Georgetown University, [2]Georgetown University Medical Center — Recent evidence points to neural mechanisms that support acute improvements in creative performance (i.e., augmented state creativity). Neuroimaging of cognitive interventions (e.g., creativity cues) indicates mechanisms by which individuals succeed at consciously augmenting state creativity. Neural interventions via transcranial direct current stimulation (tDCS) indicate encouraging potential for modulating neuronal function during creative performance. Extant evidence leads to new questions. If cognitive and neural interventions are separately effective, can they be used in combination? Does state creativity augmentation represent "real" creativity, or do interventions simply yield divergence by diminishing constraints on meaningfulness/appropriateness? A key question is whether state creativity interventions can bolster creative intelligence, including creative reasoning by analogy that is frequently the basis for innovation. Here, we used tDCS in combination with a creativity cue. tDCS was targeted to potentiate activity in a frontopolar region where activity has recently been shown to predict improvement in creative performance during cued augmentation of creative state. In a novel Analogy Finding Task, participants sought valid analogical connections in a matrix of word-pairs. tDCS elicited formation of substantially more creative analogical connections (creativity was measured quantitatively via latent semantic analysis). Critically, increased analogical creativity was not due to diminished accuracy in discerning valid analogies, indicating "real" creativity rather than inappropriate divergence. A simpler relational creativity paradigm (modified verb-generation) revealed an interaction whereby tDCS facilitated the effect of cuing on creative production. The data support augmentation of creative reasoning via neurostimulation and suggest that tDCS can make it easier to make one's self more creative.

B169

THE SIMILAR SITUATIONS TASK: AN ASSESSMENT OF ANALOGICAL REASONING IN HEALTHY AND CLINICAL POPULATIONS

Matthew J. Kmiecik[1], Guido F. Schauer[1], David Martinez[1], Daniel C. Krawczyk[1,2]; [1]The University of Texas at Dallas, [2]University of Texas Southwestern Medical Center at Dallas — Analogical reasoning—the ability to understand and utilize relational similarities between entities despite surface-level differences—helps individuals solve problems and navigate through novel situations. This ability varies across healthy and clinical populations, yet current analogical reasoning tasks often fail to capture subtle performance variations across different populations. To address this problem, we developed the Similar Situations Task (SST), in which participants are presented 48 line-art scene analogy problems, with source and target scenes presented separately. In each source, two sets of items (humans, animals, or objects) interact in distinct areas within the scene. One or two arrows direct participants to encode and remember specific items and their relational roles. In each target, two matching items interact analogously to one set of items in the source, while two distractor items interact in a superficially similar manner to the alignable items. Participants are tasked with determining which item, if any, is in a similar situation as one of those pointed to in the source. SST problems were found to be reliable measures of performance and presented a range of challenges for both college students and chronic-phase traumatic brain injury patients. Moreover, SST performance correlated with neuropsychological cognitive measures, but notably did not correlate with measures of verbal working memory or intelligence. The SST appears to be a sensitive, reliable, and realistic test of analogical reasoning that captures the ability to discern analogous relations and roles across different situations. Importantly, SST results suggest this ability may be independent of other cognitive capacities.

B170

HEMISPHERIC ASYMMETRY IN REASONING: A REVIEW AND META-ANALYSIS

Nicole Marinsek[1], Benjamin O. Turner[1], Evan Layher[1], Michael B. Miller[1]; [1]University of California, Santa Barbara — We recently proposed that neural networks in the left and right hemispheres have different reasoning biases. We suggest that networks in the left hemisphere strive to reduce uncertainty, and are therefore prone to create inferences and explanations, whereas networks in the right hemisphere strive to resolve conflict, and are therefore prone to monitor, evaluate, and inhibit hypotheses that conflict with evidence. This theory is strongly supported by patient studies, but only weakly supported by neuroimaging studies. The goal of this project was to survey a broad cross-section of the neuroimaging literature on reasoning in order to investigate hemispheric asymmetry in reasoning. To do so, we found 125 reasoning studies that used functional magnetic resonance imaging (fMRI), created labels for the contrasts in each study, pooled contrasts with similar labels, and conducted a meta-analysis of each label using Activation Likelihood Estimation (GingerALE). Based on our theory of hemispheric asymmetry in reasoning, we predicted that the labels "building a model" and "rule finding" would be largely left-lateralized and the labels "evaluating a model," "rule checking," and "conflict" would be largely right-lateralized. Our predictions were supported for the "building a model" and "conflict" labels, but the remaining labels were associated with bilateral activations. There are two opposing interpretations of our bilateral results: first, reasoning may be truly symmetrical or second, reasoning may be truly asymmetrical but either neuroimaging cannot detect asymmetric processing or inappropriate control conditions mask true laterality. This research was supported by the Institute for Collaborative Biotechnologies under grant W911NF-09-D-0001.

B171

NO EVIDENCE OF IMPROVED INTELLIGENCE WITH MINDFULNESS MEDITATION OR BRAIN-TRAINING GAMES-TRAINING COMBINED WITH TDCS

Seth Elkin-Frankston[1], Sean Guarino[1], Victoria Romero[1], G Lieberman[2], MA Hunter[2], K Witkiewitz[2], VP Clark[2], E Schumacher[3], M Bezdek[3], N Martin[3]; [1]Charles River Analytics, Cambridge, MA, [2]The University of New Mexico, Albuquerque, NM, [3]Georgia Institute of Technology, Atlanta, GA — Measures of fluid intelligence are highly predictive of performance across a wide range of contexts, including academic performance and career success (Nisbett et al., 2012) and therefore strengthening fluid intelligence through brief intervention training would be of significant benefit. Despite evidence demonstrating a transfer effect from cognitive training to measures of fluid intelligence (Jaeggi, et al., 2008; Klingberg, 2010), a clear consensus to the benefits of cognitive training has yet to be reached. The aim of this study was to investigate the impact of cognitive training in conjunction with transcranial Direct Current Stimulation (tDCS) on improvements in generalized intelligence. This question was investigated in four labs using multiple intervention strategies, in four experimental conditions, including brain-training games with tDCS, mindfulness meditation with tDCS, an active control condition with tDCS, and an active control with sham tDCS. In all conditions anodal tDCS was applied to the right inferior frontal cortex. Training in conjunction with tDCS has been shown to magnify effects of cognitive training in a number of domains (Fregni et al, 2005; Clark et al, 2012). Mindfulness training teaches sustained attention and has been associated with improved selective attention (Jha et al., 2007), and working memory (Jha et al., 2010). Cognitive brain-training games have similarly been shown to target working memory, cognitive flexibility, and executive functioning (Jaeggi et al., 2008; Brehmer et al., 2012). Analysis showed no significant changes ($p<0.01$) in performance on measures of generalized intelligence following four weeks of intervention training in among four experimental conditions (n=204).

B172

NEURAL BASIS OF THE ENCODING AND EVALUATION OF LOGICAL CONNECTIVES: A TMS STUDY

Paolo Cherubini[1,2], Elisa Di Rosa[3], Stefano Cardullo[3], Fabio Masina[3], Daniela Mapelli[3], Carlo Reverberi[1,2]; [1]Department of Psychology, University of Milan-Bicocca, [2]NEUROMI - Milan Center for Neuroscince, [3]Department of General Psuchology, University of Padua — Logical connectives constitute fundamental components of human cognition: they play a crucial role in a wide range of cognitive processes as language and executive functions, or in symbolic functions as logic or mathematics (Stenning & van Lambalgen, 2008). Recently, several studies have investigated the neuroanatomy of reasoning with propositional logic. In a fMRI study, Baggio and colleagues (in press) showed that two main regions are involved in the encoding and in the evaluation of logical connectives as "and", "or" and "if": the left dorsolateral prefrontal cortex (BA44), and the inferior parietal lobule (BA40). Interestingly, a differences between subjects with a classical interpretation of the logical connective "if" and those with a conjunctive interpretation emerged in the activity of BA 40. However, causal structure-function relationships are hard to evaluate from neuroimaging techniques as fMRI. For this reason, the aim of the present study was to assess using transcranial magnetic stimulation (TMS) the contribution of BA44 and BA40 on reasoning with propositional logic. A low-frequency rTMS off-line paradigm has been employed: BA40 and BA44 have been stimulated in two groups of participants, before the execution of a reasoning task in which they had to evaluate different statements composed using the propositional connectives "and", "or" and "if". Results indicate a crucial role of the left parietal cortex in the evaluation of statements composed using the connective "if". Importantly, the effect of BA40 stimulation is greater in subjects with the conjunctive interpretation, respect to those with the classical one.

Poster Session C

ATTENTION: Auditory

C1

TEMPORAL EVOLUTION OF ENTRAINED NEURAL DELTA OSCILLATIONS DETERMINES AUDITORY TASK PERFORMANCE Anna-Katharina R. Bauer[1], Manuela Jaeger[1,2], Jeremy D. Thorne[1], Stefan Debener[1,2,3]; [1]Neuropsychology Lab, European Medical School, University of Oldenburg, Germany, [2]Research Center Neurosensory Science, University of Oldenburg, Germany, [3]Cluster of Excellence Hearing4all, University of Oldenburg, Germany — The synchronization of neural oscillations to environmental rhythms, such as speech or music, is called phase entrainment. Recently, the detection probability of near-threshold auditory targets has been shown to co-vary with the phase of neural δ-oscillations. In a human electroencephalography (EEG) study, we investigated the temporal evolution of entrainment to a 3 Hz frequency-modulated (FM) tone and assessed the psychoacoustic and neurophysiological benefits using a gap-detection task. Gaps were equally distributed with respect to the phase angle of the 3 Hz FM tone. Two stimulus durations were compared, an early (3.67s, 11 cycles) and a late condition (7.67s, 23 cycles), the latter containing a four seconds time period of uninterrupted stimulation prior to gap occurrence. Gap detection performance and reaction times were modulated by the phase angle of the stimulus. Performance was higher and reaction times were faster for the late condition, suggesting stronger phase entrainment over time. The phase angle corresponding to peak performance was correlated between early and late conditions, indicating stable phase preferences over several seconds. Fourier analysis of the EEG showed spectral peaks at 3 Hz and the 6 Hz harmonic. Subsequent analysis of inter-trial phase coherence revealed a single peak in the 3 Hz frequency band. This study demonstrates that long versus short periodic stimulation leads to enhanced behavioral performance and stronger phase entrainment. We suggest that entrainment evolves over time and thereby optimizes perceptual processing.

C2

ATTENTION IN HEALTHY FULL TERM AND PRETERM INFANTS WITH PERIVENTRICULAR LEUKOMALACIA (PVL). Thalia Harmony[1], Claudia Calipso Gutiérrez[1]; [1]Instituto de Neurobiología, Universidad Nacional Autónoma de México — Diagnosis and subsequent intervention in children that develop attention impairment (including those affected by PVL) often begin late. There is not any sensitive and specific method for the early detection of attention deficits. As premature newborns may present attention deficits during development, we develop instruments for the early detection and treatment of attention deficits in babies. The "Infant Scale of Selective Attention" was designed to diagnose deficiencies in visual and auditory attention in infants. It was standardized in 200 infants from 1 to 8 months and validated with another 221 infants of the same age. Treatment was developed for the enhancement of the behavior that the infant should develop at his/her age and taught to the parents. Two sessions with the therapist of 20 minutes each per week were also programmed. Thirty preterm infants were studied, 10 in each group: no attention problems, 10 with attention problems and a specific treatment and 10 with attention problems without the specific treatment. Behavioral performance and ERPs in an oddball paradigm were compared before (3 months) and after the end of treatment (8 months). More infants with normal behavioral evaluations in the treated than in the non-treated group ($p<0.01$) and clear P3a and Nc responses to the deviant stimuli were observed in the treated group that were not observed in the non-treated group. These results suggest that the treatment produced favorable behavioral and electrophysiological changes. This project was partially supported by CONACyT 218556, 166772, and PAPIIT IN220110.

EXECUTIVE PROCESSES: Working memory

C3

COMPUTERIZED COGNITIVE REMEDIATION OF CHEMOTHERAPY INDUCED COGNITIVE DEFICITS IN BREAST CANCER SURVIVORS: PRELIMINARY CASE STUDY Giulia Mercuri[1], Hannah Lindsey[1], Julia Smith[2], Sylvia Adams[2], Gerald Voelbel[1]; [1]New York University, [2]New York University Langone Medical Center — Adjuvant chemotherapy is a common technique utilized in treating breast cancer. The cognitive domains that are most affected in individuals that have undergone chemotherapy are in the areas of attention, executive function, verbal memory, and processing speed (Schagen & Wefel, 2013). Research by Kesler et al. (2014) suggests that these cognitive deficits can be remediated in breast cancer survivors with computerized cognitive training. Thus, the purpose of this study was to investigate if an auditory computerized cognitive training program could improve cognitive deficits in breast cancer survivors over time. Four adults ranging from 40-61 years of age (M= 50.00, SD= 9.06) were assigned to either the experimental (N= 3) or control (N= 1) groups depending on a quasi-random selection. Participants in the experimental group completed a neurocognitive evaluation before and after the training. The control participant underwent cognitive evaluations 12 weeks apart. Preliminary analyses indicated that participants in the experimental group improved after undergoing the computerized training at their follow-up evaluation compared to their baseline performance on the WAIS-III Digit Span test and several CNS-VS domains including executive function, working memory, and sustained attention. The control participant demonstrated a decrease on the WAIS-III Digit Span test, an increase in executive function, and no change in sustained attention and working memory scores. The preliminary results of this study indicate that participation in an auditory computerized cognitive training program following chemotherapy could be helpful in remediating cognitive deficits that result from this kind of treatment.

PERCEPTION & ACTION: Audition

C4

HORMONAL CORRELATES OF P50 SUPPRESSION IN SOCIALLY ANXIOUS YOUNG ADULTS Andrea M Tountas[1], Connie Lamm[1], Elliott A Beaton[1]; [1]University of New Orleans — Ten to 15% of the population is temperamentally shy and have elevated physiological stress responses to novel social situations. Yet, the neural mechanisms underlying this personality trait are not fully understood. Efficiently attending to, acting on, and remembering relevant stimuli and filtering out less relevant stimuli is critical given the volume of sensory information the brain must process. Relevant stimuli that garner attention are remembered and consolidated with existing memories. Stimuli that do not warrant extended attention are ignored or habituated to in a process underpinned by cortical and subcortical inhibitory brain networks, reducing processing load on finite attentional resources. Inefficient filtering of irrelevant stimuli could underpin anxiety seen in those with temperamental shyness and social anxiety as the lack of filtering leads to overstimulation. One measure of filtering efficiency utilizes the P50 event-related potential (ERP) component and examines the difference in response to sound one (S1) versus sound two (S2) using an auditory paired click paradigm. Using this paradigm, we measured the P50 auditory ERP, as well as self-reported social anxiety and salivary cortisol in two groups of healthy young adults prescreened for level of social anxiety. As predicted, we found increased P50 ratio scores (S2 divided by S1; 68.06%) for the high versus low social anxiety groups, which is indicative of reduced sensory gating efficiency. Furthermore, higher salivary cortisol was associated with larger P50 ratios, suggesting that an elevated physiological stress response was associated with less efficient auditory gating in the brain.

ATTENTION: Auditory

C5

THE EFFECTS OF SLEEP DEPRIVATION ON SELECTIVE ATTENTION: AN EVENT-RELATED BRAIN POTENTIAL STUDY

Eve Wiggins[1], Seth Eggleston[1], Malayka Mottarella[1], Shelbie Wolfe[1], Rachel Green[1], Courtney Stevens[1]; [1]Willamette University — Converging evidence from behavioral and neuroimaging studies suggests that sleep deprivation impairs selective attention by inducing a specific deficit in distractor suppression, as opposed to signal enhancement (Anderson, 2006; Blagrove, 1995; Drummond, 2012; Kong, 2012; Zerouali, 2010). However, to date no studies have examined whether the effects of total sleep deprivation can be traced to the earliest stages of processing affected by selective attention. In the present study, event related brain potentials (ERPs) were used to examine the effects of 24-hour sleep deprivation on early stages of neural processing during a selective auditory attention task. Adult participants were randomly assigned to either a sleep-as-usual or 24-hour sleep deprivation condition. Following either sleep deprivation or sleep-as-usual, participants completed an ERP selective auditory attention task. In the task, participants attended selectively to one of two auditory stories, played simultaneously, to different ears and varying in narrator gender and content. ERPs were timelocked to 100 msec probe stimuli superimposed upon the 'attended' and 'unattended' stories. While the sleep-as-usual group showed a robust effect of selective attention on the N1, the 24-hour sleep deprivation group showed no effects of selective attention on early neural processing. However, contrary to predictions, group differences could not be localized to either signal enhancement or distractor suppression. These data suggest that sleep deprivation impairs the earliest stages of processing affected by selective attention but fail to provide evidence for a specific deficit in distractor suppression at this early stage of neural processing.

C6

TEMPORAL PROBABILITIES IN THE BETA-BAND

Alessandro Tavano[1,2], Erich Schröger[2], Sonja Kotz[3,4]; [1]Max Planck Institute for Empirical Aesthetics, Frankfurt am Main (Germany)., [2]Institute of Psychology, University of Leipzig (Germany)., [3]Maastricht University, Maastricht (The Netherlands), [4]Max Planck Institute for Human Cognitive Brain Sciences, Leipzig (Germany) — How does the human brain encode event probability estimates? Animal evidence suggests that post-stimulus synchronization in the beta-band (13-30 Hz) reflects the internal evaluation of stimulus relevance for motor output (Leventhal et al., 2012). In a hazard rate paradigm, where a button is pressed to a target appearing at different points in time, stimulus relevance is fully defined by internal onset probability estimates. We hypothesized that event-related synchronisation (ERS) in the beta-band would encode temporal probability estimates. We analyzed human electrophysiological responses to rare target deviant tones appearing randomly but equiprobably at either of three successive positions in a repeating tone sequence of five tones. Stimulus rate was held constant. ERS in the beta-band reflected the discrete hazard rate of response times, i.e. linearly increasing with waiting time. Crucially, when participants were informed about the uniform distribution of targets, response time as well as beta-band ERS were constant across positions. Hence, beta-band power tracks contextual changes in subjectively attributed stimulus probabilities. Disinhibition of cortico-striato-cortical pathways leads to a generalized beta power increase in Parkinson Disease (PD). We thus investigated whether hazard rate processes are impaired in participants with PD. We found that the hazard rate is preserved in healthy older adults but substantially attenuated or cancelled in participants with PD, suggesting an impairment in tracking elapsed time. Beta-band ERS predicted response times in both groups. We propose that ERS in the beta-band reflects the rapid verification of stimulus-specific temporal probabilities. This neurophysiological mechanism may be dysfunctional in PD.

C7

ATTENTIONAL CAPTURE BY ACOUSTIC PATTERNS

Rosy Southwell[1], Anna Baumann[1], Cécile Gal[1], Nicolas Barascud[1], Karl Friston[1], Maria Chait[1]; [1]University College London — In this series of behavioural and EEG experiments we investigate the extent to which acoustic regularities, consisting of repeating patterns of sounds, capture attention. Previous work in the visual modality revealed attentional capture by statistically structured stimulus streams (Zhao et al, 2013). Indeed, predictive coding accounts suggest that attention arises from brain mechanisms which infer the predictability of sensory signals, and encode this though optimising post-synaptic gain. Here, signals were rapid sequences of successive tone pips, arranged in regular or random patterns. REG sequences were generated by randomly selecting a number of frequencies from the pool, and then iterating them to create a repeating pattern (different for each trial). RAND sequences consisted of a sequence of tones of random frequencies. EEG data (naïve, distracted listeners) demonstrate that the brain rapidly acquires the patterns, shown by a rapid increase in brain response amplitude to REG relative to RAND sequences. The difference between REG and RAND is revealed as an increase in power, similar to the gain increase often seen in attentional manipulation experiments. This is consistent with the hypothesis that predictable sound sequences spontaneously draw attention. To study potential attentional capture by auditory regularities, we used the above sequences embedded into four different behavioural tasks designed to reveal effects of attentional capture by regularity. Overall, the pattern of results suggests that regular auditory patterns do not capture attention more than random patterns. This indicates that the increased brain response to regularity is not manifest as salience at the perceptual level.

C8

AUDITORY SPATIAL ATTENTION CONTROL IN THE AGING BRAIN

Jeffrey Mock[1], Danielle Charney[1], John Holmes[1], Edward Golob[1]; [1]Tulane University — Normal aging is accompanied by slower processing speed and deficits in aspects of selective attention. Our previous study identified cortical sources associated with auditory spatial attention gradients. Here we investigated whether these neuronal sources differ in younger (n=34) vs. older (n=23) participants. We measured EEG during an auditory spatial attention task. Subjects attended and responded to infrequent targets at one location (-90° or +90°, separate blocks) while distractors were delivered in 45° intervals up to 180° away from the target. Attentional gradients were quantified by regressing independent component analysis ERP and ERSP responses to distractors against their location relative to the target. Fronto-centrally, an ERP gradient (~300 ms) was found in both groups that was prolonged in the older participants (~360-500). In fronto-lateral components, younger participants showed a contralateral ERP gradient for both target locations while older participants showed a contralateral ERSP gradient only in the left fronto-lateral component. The right posterior component ERP gradient had an earlier onset in the older participants when attending to the left (older: 240-440 ms, younger: 440-600 ms) and right (older: 240-340 ms, younger: 340-440 ms). The right posterior ERSP measure showed a gradient in the young when attending to the left while the older participants showed a gradient when attending to either side. Overall, the auditory spatial attention gradient was found in both groups but differed by the type of evoked response that showed the gradient, the onset/offset of the gradient, and which target location a specific component encoded.

LANGUAGE: Development & aging

C9

EVALUATION OF MISMATCH NEGATIVITY AS BIOMARKER FOR LANGUAGE IMPAIRMENT IN AUTISM SPECTRUM DISORDER

Heather Green[1], Lauren Goodwin[1], Karen Froud[1]; [1]Teachers College, Columbia University — Finding an early and objective way to identify language impairment (LI) in ASD has the potential to lead to earlier speech and language intervention for affected children. Previous magnetoencephalography studies utilizing the mismatch field component (MMF) component have shown that increased MMF latency is a predictor of LI in children with ASD. We attempted to replicate these results using the mismatch negativity (MMN), the electroencephalography (EEG) equivalent of MMF. EEG was recorded in children ages 5-10 with ASD+LI, ASD-LI and typically developing controls (TD) during a passive auditory oddball experiment presenting speech sounds. Contrary to previous MMF findings, individuals with ASD+LI demonstrated decreased MMN latency in the left hemisphere in response to novel vowel sounds compared to individuals with ASD-LI and TD controls. A positive correlation between left hemisphere MMN latency and language scores on the Clinical Evaluation of Language

Fundamentals was found when combining both ASD groups. Parent report revealed that all individuals with ASD who participated in the study were hypersensitive to sounds. Our results lend support to the theory that some children with ASD+LI have increased connectivity in primary sensory cortices at the expense of computational connectivity between association areas of the brain. This may account for faster sound processing despite low language scores in these children. Further research needs to be done in order to determine if grouping children by hyper– versus hyposensitivity to auditory stimuli could explain conflicting results between studies and elucidate a neurophysiological biomarker of LI in subgroups of children with ASD.

ATTENTION: Auditory

C10

VARIATIONS IN IMPLICIT TEMPORAL PREDICTABILITY ARE ENCODED IN THE ELECTROENCEPHALOGRAM

Sophie Herbst[1], Lorenz Fiedler[1], Jonas Obleser[1,2]; [1]Max Planck Institute for Human Cognitive and Brain Sciences, [2]Department of Psychology, University of Lübeck, Germany — The human brain automatically extracts temporal contingencies from the environment – but are these used to form temporal predictions even in strictly implicit timing scenarios? Using electroencephalography (EEG), we here studied the neural mechanisms of temporally predictive processing in an auditory foreperiod paradigm combined with a forward encoding model of temporal hazard. Unbeknownst to participants (N=22), we induced a probabilistic variation of foreperiods in a pitch-discrimination task on a noise-embedded tone. Foreperiods were block-wise either drawn from a uniform distribution, yielding a monotonically increasing hazard of tone occurrence (nonpredictive), or from a normal distribution, yielding a mixture of increasing hazard with a peak in occurrence probability (predictive). Although predictability manipulations were not detected, unpredictably short foreperiods yielded slower response times in the predictive condition. In EEG, predictability resulted in enhanced delta (0.5--2 Hz) phase coherence over posterior channels prior to tone onset. We then constructed a forward encoding model, using as trial-wise regressors the two different hypothesized hazard functions. The fit between modeled and measured time-domain EEG signals allowed us to quantify representation of temporal hazard in the EEG. The nonpredictive monotonically increasing hazard function was reflected in the EEG signal in all conditions, while the predictive-condition hazard function was encoded relatively best in the predictive-condition EEG signals. This is the first attempt to quantify implicit temporal predictability from EEG data using a forward encoding model. Our data show that even if participants are unaware of temporal contingencies in their environment, these are used to form temporal predictions.

ATTENTION: Development & aging

C12

VALIDATING A CHILD-ADAPTED MIND WANDERING TASK

Sarah Elke[1], Katherine Maki[1], Sandra A Wiebe[1]; [1]University of Alberta — Mind wandering (MW), endogenous thoughts directed away from the current task and external environment, constitutes up to half of our waking hours. MW has been studied minimally in children and few child-appropriate tasks to probe attentional states are available. This study aimed to validate a child-adapted Sustained Attention to Response Task (SART) in young adults by replicating established changes in behavioural measures and decreases in amplitude of the P3 event-related potential (ERP). SARTs require frequently (89%) responding to one stimulus type and occasionally (11%) withholding responses to the other stimulus type. Most SARTs used in the MW literature use single digits as stimuli, but we chose to use simple line-drawings of animals (frequent stimuli) and household objects (infrequent stimuli) to appeal to children. Interspersed within these trials are probes about the participant's focus of attention. Relatable drawings of a child were used to probe participants for on-task, externally distracted, and MW states rather than the written probe questions usually used in SARTs. We found blocks ending in MW or distracted thought probes were performed less accurately than blocks ending in on-task probes. At a midline parietal electrode cluster, we found depressed P3 amplitudes in trials preceding MW probes relative to both distracted and on-task probes, comparable to other studies using SART tasks with ERPs. Studying MW in childhood provides an opportunity to examine the relationship between MW and executive control at a time when cognitive control is limited and has important implications for education.

C13

AGE-RELATED EFFECTS IN IMPLICIT MOTOR SEQUENCE LEARNING

Rebecca J. Campbell[1], Nina Farah[1], Jin Bo[1]; [1]Eastern Michigan University — Motor learning can occur both with and without awareness. That is, it can be acquired explicitly or implicitly. It has been hypothesized that implicit sequence learning develops early in life and is invariant thereafter (Reber, 1993). Research examining the effect of age on implicit sequence learning has been both supportive (e.g. Meulemans et al., 1998) and controversial (e.g. Maybery et al., 1995) to this claim. This discrepancy could be attributed to variant task difficulties and explicit awareness. Thus, the current study examined age-related effects on implicit learning of a motor sequence. Ten typically developing children were recruited, aged 6 and 14 years. A serial response time task was employed with nine blocks, each containing 10 repetitions of a 12-element sequence. Blocks 1, 2, and 8 contained a baseline sequence. Blocks 3 to 7, and 9 contained the learning sequence, which had a different predictive structure than the baseline. Learning was measured as the response time (RT) differences between Block 7&8 and Block 8&9. One sample t-tests revealed positive learning on RT difference between Block 7&8 ($t = 3.62$, $p < 0.01$) and Block 8&9 ($t = 1.91$, $p < 0.05$). Age effects were found on RT differences in Block 7&8 ($r = -.10$, $p < 0.01$). However, age effect on the RT difference on Block 8&9 was not significant ($r = .01$, $p = 0.06$). The preliminary analysis offers mixed support of invariant learning. Future research will include a larger sample and children with motor difficulties such as autism.

C14

CEREBRAL BLOOD FLOW VELOCITY REVEALS DEFICITS IN SUSTAINED ATTENTION IN OLDER ADULTS

Amanda Harwood[1], Pamela Greenwood[1], Tyler Shaw[1]; [1]George Mason University — Are older operators well-suited for high-risk vigilance assignments? People generally have trouble maintaining sustained attention – or vigilance – for infrequent events over a long vigil, but the nature of the deficits is not well understood. A better understanding can be obtained by a consideration of individual differences in vigilance; the current investigation focuses on healthy aging in adulthood. While some research suggests no effect of aging on vigilance, other research has found age-related decline in vigilance performance. That is important in light of the rising number of older people in the workforce. Our approach to this question is to examine the effects of healthy aging on the underpinnings of vigilance performance using a relatively new neurophysiological measure of resource allocation, functional Transcranial Doppler Sonography (fTCD). A sample of young (aged 18-35) and healthy older (aged 65-80) adults underwent fTCD recording during a one-hour vigilance task. The older participants were not as adept in vigilance performance as their younger counterparts. Older adults had higher cerebral blood flow velocity (CBFV) in both hemispheres, decreased hit rates, increased false alarm rates, and slower reaction times during the one-hour vigilance task compared to young adults. We conclude that older adults exert more effort in vigilance – as measured by changes in CBFV – while underperforming when compared to their young counterparts. Results are interpreted in terms of the cognitive resource account of vigilance and theories of cognitive decline in older adults.

C15

DIFFERENTIAL PREFRONTAL INVOLVEMENT IN ENDOGENOUS CONTROL OF VISUAL ATTENTION: A NEAR-INFRARED SPECTROSCOPY STUDY

Jaeah Kim[1], Ted J. Huppert[2], Erik D. Thiessen[1], Anna V. Fisher[1]; [1]Carnegie Mellon University, [2]University of Pittsburgh — Selective sustained attention (SSA) depends on both exogenous factors (e.g., stimulus salience) and endogenous factors (e.g., internal goals). The Track-It paradigm, in which children track an object moving among a set of distracters, was developed to study the relative contributions of these factors to attention in a developmental population (Fisher et al., 2013). In the developmental literature, the increasing contribution of endogenous factors to SSA has been linked to the development of prefrontal areas. However, this connection has not been extensively explored during task performance, largely due

to a paucity of children-appropriate behavioral methods (which Track-It addresses) and neuroimaging methods. Near-infrared spectroscopy (NIRS) offers an attractive neuroimaging option for developmental researchers. Establishing a link between prefrontal activity and endogenous control of attention, using Track-It and NIRS, will provide a framework for future work investigating the development of endogenous attentional control and prefrontal maturation. Towards this goal, we used NIRS to record prefrontal cortex (PFC) activity in 20 adult participants engaged in the Track-It task. We compared the relative activation of the PFC between two conditions, where one of the conditions required more endogenous control of attention, predicting that PFC activation would be greater in the condition requiring more endogenous control. Consistent with this prediction, NIRS data showed significantly greater oxygenated hemoglobin (HbO) concentrations in the left PFC in the condition that required more endogenous control. This result is consistent with the theory that the development of PFC is involved in development of endogenous attentional control.

C16

INVESTIGATING THE EFFECTS OF BRAIN STIMULATION ON VISUAL ATTENTION IN OLDER ADULTS

Giorgia Demaria[1,2], Méadhbh Brosnan[1], Anders Petersen[3], Paul Dockree[1], Iris Wiegand[3], Ian Robertson[1], Pascal W. M. Van Gerven[2]; [1]Trinity College Dublin, Ireland, [2]Maastricht University, The Netherlands, [3]University of Copenhagen, Denmark — Aging is associated with a progressive reduction in fundamental processing resources following structural changes in the fronto-parietal areas of the brain. Functional neuroimaging has shown that cortical reorganisations in aging brains could support compensatory mechanisms to counteract these losses. In our study, we used transcranial direct current stimulation (tDCS) to induce neuroplasticity and tested whether this would improve two core processing capacity functions of the visual system: visual processing speed and visual short-term memory storage capacity. Based on Bundesen's theory of visual attention (TVA), which provides a computational model that allows to quantify subcomponents of visual attention processing, these two functions can be estimated as independent parameters based on individual's performance in a whole report task. Twenty-nine healthy older adults (65-85 years) were administered sham, right prefrontal cortex (PFC) and right posterior parietal cortex (PPC) stimulation (1 mA) in three sessions, while performing a lateral TVA whole report task with stimuli being presented either in the left or right hemifield. We found that right PFC stimulation significantly improved the processing speed, suggesting that tDCS increased availability of frontal control functions to support fast information uptake. Concerning storage capacity, we observed a trend that stimulation improved capacity for stimuli presented in the left hemifield, but lowered capacity for stimuli presented in the right hemifield. These results support that tDCS can induce plasticity in older individuals' fronto-parietal attention network, and that stimulation effects are specific with regard to the distinct capacity parameters formalized in the TVA framework.

C17

CAPTURING THE NEURAL CORRELATES OF TRAIT DIFFERENCES IN ATTENTIONAL REGULATION: THE IMPACT OF QUESTIONNAIRE DESIGN

Lindsay M. Alexander[1,2], Maki S. Koyama[1,2], David O'Connor[1,2], Erica J. Ho[1,2], Michael P. Milham[1,2]; [1]Center for the Developing Brain, Child Mind Institute, New York, NY, [2]Nathan Kline Institute for Psychiatric Research, Orangeburg, NY — Focused on the characterization of symptom severity in Attention-Deficit/Hyperactivity Disorder (ADHD), a number of standardized rating scales have emerged for quantifying domains of attentional dysregulation (i.e., inattention and hyperactivity). Unfortunately, the majority of these assessments, such as Conners Rating Scale, are based on problem behaviors. These problem-based scales potentially fail to capture meaningful dimensional variation among non-clinical populations, thereby skewing the distribution. In contrast, the Strengths and Weaknesses of ADHD-Symptoms and Normal-Behaviors (SWAN) is designed to capture the full range of behavior, yielding a normal distribution. The present study examined commonalities and distinctions in the neural correlates of trait differences in attentional regulation identified using the SWAN and Conners – two widely used questionnaires in clinical practice. Parents of 69 child participants (ages: 5-17) in the NKI-Rockland Sample completed both scales. To identify regions for which full-brain connectivity patterns varied with inter-individual variation in scale scores, we applied a Multivariate Distance Matrix Regression (MDMR) approach to multiband resting-state fMRI data. Consistent with the relatively high correlations between SWAN and Conners in this sample (inattention: r=0.71; hyperactivity: 0.62), the results obtained with each of the two scales overlapped in several areas (e.g., bilateral frontoparietal operculum for inattention and hyperactivity symptoms). However, regions identified with the SWAN tended to have greater spatial extent; additionally, the SWAN identified more regions with associations, including subcortical regions (e.g., pallidum for inattention; thalamus for hyperactivity) commonly implicated in ADHD. Our results indicate greater capability of SWAN in representing neural correlates of inter-individual variation in attentional regulation.

C18

ATTENTION-DEFICIT HYPERACTIVITY DISORDER AND GAMBLING DO NOT SHARE A COMMON REWARD-LEARNING DYSFUNCTION

Mehdi Abouzari[1], Scott Oberg[1], Matthew Tata[1]; [1]The University of Lethbridge, Canada — Problem gambling is thought to be comorbid with attention-deficit hyperactivity disorder (ADHD). A series of brain electrical responses can be observed in the electroencephalogram (EEG) and the stimulus-locked event-related potentials (ERP), when participants in a gambling task are given feedback regardless of winning or losing the previous bet. Here, we used a simplified computerized version of the Iowa Gambling Task (IGT) to assess differences in reinforcement-driven choice adaptation between unmedicated ADHD patients with or without problem gambling. EEG was recorded from the participants while they were engaged in the task which contained two choice options with different net payouts over the session; a low-risk (50-point) bet with 0.6/0.4 win/loss probability and a high-risk (100-point) bet with 0.4/0.6 win/loss probability. Learning trend which shows the ability to acquire and use knowledge of the reward outcomes to obtain a positive financial outcome was not observed in ADHD gamblers versus nongamblers. Induced theta-band (4-8 Hz) power over frontal cortex was significantly higher in gamblers versus nongamblers in all different high-risk/low-risk win/lose conditions. Whereas induced low alpha (9-11 Hz) power at frontal electrodes could only differentiate high-risk lose between gamblers and nongamblers but not the other three conditions between the two groups. The results indicate that ADHD impairs attention-induced theta for feedback stimuli in nongamblers compared with those with problem gambling. These pilot data highlight the need for studies of ADHD in gambling to elucidate how motivational states are represented during feedback processing.

C19

SUPERIOR LONGITUDINAL FASCICULUS STRUCTURE PREDICTS ATTENTION SKILLS IN EARLY CHILDHOOD

Kari Parsons[1], Christiane Rohr[1], Ivy Cho[1], Sarah Vinette[1], Dennis Dimond[1], Tahireh Shams[1], Elodie Boudes[1], Siena Achal[1], Deborah Dewey[1], Signe Bray[1]; [1]University of Calgary — Visuospatial attention undergoes rapid maturation during early childhood, and these changes are accompanied by profound changes in brain structure. The superior longitudinal fasciculus (SLF) is an association fiber bundle comprised of three branches (I-III; medial to lateral) and is thought to play a key role in visuospatial attention. In this study, we assessed relationships between SLF fractional anisotropy (FA) and mean diffusivity (MD), and attention skills in preschool-age girls. We collected diffusion tensor images (DTI) and measures of selective, sustained, and executive attention from 39 typically developing girls aged 4 – 7 years (mean±SD, age=5.3±0.91; FSIQ=110±11). Probabilistic tractography (ProbtrackX, FSL) was used to delineate individual SLF branches in each hemisphere. Mean FA/MD values were extracted and entered into partial correlation analyses, controlling for whole brain FA or MD. We found a positive association between visual sustained attention and FA in SLF-III. No significant associations were found between FA/MD values and selective attention scores. Scores on a preschool measure of cognitive flexibility positively correlated with right SLF, left SLF, and left SLF-III FA values. Although cross-sectional in nature, this study suggests that in the context of typical early childhood development, specific attention skills are predicted by higher FA in distinct branches of the SLF. These findings add to our understanding of the brain correlates underlying maturation of attentional abilities.

EMOTION & SOCIAL: Emotion-cognition interactions

C20

SOCIAL INFLUENCE SHAPES NEURAL AND BEHAVIORAL REACTIONS TO EMOTIONAL SCENES

Rebecca Martin[1], Jochen Weber[1], Kevin Ochsner[1]; [1]Columbia University — Emotions, though generated individually, are strongly influenced by other people. The goal of this study was to examine how other people shape our emotions. We scanned participants while they viewed and rated how pictures of negative and neutral social scenes made them feel. Following each rating participants were shown what they believed to be a group rating from a sample of approximately 100 peers. After a rest period, participants then rerated the same scenes a second time, this time without seeing peer ratings. We found a strong main effect of social influence such that participants changed their second ratings of the scenes to conform to those of their peers. At the neural level, our findings replicated previous studies (e.g., Klucharev et al., 2009; Izuma & Adolphs, 2013) demonstrating activation of the dorsomedial prefrontal cortex during peer conflict (when peers rated items higher or lower than participants), and this activation increased with the magnitude of conflict. We also found activity in lateral prefrontal regions commonly associated with emotion regulation while participants viewed peer ratings. Additionally, we found that amygdala activation increased during the second rating period when peers rated those scenes as more negative. Taken together these findings suggest that social influence modulates neural circuitry associated with emotional responding.

C21

EXAMINING FEAR GENERALIZATION WITH STEADY-STATE VISUALLY EVOKED POTENTIALS

Lea Ahrens[1], Andreas Reif[2], Paul Pauli[1], Matthias Wieser[1]; [1]University of Würzburg, Germany, [2]University of Frankfurt, Germany — Although many studies suggest that anomalies in fear generalization contribute to the etiology of anxiety disorders, little is known about their underlying mechanisms. As learning experiences have an impact on the activity of the brain's sensory neurons, the present study examines fear generalization in the visual cortex. 67 subjects were conditioned to two different faces (conditioned stimulus [CS]; CS+: reinforced; CS-: non-reinforced) flickering at a frequency of 12 Hz, which were paired with a fearful face and a shrill scream (unconditioned stimulus [US]). To investigate fear generalization, four generalization stimuli (GS) were presented, which were created by morphing the two original faces into each other in 20% steps. The conditioned response was measured via steady-state visually evoked potentials (ssVEPs), valence, arousal and US expectancy ratings. Analyses revealed significant generalization gradients in all ratings with highest fear responses to the CS+ and a progressive decline of these reactions with increasing similarity to the CS-. In contrast, in the ssVEP signal the generalization gradient was marginally significant with highest amplitude for the CS+ and lowest for the GS most similar to the CS+, which might be interpreted as lateral inhibition. The observed dissociation among explicit and implicit measures points to different functions of behavioral and sensory cortical processes during fear generalization: While the ratings might reflect an individual's consciously increased readiness to react to threat, the lateral inhibition pattern in the occipital cortex might serve to maximize the contrast among stimuli with and without affective value and thereby improve adaptive behavior.

C22

POTENTIAL REWARD MODULATES FEEDBACK PROCESSING: AN EVENT-RELATED POTENTIAL STUDY

Matthew Miller[1], Caroline Meadows[1], Philip Gable[2], Keith Lohse[1]; [1]Auburn University, [2]University of Alabama — Evaluating feedback is crucial for adaptive behavior. Thus, shedding light upon how the brain evaluates feedback is of interest. The event-related potential (ERP) technique has been commonly employed to address this interest. Specifically, feedback indicating failure may be subtracted from feedback indicating success (i.e., a difference wave may be created) to reveal the reward positivity (RewP) ERP component. The RewP is a positive-going component that peaks 250 – 350 ms after feedback delivery, and it is believed to reflect a phasic increase in dopaminergic signaling from the basal ganglia. From both a neurobiological and motivational perspective, RewP amplitude should increase as a function of reward magnitude (the reward associated with the feedback). This follows because the size of potential reward should scale with motivation and degree of dopaminergic signaling. However, evidence in support of this theory is sparse. To address this shortcoming, we recorded participants' electroencephalograms while presenting them with potential monetary rewards ($0.00 - $4.96) pre-trial for each trial of a reaction time task and then presenting them with valence feedback post-trial. ERPs time-locked to valence feedback were extracted, and results revealed RewP amplitude was greater on trials with low or high magnitude potential reward than zero magnitude potential reward. Moreover, we observed a reliable correlation between potential reward magnitude and RewP amplitude derived from single trial ERPs. Thus, results indicate RewP amplitude is sensitive to reward magnitude and provide modest support for the hypothesis that RewP amplitude scales with magnitude.

C23

THREAT-INDUCED AROUSAL AMPLIFIES THE GAIN ON COMPETITION BETWEEN GOAL-RELEVANT AND DISTRACTER-RELATED MEMORY TRACES

David Clewett[1], Ringo Huang[1], Rico Velasco[1], Tae-Ho Lee[2], Mara Mather[1]; [1]University of Southern California, [2]University of Illinois at Urbana-Champaign — According to the arousal-biased competition (ABC) model (Mather & Sutherland, 2011), an increase in arousal, such as during threat, enhances processing goal-relevant stimuli at the expense of processing distracters. Thus, arousal optimizes cognitive selectivity when it matters most. Past work demonstrates that arousal differentially modulates brain activity as a function of stimulus priority during perception; however, whether such arousal-related selectivity relates to differential memory outcomes is unclear. Using functional magnetic resonance imaging (fMRI), we tested ABC using a monetary incentive encoding task in which participants explicitly prioritized a background scene in attention and memory while ignoring a transparent foreground object. On some trials, arousal was induced by threatening to deduct 50 cents from a preset account if participants forgot loss-cued scenes during a subsequent memory test. A functional localizer was used to identify category-selective visual regions-of-interest (ROIs) specialized to process the high priority scenes (parahippocampal place area; PPA) and lower priority objects (lateral occipital cortex; LOC). Consistent with ABC, threat of monetary punishment enhanced memory of scenes, while impairing memory of objects. Arousal also intensified competition on trial-by-trial basis, such that participants were even more likely to remember a scene and forget its corresponding object. As predicted, threat yielded brain activity patterns consistent with increased neuronal gain, with arousal strengthening successful scene memory traces in the PPA. In contrast, lower priority object memory traces were associated with weakened activity in the LOC under arousal. Together these results demonstrate that threat-induced arousal optimizes memory selectivity via priority-specific effects in sensory cortex.

C24

CONTEXT-DEPENDENT VALENCE CODING

Jingwen Jin[1], Aprajita Mohanty[1], Christina Zelano[2], Jay Gottfried[2]; [1]Stony Brook University, Department of Psychology, [2]Northwestern University, Feinberg School of Medicine — It is well established that the perception of a stimulus varies with the context within which it is presented. This contextual modulation holds true not only for stimulus quality, but also for stimulus valence. For example, an odorant is perceived as more pleasant or unpleasant depending on the associated verbal label (e.g., "vomit" vs. "parmesan cheese"). Using high-resolution olfactory functional imaging and sensory psychophysical approaches, we examined the contextual modulation of valence coding in olfaction by presenting a nominally neutral odor (isobornyl acetate, IBA) in two different contexts, once with a pleasant odor (limonene) and once with an unpleasant odor (isovaleric acid). Perceptual valence ratings for the neutral odor varied with context, IBA was rated as relatively unpleasant (IBA-) when it was presented with limonene and as relatively pleasant (IBA+) when it is presented with isovaleric acid ($p<.05$). Analyses of imaging data revealed greater activation for IBA- vs. IBA+ in caudolateral orbitofrontal cortex (OFC) and lateral prefrontal cortex (LPFC), regions that have been shown to index change in stimulus valence from pleasant to unpleasant. In contrast, fMRI activity in the amygdala did not show differences between IBA-

and IBA+. These results will help clarify the contributions of amygdala and OFC to valence coding in the human brain and provide greater insight into how relative changes in stimulus pleasantness are indexed by the OFC.

C25

THE NEURAL MECHANISM OF INVOLUNTARY SMILING AFFECTING STROOP TASK PERFORMANCE

SukHee Yun[1], Soo Young Park[1], Na-Young Shin[2], Seung-Koo Lee[3], Sanghoon Han[1]; [1]Yonsei University, [2]Ewha Womans University School of Medicine, [3]Yonsei University College of Medicine

— A social being occasionally needs to show the opposite of one's genuine emotion. This research aims to investigate neural underpinnings of smiling when it is against the agent's inner state. The influence of human volition during affective experience on the subsequent cognitive process would be discussed. Fifteen participants underwent three steps in fMRI scanner; emotion arousing period (Negative/ Positive/ Neutral), facial expression period (Smiling/ Neutral) and Stroop task period. Voluntary smiling was operationally defined as smiling after a positive stimuli and involuntary smiling was defined as smiling after a negative stimuli. Reaction time for Stroop task was faster after voluntary smiling than after involuntary smiling. In the fMRI data, brain regions including bilateral precuneus, PCC and caudate were activated more by voluntary smiling and involuntary smiling recruited no dominant activation during facial expression. However bilateral insula, ACC and left HC showed more activation during Stroop task after involuntary smiling. Machine learning distinguished activation patterns of two types of smiling within the structural ROIs inspired by results of GLM analysis. We also investigated the regions showing functional interactivity in response to involuntary smiling. Results suggest that smiling congruent to one's inner state evokes brain activities related to the reward process and self-referential process and benefits subsequent cognitive control. During cognitive control, involuntary smiling resulted in dominant activities related to the conflict process and negative emotion. Interactivities across these regions and the results of pattern classifications within the regions also demonstrate the importance of human volition, in terms of emotional expression.

C26

THE POSITIVE SIDE OF PAST FAILURES: EXPRESSIVE WRITING REDUCES CORTISOL LEVELS AND IMPROVES ATTENTIONAL PERFORMANCE

Brynne DiMenichi[1], Elizabeth Tricomi[1]; [1]Rutgers University, Newark

— Writing about stressful events has been shown to improve physical health, decrease anxiety, depression, and rumination, and improve cognitive functioning. Psychological stress has been found to increase activation in brain regions associated with self-referential thought, so one hypothesis is that expressive writing may help to clear negative or intrusive self-referential thoughts, thereby reducing psychosocial stress. Previously, our lab found that performance is negatively correlated with activation in brain areas associated with task-unrelated thoughts, such as the posterior cingulate and precuneus. However, it remains unknown whether findings such as these relate to the effect that stress can have on attention. In this experiment, we studied the effects of psychosocial stress produced by the Trier Social Stress Test on attentional performance and salivary cortisol; additionally, we investigated whether an expressive writing task could reduce the detrimental effects of stress on performance and subsequent increases to salivary cortisol. We found that asking individuals to write about a difficult time in their life in which they did not succeed significantly reduced the response of cortisol and significantly improved performance on a task requiring persistent sustained attention. Our results suggest that disclosing about past failures may attenuate one's cortisol response to stress, though individual differences may exist. Broadly speaking, our results also suggest that stress may contribute to task-unrelated thoughts, which may help to explain previous findings of increases in activation in attention-related brain regions accompanying decreases in performance.

C27

FEAR EXTINCTION IN VIRTUAL REALITY: THE RETURN OF ANXIETY AFTER REINSTATEMENT

Hannah Genheimer[1], Marta Andreatta[1], Esther Asan[1], Paul Pauli[1]; [1]University of Wuerzburg

— Extinction is a process in which learned associations are reduced by multiple repetition without the anticipated reinforcement. An animal study demonstrated the facilitation of fear extinction through vagus nerve stimulation (VNS). In humans, exposure therapy is frequently used to treat pathological anxiety and reduce the return of anxiety. We investigated the influence of transcutaneous VNS on the reinstatement in humans after contextual fear conditioning and extinction. Seventy-five healthy participants underwent a 3-Day paradigm. During acquisition (Day1), participants perceived unpredictable electric shocks (unconditioned stimuli, US) when guided through one virtual office (anxiety context, CTX+) but never when guided through another office (safety context, CTX-). During extinction (Day2), no US was delivered and both CTX+ and CTX- were visited again. During reinstatement (on Day3), participants received three US and then the test phase started. Participants showed successful context conditioning in startle potentiation in CTX+ and lower valence and higher arousal and anxiety ratings in CTX+ compared to CTX-. Successful physiological extinction was indicated by similar startle responses in CTX+ and CTX- at the end of Day2 and weak extinction in the ratings. On Day3, all participants showed reinstatement in terms of enhanced startle responses in both offices compared to the neutral corridor. Reinstatement seemed to activate not only the anxiety memory trace in CTX+, but also in CTX-, which in terms of evolution, is the safer mechanism for survival. Additionally, we tried to accelerate extinction and decrease reinstatement by transcutaneous VNS, but did not find any benefit in humans.

C28

HIGH GAMMA PREDICTS ENGAGEMENT RATINGS BUT NOT MENTAL EFFORT RATINGS

Bridgid Finn[1], Laura Halderman[2], Nicole Long[3], J.R. Lockwood[4], Michael Kahana[5]; [1]Educational Testing Service, [2]Educational Testing Service, [3]University of Oregon, [4]Educational Testing Service, [5]University of Pennsylvania

— In educational assessment, low engagement is problematic when tests are low-stakes for students but have significant consequences for teachers or schools. The current study sought to establish EEG correlates of engagement and to distinguish engagement from mental effort. Forty university students participated in a simulated GRE session while EEG was recorded from 128 channels. Participants completed two verbal and two quantitative GRE test blocks for a total of 40 items each and after each item, rated either their engagement or mental effort on a scale of 1-6. Power in 7 frequency bands (delta, theta, alpha, beta, low, medium and high gamma) was computed for 6 ROIs on the scalp (left/right frontal, left/right temporal and left/right parietal). Preliminary results suggested that power in gamma frequency bands indexed differences between high and low engagement ratings. This pattern was similar but weaker for mental effort. A cumulative logit model with cross-classified random effects determined that high gamma over left temporal cortex predicted engagement ratings, while controlling for reaction time and accuracy. However, for effort ratings, reaction time was the sole significant predictor. These results suggest high gamma may be a correlate of engagement during complex cognitive tasks, but not effort. These findings could be used in future studies to objectively measure levels of engagement across different assessment designs.

C29

COGNITIVE APPRAISAL OF THREAT INFLUENCES STRIATAL RESPONSE TO NEGATIVE FEEDBACK

Christina Bejjani[1], Samantha DePasque[2], Elizabeth Tricomi[1]; [1]Rutgers University, Newark, [2]University of California, Los Angeles

— How individuals appraise the cognitive demands of their environment may influence their ability to learn from performance feedback. In our previous study, we found that manipulating the predictability of feedback receipt altered the subjective value and neural processing of negative feedback (Lempert and Tricomi, 2015). A predictable feedback context ("blocked feedback") evoked a punishment response in the striatum to negative feedback, whereas an unpredictable feedback context ("mixed feedback"), which biased participants toward viewing negative feedback as carrying informational rather than evaluative weight, elicited greater striatal activity. Using the same paired-associate learning task, this neuroimaging experiment tested the effects of a competence threat on the striatal response to negative feedback. Prior to performing the task, participants took a 15-item timed computerized test, ostensibly related to verbal and reasoning abilities, and received either no score or a false, but believable, score of the 47th percentile. Regardless of whether participants received a score, there were individual differences in their appraisal of

the test. Participants who appraised the test as less "demanding" showed responses replicating our work: negative feedback elicited the typical punishment response in the striatum only for blocked feedback, whereas this response was attenuated in the mixed feedback condition. However, participants who appraised the test as more "demanding" showed the typical punishment response in the striatum to negative feedback in both feedback conditions. These results suggest that individual differences in ability to cope with a cognitive stressor, as well as contextual influences, may alter the neural processing of negative feedback.

C30

THE INFLUENCE OF ACUTE PSYCHOPHYSIOLOGICAL STRESS ON APPETITIVE CONDITIONING Mana Ehlers[1], Rebecca Todd[1]; [1]University of British Columbia — Appetitive conditioning is a form of associative learning during which neutral stimuli/events become motivationally salient through pairing with rewards. As an underlying mechanism of habit formation, appetitive learning is adaptive. However, enhanced learning of stimulus-outcome relations has been related to higher susceptibility for addictive behaviors. Despite its relevance for human psychopathology, little is known about effects of environmental factors such as stress on appetitive conditioning. In the present study healthy undergraduates performed conditioning tasks under stress or control conditions. Stress was induced using the socially-evaluated cold pressor test. Participants were asked to put their hand in ice water while their behavior was video recorded and evaluated; the physiological response was assessed by means of heart rate and cortisol measurements. In an operant conditioning task participants learned to squeeze a handgrip in order to gain a reward, while a Pavlovian paradigm aimed to learn associations of compound stimuli with rewards. Results revealed that, whereas participants in both stress and control conditions readily learned to squeeze the handgrip to gain a reward, under stress participants showed reduced grip frequency after the first few trials. Likewise, preliminary results suggest that acute stress also impairs Pavlovian conditioning. The present study supports the hypothesis that different forms of appetitive conditioning are altered under acute stress. In particular, operant conditioning may be reduced in the sense that under stress participants are less willing to work for a reward. The findings may help to understand how stress influences associative learning related to dysfunctional behaviors such as addiction.

C31

THE ROLE OF THE ORBITOFRONTAL CORTEX IN REGULATION OF INTERPERSONAL SPACE: EVIDENCE FROM FRONTAL LESION AND FRONTOTEMPORAL DEMENTIA PATIENTS Anat Perry[1], Sandy J. Lwi[1], Alice Verstaen[1], Callum Dewar[1], Robert W. Levenson[1], Robert T. Knight[1]; [1]University of California, Berkeley — Interpersonal distance is central to communication and complex social behaviors but the neural correlates of interpersonal distance preferences are not defined. Previous studies suggest that damage to the orbitofrontal cortex (OFC) is associated with impaired interpersonal behavior. To examine whether the OFC is critical for maintaining appropriate interpersonal distance, we tested two groups of patients with OFC damage: Patients with OFC lesions and patients with behavioral variant frontotemporal dementia. These two groups were compared to healthy controls and to patients with lesions restricted to the dorsolateral prefrontal cortex. Only patients with OFC damage showed abnormal interpersonal distance preferences. The comfortable distances these patients chose with strangers were significantly closer than controls and resembled distances normally used with close others. These results shed light on the role of the OFC in regulating social behavior and may serve as a simple diagnostic tool for dementia or lesion patients.

EMOTION & SOCIAL: Emotional responding

C32

NEURAL CORRELATES OF THREAT ANTICIPATION IN BLOOD-INJECTION-INJURY PHOBIA Leonie Brinkmann[1], Hendrik Poller[2], Martin Herrmann[3], Wolfgang Miltner[2], Thomas Straube[1]; [1]University of Muenster, [2]Friedrich-Schiller-University Jena, [3]University Hospital Wuerzburg — Blood-injection-injury (BII) phobia is associated with elevated disgust-sensitivity as well as specific autonomic and brain responses during processing of phobia-relevant stimuli. In how far these features play a role during anticipation of threat is unclear. In the current fMRI experiment, 16 BII phobics and 16 non-phobic controls anticipated the presentation of phobia-specific and neutral pictures. Behavioral data showed that anxiety dominated the anticipatory period in BII phobics as compared to controls, while both anxiety and disgust were increased during picture presentation. By applying two different models for the analysis of brain responses to anticipation of phobia-specific versus neutral stimuli, we found initial and sustained activation increases in anterior cingulate cortex (ACC), insula, lateral and medial prefrontal cortex (PFC), thalamus and visual areas, as well as initial hyperactivation of the amygdala for BII phobics in comparison to healthy controls. Correlation analysis revealed a relationship between sustained activation in the bed nucleus of the stria terminalis (BNST) and increased symptom severity of BII phobics. Results suggest that BII phobics recruit a typical neural defense network during threat anticipation, with anxiety as the predominant emotion.

C33

EMOTIONAL PROCESSING AFTER UNILATERAL INSULAR DAMAGE Olga Schröder[1], Julia Kürten[1], Nico Melzer[1], Wolfgang H.R. Miltner[2], Thomas Straube[1]; [1]University of Muenster, [2]Friedrich Schiller University Jena — In neuroimaging research, the insular cortex (IC) has been assigned a crucial role in emotional experience, in particular with respect to processing of disgust-related signals. Specific deficits in disgust recognition have been found after isolated left or bilateral insular damage in a few single case studies. Other groups reported selective hypersensitivity to disgust in a patient with a right IC stroke or more general impairments of emotion recognition after both left- and right-sided insular resections. We addressed this debate of (lateralized) insular specificity regarding disgust processing by investigating a group of seven patients with left- (n = 4) or right-hemispheric (n = 3) insular injury in relation to 17 matched healthy controls. All subjects underwent affective screening questionnaires, a facial expression recognition task and an emotion-inducing task. Specific emotion analyses were premised on the computation of composite scores for each emotion across all methods, with higher values indicating hyper- and lower values representing hyposensitivity to an emotion. Patients with left-hemispheric lesions showed lower disgust-related scores than the controls, with significant impairments of disgust processing given in three patients. By contrast, patients with right-hemispheric insular damage tended to higher disgust-related scores than the controls; significant hypersensitivity to disgust was found in one patient, thus confirming the possible occurrence of this phenomenon after right-sided insular injury. This pattern of findings was not ascertained in other basic emotions. Our results suggest specific insular involvement in disgust processing, with lateralized processes contributing to the recognition and experience of disgust.

C34

MODULATING EMOTIONAL INTELLIGENCE WITH TRANSCRANIAL DIRECT CURRENT STIMULATION AND MEDITATION TRAINING: A PILOT STUDY Charles Robinson[1], Mikaela Armenta[1], Angela Combs[1], Melanie Lamphere[1], Gabrielle Garza[1], James Neary[1], Janet Wolfe[1], Aaron Jones[1], Mike Trumbo[1], Michael Hunter[1], Katie Witkiewitz[1], Vince Clark[1]; [1]University of New Mexico — The literature on emotional perspective-taking (empathy) suggests possible targets for enhancement via neurostimulation including the dorsolateral prefrontal cortex (dlPFC; Weng et al., 2013) and right temporoparietal junction (rTPJ; Santiesteban et al., 2012). However, it is unclear which electrode placement is beneficial for enhancing empathy-building

meditation. In this study, we investigated using loving-kindness meditation training (LKM) with transcranial direct current stimulation (tDCS) to alter the emotional perception of images from the International Affective Picture System (IAPS; Bradley, 2014). Eighty-eight undergraduates received anodal stimulation to the rTPJ or left dlPFC using an extracephalic cathode at 0.1 or 2.0 milliamps(mA) and in tandem with an LKM-instructional recording or control recording for 30mins. Participants completed an IAPS task pre-post, rating 60 images on a 1-9 scale measuring affect (negative-vs.-positive). Although there was no omnibus main-effect between the 0.1mA and 2.0mA conditions (p=0.824; d=0.10), the interaction of meditation type*electrode placement was significant (p=0.004) with subjects practicing LKM and receiving rTPJ stimulation rating images more positively, post-training. The contrast of electrode placements among LKM participants was also significant (p=0.001; d=0.98) suggesting rTPJ stimulation produced more positive changes in affect than dlPFC stimulation. Contrasting LKM and control reached significance (rTPJ>dlPFC; p=0.001; d=1.04) among rTPJ-stimulated but not dlPFC-stimulated participants, suggesting LKM was effective specifically for rTPJ-treated meditators. Marginal trends were also observed for those receiving 2.0mA of current: (LKM>Control; p=0.07;d=0.53 & rTPJ>dlPFC; p=0.096;d=0.47). These findings show an effect of meditation and suggests a differential impact of electrode placement however further research should include neuroimaging to better-characterize these results.

C35

GREATER VISUAL ATTENTION TO SUFFERING IN COMPASSION IS ASSOCIATED WITH GREATER CENTROMEDIAL AMYGDALA ACTIVATION AND PROSOCIAL BEHAVIOR

Helen Weng[1,2], Regina Lapate[2], Diane Stodola[2], Richard Davidson[2]; [1]University of California, San Francisco, [2]University of Wisconsin-Madison — Compassion meditation training is hypothesized to increase attention to suffering in order to motivate prosocial behavior. It is currently unknown how compassion training impacts visual attention to suffering and the neural mechanisms associated with eye-tracking patterns. Participants were randomized to compassion (N=28) or reappraisal training (N=28), and practiced for 2 weeks via the Internet. Brain activation was measured with fMRI both pre and post-training while participants implemented their assigned regulation strategies to images of social suffering or non-suffering. Eye-tracking was collected in the scanner, and percentage looking time was computed for emotional areas of interest in a subset of participants with high quality data (Compassion N=12, Reappraisal N=12). Prosocial behavior was measured post-training using the Redistribution Game, where personal funds could be spent to redistribute money after witnessing an unfair interaction. The Compassion group increased their visual attention to suffering, such that they looked longer at suffering vs. non-suffering compared to the Reappraisal group ($F1,22 = 8.47$, $p < 0.01$). Across the entire sample, visual preference for suffering was associated with greater activation in the right centromedial complex of the amygdala (CeA; $r22 = 0.45$, $p < 0.05$). In addition, visual behavior revealed prosocial motives where individuals who looked longer at suffering vs. non-suffering spent more in the Redistribution Game ($r15 = 0.41$, $p = 0.05$, 1-tailed). These results suggest that compassion increases visual attention to suffering and prosocial behavior through engagement of the CeA, which is involved in allocation of attention to stimuli of high significance.

C36

THE TIME COURSE OF BEAUTY: COMPARING PERCEPTUAL AND PHYSIOLOGICAL MEASURES OF AESTHETIC EXPERIENCE

Lauren Vale[1], Gernot Gerger[2], Helmut Leder[2], Denis G. Pelli[1]; [1]New York University, New York, NY USA, [2]University of Vienna, Vienna, Austria — When we experience beauty, do our facial muscles mirror perceived pleasure? How quickly do these responses decay? Facial muscle activity displays our emotions and has been used to categorize valence, arousal, and aesthetic responses. However, little is known of the time course of these responses and how they relate to perceived pleasure. So we recorded pleasure using our smartphone app (emotiontracker.com) and facial muscle activity using facial electromyography (fEMG) of corrugator supercilii (frown) and zygomaticus major (smile) muscles continuously while people looked at images for 8 s and a further 30 s after the image disappeared. At the end of each trial, we asked participants if they felt beauty (definitely yes, perhaps yes, perhaps no, or definitely no). We fit an exponential function with two parameters, α(amplitude) and τ(time constant of decay) to the data after stimulus offset. When participants reported definitely feeling beauty, they reported feeling prolonged pleasure (τ= 378±14 s) and showed a brief zygomaticus response (τ= 8 ±2 s). When participants reported definitely not feeling beauty, they showed a prolonged corrugator response (τ= 360±134 s). Overall, we find felt beauty correlates +92% with pleasure, +11% with zygomaticus activity, and −25% with corrugator activity. After an image disappears, the time course of decay for pleasure and corrugator activity is very long, about 350 s, and merely 8 s for zygomaticus activity. Thus, experienced beauty lingers perceptually and physiologically, but only in the frown and not the smile.

C37

NEURAL CORRELATES OF POST TRAUMATIC STRESS DISORDER IN MILD TRAUMATIC BRAIN INJURY

Mark Varvaris[1], Theresa Teslovich[1], Priya Santhanam[1], Jennifer Pacheco[1], Terry R. Oakes[1], Gerard R. Reidy[1,2], Lindell K. Weaver[3,4]; [1]National Intrepid Center of Excellence (NICoE) Bethesda, MD, [2]Uniformed Services University of the Health Sciences Bethesda, MD, [3]Intermountain LDS Hospital and Intermountain Medical Center Salt Lake City, UT, [4]University of Utah, Salt Lake City, UT — Post traumatic stress disorder (PTSD) is a major concern for military personnel. Current studies suggest 12%-18% of service members will experience PTSD symptoms; a traumatic brain injury (TBI) may increase this probability. To investigate the relationship between mild TBI and PTSD among military personnel a group of TBI patients with PTSD (n=23) was compared to a group of TBI patients without PTSD (n=20) using functional and structural magnetic resonance imaging. All participants were males and in all analyses age was used as a covariate. To identify the default-mode network, an independent component analysis was conducted using FSL's MELODIC. Measures of cortical surface area and fractional anisotropy (FA) were extracted from within the network in T1-structural and diffusion weighted imaging, respectively. An independent sample t-test showed an effect of PTSD on network synchrony [$t(41)=2.909$, $p=0.006$] with greater synchrony in the TBI group without PTSD. The MANCOVA comparing cortical surface area in regions of the default-mode network showed a significant effect of PTSD [$F(1,41)= 12.112$, $p=0.001$], with the non-PTSD group showing relatively greater surface area. Additionally, there was a significant difference in FA values [$F(1,41)=48.494$ $p<0.001$], with greater FA observed in the non-PTSD group. Lower FA values have been shown to reflect microstructural changes in white matter, while gyral complexity and surface area increase in response to neural stress as a mechanism for retaining functional connectivity. A decrease in FA following TBI may prevent these key structural interactions leading to decreased function and susceptibility to or enhanced symptoms of PTSD.

C38

EFFECTS OF EMOTIONAL INTENSITY ON INVOLUNTARY FACE-PROCESSING: A SIMULTANEOUS EEG-FMRI STUDY

Miriam Müller-Bardorff[1], Maximilian Bruchmann[1], Leonardo Tozzi[2], Martin Mothes-Lasch[1], Wolfgang Miltner[3], Thomas Straube[1]; [1]University of Münster, [2]University of Dublin, [3]University of Jena — An increasing number of EEG-informed fMRI studies investigates the neural basis of face-specific processing in the brain. The present simultaneous EEG-fMRI study aimed at identifying neuronal networks involved in load-dependent processing of faces varying in emotional expression and emotional intensity. To this end, we simultaneously measured EEG and fMRI responses elicited by task-irrelevant neutral, happy (low, high), and angry (low, high) facial expressions, while participants judged the length of two horizontal bars presented superimposed on the facial expressions. The focal bars task implemented two difficulty levels (low vs. high load) to test for load-dependent intensity-processing. We found intensity-driven modulations of the N170 component (EEG analysis) as well as intensity-driven modulations of BOLD responses in the fusiform gyrus (fMRI analysis). These modulations by emotional intensity did not depend on perceptual load. Trial-by-trial variations in the face-specific N170 component correlated with face-specific BOLD responses, especially in the fusiform gyrus. Our study adds new evidence to the assumed association between N170 responses and activation in face-specific brain regions.

C39

BODILY REACTIONS WHILE READING EMOTIONAL WORDS CAN SIGNIFY VALENCE AND PERSONAL REFERENCE: EVIDENCE FROM FACIAL MUSCLE ACTIVITY, HEART RATE, AND SKIN CONDUCTANCE

Patrick Weis[1,3,4], Cornelia Herbert[2,3,5]; [1]George Mason University, [2]Ulm University, Germany, [3]University of Tuebingen, Germany, [4]International Max Planck Research School Tuebingen, Germany, [5]University Hospital Tuebingen, Germany — Findings in social, cognitive and affective neuroscience suggest that emotion and language are closely related. The nature of the link between cognitive functions and bodily responses is subject to controversy. Here, a multimodal paradigm to investigate emotional word processing from a whole-body perspective is presented. The paradigm uses word phrases that are related to own or other people's emotions. Subjects had to intuitively judge emotional valence of the word phrases while bodily responses were recorded. The word phrases consisted of a pronoun and a noun and were presented on a computer screen. Nouns varied in valence (positive/neutral/negative), pronouns in self-reference (self/other/negation), resulting in a 3*3 design. Physiological recording included skin conductance (EDA), facial expression (fEMG), and heart rate (HR). It was found that pronoun-noun-phrases with positive or negative nouns were evaluated faster than pronoun-noun-phrases with neutral nouns. Self-related positive pronoun-noun phrases (e.g. my happiness) were judged and responded to the quickest. Physiologically, emotional pronoun-noun pairs elicited an increase in phasic heart rate compared to phrases of neutral meaning. The same pattern seemed to emerge for electrodermal activity while fEMG varied as a function of both, stimulus valence and self-reference. Facial responses were most pronounced for other-related word phrases. Reaction time data is interpreted to be in accordance with the self-serving attributional bias present in Western culture. Physiological data supports the embodied nature of emotions in language. However, fEMG data indicates facial musculature not only to embody emotion but furthermore to be sensitive for personal reference.

EMOTION & SOCIAL: Other

C40

GENDER DIFFERENCES IN RESPONSE TO NATURALISTIC VERSUS ARTIFICIAL NOISE STRESS: BEHAVIORAL AND NEUROPHYSIOLOGICAL EVIDENCE FROM A SPATIAL N-BACK TASK

Martin Paczynski[1], Raja Parasuraman[1]; [1]George Mason University — The current study sought to answer the question whether more naturalistic auditory stressors (e.g. jackhammer) elicit similar behavioral and neural changes as more commonly used artificial auditory stressors (e.g. white noise). Participants completed four blocks of a spatial 2-back task, two in silence, two with noise presented through headphones. Three to nine second bursts of noise (~82dB) were randomly presented throughout each sound block. Two types of noises were used: artificial or naturalistic. Order of blocks was counterbalanced across participants though silent and noise blocks always alternated. Noise blocks lead to significantly higher arousal than silent blocks. For male, but not female, participants, both types of noise led to a significant increase in reaction time. Overall, both types of noise led to a decrease in performance accuracy. Importantly, for female, but not male, participants, state anxiety correlated with accuracy (higher anxiety, higher accuracy) but only for the silent and naturalistic noise conditions. Both male and female participants showed similar bilateral increases in blood oxygenation over the course of silent blocks as well as similar initial decreases in blood oxygenation for white noise blocks. However, only male participants showed a similar decrease in oxygenation for naturalistic noise. A similar pattern was observed for total blood volume. These findings may help explain the inconsistent literature on gender differences in response to stress. In the current study, gender based differences were observed for naturalistic noise stress but not white noise. Implications for past and future research on effects of stress are discussed.

C41

NEUROANATOMICAL INDICATORS OF ALTRUISTIC CONCERN

Jason Hubbard[1], Ulrich Mayr[1], William Harbaugh[1]; [1]University of Oregon — Previous work has established candidate neural mechanisms that describe differences in altruistic motivation. We sought to extend this work by leveraging a moderately large sample size (N = 80) and establishing fine-grained indicators of individual differences in altruism. In a first step, we used structural equation modeling to establish a common latent factor reflecting genuine altruistic concern for others, across measures from personality psychology, behavioral economics, and neuroscience. Using this latent factor, we attempted to further characterize individual differences in altruism based on variation in brain structure. Based on previous work linking small amygdala volume with psychopathic traits, and conversely, large amygdala volume with "extreme altruism", we focused on amygdala volume as a potential predictor of altruism. Consistent with this work, right amygdala volume was positively predictive of altruistic concern as captured by our latent factor ($t = 2.6$, $p < .05$). Individual comparisons found it was predictive of individual self-reported empathic traits ($t = 2.3$, $p < .05$) and of brain responses to observing monetary transfers to charities ($t = 2.6$, $p < .05$). Further, activation within the left amygdala was also predictive of charitable donations in a laboratory task ($t = 3.5$, $p < .001$). These findings support previous work highlighting the amygdala's involvement in altruistic motivation, and importantly extend this work by showing a continuous relationship within a single sample. Together, findings are consistent with the notion of a common, general factor related to altruistic concern that, at least in part, can be attributed to neuroanatomical differences.

C42

OLFACTORY AVERSIVE LEARNING ENHANCES SHORT-TERM AND LONG-TERM PERCEPTUAL DISCRIMINATION

Yuqi You[1], Lucas Novak[1], Wen Li[1]; [1]Florida State University — Recent evidence indicates that aversive associative learning improves perceptual and sensory cortical discrimination of the conditioned stimuli (CS), but the long-term perceptual and memory effects are poorly understood. By pairing neutral olfactory CS with either highly disgusting or neutral stimuli (pictures and sounds combined), we measured learning-related changes in behavioral and fMRI data across three phases: before, immediately after, and one-week after conditioning. Aversive conditioning was evidenced by elevated risk ratings towards CS+ relative to CS- both immediately and one-week after learning ($F(1,31)=9.14$, $p=.005$). A Phase-by-CS interaction on olfactory discrimination (between the CS+/CS- odor and its similar morph mixture; $F(1,36)=3.25$, $p=.08$) further indicated enhanced discriminability of CS+ odor from before to immediately after learning ($t(36)=2.02$, $p=.05$), rising from at-chance ($p=.22$) to above-chance ($p<.001$) levels; however, no such perceptual change was observed in CS- ($p=.55$). Moreover, this effect was paralleled by a Phase-by-CS interaction on response time (RT; $F(1,36)=3.95$, $p=.06$), demonstrating faster RTs towards CS+ from before to immediately after learning ($t(36)=2.01$, $p=.05$) and no effect on CS- ($p=.69$). Critically, these learning effects persisted one-week later, evinced by similar Phase-by-CS interactions mentioned above (Discrimination accuracy: $F(1,32)=5.84$, $p=.02$) and RT:$F(1,32)=3.57$, $p=.07$). Replicating recent findings of enhanced perceptual discrimination of CS+ immediately after aversive learning, these results further demonstrated long-term olfactory aversive associative memory and its lasting impacts on perception. Multivariate fMRI analysis is underway to confer additional insights into learning-induced changes in ensemble neural activity in the sensory cortex over time.

C43

INCREASES IN INTRINSIC NETWORK CONNECTIVITY FOLLOWING ANTERIOR TEMPORAL LOBE RESECTION: A PRE-TO-POST-OPERATIVE LONGITUDINAL STUDY

Matthew Sutterer[1], Joel Bruss[1], Michelle Voss[1], Daniel Tranel[1], Matthew Howard[1]; [1]The University of Iowa — Despite intense study, our understanding of how the brain recovers in the face of neurological injury, and proceeds through phases of recovery, remains limited. Using a within-subjects approach, we characterized functional networks and behavior before, shortly after, and months after surgical resection of the medial and anterior temporal lobe. Resting-state fMRI data were collected in 14 patients undergoing surgery for medically intractable epilepsy at three time points: one month prior to surgery, 2-8 weeks

following resection of the anterior temporal lobe, and 6 months or more after surgery. Functional connectivity analyses were employed to assess preoperative to postoperative changes in the salience, fronto-executive, default mode networks, as well as control areas in primary sensory areas. We hypothesized that focal resection of the anterior temporal lobe would selectively affect the salience and default mode networks, as these networks include resected areas in the amygdala, temporal pole, and hippocampus. The fronto-executive network does not involve medial temporal lobe areas, and was predicted to be unaffected by focal damage. We observed significant increases in the connectivity of nodes in the salience network from preoperative baseline to acute postoperative assessments, and a significant increase in connectivity from acute postoperative to chronic postoperative assessment. Our results suggest early increased recruitment of non-resected salience network regions following focal damage to the medial temporal lobe that continues into the chronic epoch of recovery. This pattern of network changes might reflect a release of function following surgery and could shed light on spontaneous recovery and reorganization processes.

C44

SOCIAL PROBLEM SOLVING IN ADULTS WITH ATTENTION DEFICIT HYPERACTIVITY DISORDER

Patrizia Thoma[1], Nathalie Marcinkowski[1], Stephanie Sonnenburg[1], Marc-Andreas Edel[2], Boris Suchan[1]; [1]Ruhr University Bochum, [2]LWL University Hospital, Ruhr University Bochum — Patients with attention deficit hyperactivity disorder (ADHD) show impaired social cognition, particularly in terms of deficient theory of mind. However, little is known about how this translates into potential behavioural impairments in social situations. In particular, the ability to handle difficult interpersonal situations and its relationship with trait empathy and higher order cognitive functions have not been investigated in adults with the disorder. In the current study, we examined 17 adult patients diagnosed with ADHD and 19 matched healthy controls with a battery of scenario-based tests assessing the ability to solve interpersonal problems in an ecologically valid manner. Furthermore, patients were assessed on standard measures of trait empathy, social anxiety and executive functions. In the social problem solving task, patients generated significantly fewer optimal solutions that were both socially sensitive and practically effective than healthy controls. However, they did not differ with regard to the number of solutions that were only socially sensitive, only practically effective or irrelevant. Furthermore, ADHD patients showed increased trait personal distress on a standard empathy questionnaire as well as increased social anxiety scores relative to healthy controls. In the patients, increased social anxiety was related to a diminished capacity to generated optimal solutions for social problems. There were no significant associations with executive function or trait empathy. The result pattern points towards impaired social problem abilities in patients with ADHD which should be addressed in treatment.

C45

MODULATING SOCIAL ATTENTION THROUGH NONINVASIVE BRAIN STIMULATION TO THE ANTERIOR PARACINGULATE CORTEX

Eva Wiese[1], Raja Parasuraman[1], Amanda Hanelli[1], Eric J. Blumberg[1]; [1]George Mason University — Attending to where others look (i.e., gaze-following) is a fundamental mechanism of social cognition and is modulated by adopting the intentional stance to the gazing agent; in particular, attentional orienting to gaze direction is enhanced when agents are believed to be intentional (e.g., human) versus mechanistic (e.g., robot). Adopting the intentional versus the mechanistic stance is associated with stronger activation in the anterior paracingulate cortex (aPCC), a structure that is part of the brain's mentalizing network. In one experiment, we investigated whether stimulating aPCC with transcranial direct current stimulation (tDCS) increases the degree to which an agent's gaze is followed and whether this effect is different for human versus robot agents. Electrodes were placed on EEG scalp locations FZ and F9 following current modeling predictions of optimal current flow through the aPCC. Participants performed a gaze-following task with a human and a robot agent at two different time-points: once at pre-stimulation (as baseline measure) and again while either being stimulated or under sham. Data showed that stimulating aPCC increases gaze-following for the human agent, but decreases gaze-following for the robot agent. Interestingly, this effect was only observed for participants, who showed stronger gaze-following for the human agent at pre-stimulation, but not for those who showed stronger gaze-following for the robot agent. The findings suggest that participants who show top-down control of gaze-following at baseline benefit from stimulation of aPCC, while those who do not recruit medial-prefrontal areas at baseline do not seem to be affected by stimulation.

EXECUTIVE PROCESSES: Monitoring & inhibitory control

C46

NEURAL CIRCUITRIES OF RESPONSE SELECTION REVEALED BY A FLANKER TASK WITH AVERTED EYE-GAZES SERVING AS RESPONSE CUES

Hsin-Ju Lee[1], Wen-Jui Kuo[1]; [1]National Yang-Ming University — The Eriksen flanker task is an experimental task often used to investigate cognitive control such as response selection. It can reveal one of our essential, central abilities, i.e., the ability to select among possible responses to a given stimulus or situation which were learned through S-R associations. Neuroimaging evidence indicates that, during the task, the parietal cortex was activated to maintain representations of possible responses/S-R associations. Lateral prefrontal and anterior cingulate cortices were engaged by the need of selection among competing response alternatives. Since humans are developmentally socialized, we are sensitive to others' eye-gaze status and often interpret others' intention or attention focus by their eye-gaze direction. We were interested in if there is influence when we constructed the task by using human eye-gaze, i.e., the left-averted and right averted eye-gazes for the left and right response cues and straight eye-gaze for the neutral condition. The behavioral data indicated that congruency effect from either the eye-gaze version or the traditional version flanker task was significant. However, BOLD activation patterns of the two versions differed. In the comparison of incongruent vs. congruent condition, while the traditional version activated brain regions similar to previous studies' findings, i.e. the fronto-parietal areas, the eye-gaze version perturb different brain networks including the prefrontal cortex, the superior temporal sulcus, and the left anterior superior temporal gyrus. Brain areas associated with social cognition seemed to be more engaged to support response selection in a flanker task with social stimuli, i.e., the eye-gaze.

C47

EVALUATING THE EFFECTS OF MINDFULNESS PRACTICES IN YOUNG CHILDREN USING ELECTROPHYSIOLOGICAL MEASURES OF ATTENTION AND SALIVARY MEASURES OF STRESS

Trey Avery[1,2], Meriah DeJoseph[1], Karen Froud[1]; [1]Teachers College, Columbia University, [2]Haskins Laboratories — Attention and executive functions are critical for school success and can be improved with intervention. Exposure to chronic stress is often associated with deficits that without intervention will negatively affect school performance. Mindfulness-based interventions have been shown to improve attention and reduce stress in adults, but there is little empirical data on the effects of these practices and programs on young children. While most studies using surveys and behavioral measures show positive effects associated with school-based mindfulness programs, the underlying mechanisms that produce changes in behavior are largely inferred from research on adults, leaving open countless questions about age of initiation and the format, dosage and emphasis of programs. Using event-related potential responses to the Attention Network Test for Children (ANT-C), multiple samples and markers of stress found in saliva and behavioral measures, we examine the effects of mindfulness-based interventions on children ages five to seven. We found significant group differences in executive attention measured by the amplitude and topography of the P3 event-related potential associated with target congruency evaluation in the ANT-C. Saliva measures indicate differences in stress responses between groups, with the mindfulness group having consistently lower cortisol levels but increasing levels of alpha amylase, possibly a result of more task related engagement. Together, these data suggest multiple positive effects associated with mindfulness practices in young children.

C48

BALANCE BETWEEN THE FRONTOPARIETAL AND THE REWARD SYSTEM REGULATES SEXUAL BEHAVIOR

Pin-Hao Chen[1], Dylan Wagner[2], William Kelley[1], Todd Heatherton[1]; [1]Dartmouth College, [2]Ohio State University — Based on the balance model, the imbalance between the executive control and the reward system leads to self-regulatory failures (Heatherton & Wagner, 2011). Self-regulatory failures are a key cause in several contemporary societal problems, such as obesity, drug abuse, and risky sexual behavior. In this study, we examined whether individual differences in sexual activity can be predicted based on the balance between the two systems. Twenty-five male heterosexual participants first watched a series of brief erotic films and then performed an attractive/unattractive go-nogo task that required them to withhold responses to images of nude female pictures. We computed the balance score for each participant based on the difference between the mean z-score extracted from hubs within the frontoparietal network and the mean z-score from hubs within the reward network for those trials when participants made disinhibition errors to attractive targets. We found that individuals with the highest balance scores (indicating greater frontoparietal compared to reward) made the fewest disinhibiton errors when viewing attractive targets. These participants also reported the lowest scores on the SOI-R scale, indicating that they have the highest tendency to regulate sexual desire and behavior. These findings suggest that the balance between the frontoparietal and the reward system may play a role in successfully regulating sexual behavior.

C49

SEX-SPECIFIC DIFFERENCES IN BEHAVIORAL AND NEURAL CORRELATES OF FORETHOUGHT IN YOUTH WITH ADHD

Helene Poissant[1], Lucile Rapin[2], Stéphanie Chenail[3], Adrianna Mendrek[3]; [1]Universite du Quebec a Montreal, [2]Douglas Hospital, [3]Bishops University, [4]Bishops University — Introduction: Most studies investigating neurocognition in attention deficit/hyperactivity disorder (ADHD) has been conducted on male participants. Very few studies examined sex differences in ADHD. Deficit in forethought seems particularly important as children with ADHD often fail to adequately use previous information in order to prepare for upcoming responses. Our main goal was to assess sex-specific differences in behavioral and neural correlates of forethought in youth with ADHD. Methods: 21 TD youth:23 youth with ADHD were asked to judge whether two pictures told a congruent or an incongruent story. Reaction time, performance accuracy, and cerebral activations were recorded during functional magnetic resonance imaging (fMRI). Results: Although no differences in performance of the forethought task were found between boys and girls when controlling for age, significant sex-specific differences were apparent in the patterns of cerebral activations. Relative to the same-sex TD participants, boys with ADHD had extensive bilateral frontal and parietal hypo-activations, while girls with ADHD demonstrated more scattered and circumscribed hypo-activations in the right temporal, parietal, frontal and cerebellar regions. Discussion: Present results revealed that both boys and girls with ADHD exhibit diminished cerebral activations during a forethought task. Most regions of under-activations observed in the present study were consistent with previous reports in individuals with ADHD during performance of executive tasks. Nevertheless, the pattern of deficits was different in boys and girls, suggesting a different neurocognitive strategy utilized by the two sexes. This emphasizes the importance of including both males and females in the cognitive and neuroimaging investigations of ADHD.

C50

CONGRUENCY SEQUENCE EFFECTS: WHAT GOOD ARE THEY?

Kenneth Paap[1], Oliver Sawi[2], Hunter Myuz[3]; [1]San Francisco State University, [2]University of Connecticut, [3]New Mexico State University — Congruency sequence effects (CSEs) are robust context effects observed in many choice RT tasks that include both congruent and incongruent trials. The defining pattern is that interference effects are smaller when the previous trial is incongruent compared to when the previous trial is congruent. Grundy and Bialystok (2015), reported smaller CSEs for bilinguals compared to monolinguals in a flanker task and concluded that bilinguals are better than monolinguals at disengaging attention. Reanalyses of nine different datasets from two different laboratories and with much larger sample sizes show that these language-group differences do not replicate in either flanker or Simon tasks. Furthermore CSEs in standard interference tasks likely result from bottom-up learning and memory effects and not from top-down cognitive-control effects. The present results are also consistent with many previous reports indicating that typical CSEs have comparable costs (slower responses when an incongruent trial is followed by a congruent one) and benefits (faster responses when an incongruent trial is followed by another incongruent trial). Thus, from a system perspective that is concerned with improving overall performance, small versus large CSEs are usually neither advantageous nor disadvantageous. Rather than being the paragon of cognitive control CSEs may have little to do with inhibitory-control ability, but something to do with making micro-adjustments in temporal preparation for the next trial.

C51

AN FMRI COMPARISON OF BILINGUALS AND MONOLINGUALS DURING THE SIMON TASK: EVIDENCE FOR DIFFERENT CONTROL PROCESSES

Kelly A. Vaughn[1], Brandin Munson[1], Maya R. Greene[1], Aurora I. Ramos-Nuñez[1], Arturo E. Hernandez[1]; [1]University of Houston — Current models of bilingual language production suggest that inhibition plays an important role. Experience with inhibition during daily language use may train the brain for other inhibition tasks; some studies have found that bilingual children and older adults show enhanced inhibition over monolinguals on the Simon task. Although behaviorally this advantage in young adults is not supported, neuroimaging studies suggest that bilinguals and monolinguals at this age may still be processing these types of tasks differently. The current study is the first to compare bilingual and monolingual performance and fMRI activity during the Simon task. Behavioral and fMRI data from 26 Spanish-English bilinguals and 23 English monolinguals matched on gender, age, and socioeconomic status were analyzed in this study. Both groups performed with high accuracy, though the monolinguals demonstrated significantly faster response times. The groups did not differ on the Simon effect, a measure of difference in response time for trials that do and do not require inhibition (congruent and incongruent, respectively). The fMRI results suggest that bilinguals activate control areas including the cingulate gyrus and inferior parietal lobule more than the monolinguals during the congruent condition, but monolinguals activate control areas including the supplementary motor area and cingulate more than bilinguals during the incongruent condition. These results suggest that the behavioral data alone do not tell the whole story; bilingual and monolingual adults complete inhibition tasks using different neural processes. Future studies should seek to connect these differences directly to bilingual and monolingual language experiences.

C52

DYNAMIC NETWORK CONNECTIVITY AND COGNITIVE CONTROL

Derek M. Smith[1], Christine A. Godwin[1], Joshua K. Grooms[1,2], Shella D. Keilholz[1,2], Eric H. Schumacher[1]; [1]Georgia Institute of Technology, [2]Emory University — Both the connectivity between functional brain networks and prestimulus activity have been associated with enhanced performance on cognitive control tasks (Kelly et al., 2008: Weissman et al., 2006). Research has shown that the dynamics of the interaction between the default mode network (DMN) and the task positive network (TPN) is related to performance on a sustained attention task (Thompson et al., 2013). Analysis of the connectivity dynamics demonstrated that faster reaction times were associated with greater anticorrelation between these networks before detected targets. To better understand the role of dynamic connectivity in control processing subjects completed the flanker and the global/local tasks during two fMRI sessions. Both tasks had long intertrial intervals (averaging 18.8 s & 18.2 s). Images were captured using a multiband sequence with a 700 millisecond repetition time. A sliding window correlation analysis was used. Changes in functional connectivity were charted by calculating network correlations for 12 second sliding time windows centered at each instance of the stimulus. It was predicted that faster performance especially for incongruent trials would be associated with more anticorrelation between the DMN and the TPN. Results support this prediction with a seed based network method. In addition, to the observation of conflict related effects in the anterior cingulate cortex the sliding window method was applied to ICA defined networks and was compared to the seed based results. These findings show that dynamic connectivity analysis has the potential to open a new dimension of control research.

C53

IMPACT OF STRENUOUS EXERCISE ON COGNITIVE CONTROL, AN EMG STUDY ON CYCLE ERGOMETER Celine Ramdani[1], Emmanuel Sagui[2], Karen Davranche[3], Franck Vidal[3], Thierry Hasbroucq[3]; [1]Institut de recherche biomédicale des armées, Brétigny sur Orge, [2]Hôpital d'Instruction des Armées Laveran, Marseille, [3]Aix-Marseille Université, CNRS, Marseille — In strenuous exercises, optimal performance depends on the subject's ability to simultaneously deal with cognitive and physical demands. The present study aimed to evaluate the impact of a strenuous exercise on cognitive control and more specifically on error monitoring. To this aim, 16 healthy volunteers performed a conflict reaction time task on a cycle ergometer: on the control condition, the resistance was set up at a 15W constant output. The resistance was automatically regulated to ensure constant power output independent of pedal frequency. On the exercise condition, the intensity was setup above the first ventilatory threshold (VT1 +5%) for about 25 minutes. Classical mental chronometric measures were augmented with an analysis of the electromyographic activity of the response effectors. Electromyography allows one to detect covert activations undetectable with only behavioral measures and reveals the participants' ability to quickly suppress covert activations before they result in an overt movement. Correction rate was then calculated by dividing the number of partial errors (incorrect activations suppress before they result in an overt error) by the number of incorrect activations (partial errors plus errors). Exercise diminished the occurrence of incorrect activations for congruent associations (control: 28% ; exercise: 27%) and decreased the correction rate for both congruent and incongruent associations (control: 70% ; exercise: 62%). These results suggest that strenuous exercise (i) impairs the ability to detect and correct incorrect activations and (ii) reduces the occurrence of fast-guesses, the net behavioral result being reflected in an increase in error commission for incongruent associations.

C54

EVALUATION OF ERRORS IS NOT ALL AUTOMATIC: EFFECTS OF WORKING MEMORY LOAD ON ERROR-RELATED NEGATIVITIES OF DIFFERENT ERROR TYPES. Martin E. Maier[1], Marco Steinhauser[1]; [1]Catholic University of Eichstaett-Ingolstadt, Eichstaett, Germany — The ability to detect and evaluate one's own errors is crucial for the optimization of performance. Early error monitoring mechanisms are thought to be rather automatic because otherwise they would interfere with task-related processing. To test this hypothesis, we investigated whether early error monitoring is affected by working memory load. In previous studies, we have shown that the error-related negativity, an electrophysiological marker of early error monitoring, differentiates between error types of different significance, and thus, is a consequence of an evaluation process. In the present study, we combine a flanker task with a Sternberg working memory paradigm to investigate whether this evaluation process deteriorates under high working memory load. On each trial of the experiment, participants received a small or a large memory set, followed by a flanker task. After providing the flanker task response, participants had to indicate whether a memory probe was part of the memory set. Because it required holding the memory set in working memory during the flanker task, this design allowed investigating effects of working memory load on error monitoring in the flanker task. The results showed that the error-related negativity was larger for more significant than for less significant errors only with low, but not with high working memory load. This shows that working memory load impairs the evaluation of error significance, and thus that early error monitoring is not truly automatic.

C55

ERROR-INDUCED ATTENTIONAL ADJUSTMENTS COMMENCE PRIOR TO CONSCIOUS ERROR DETECTION Marco Steinhauser[1], Søren K. Andersen[2]; [1]Catholic University of Eichstätt-Ingolstadt, [2]University of Aberdeen — Learning from errors is crucial for optimizing performance. Theories of performance monitoring assume that detecting errors leads to adaptive behavioral and attentional adjustments that serve to prevent these errors in the future. However, although numerous studies have identified stages of error processing in error-related brain activity, it is still unclear how these stages are related to adaptive adjustments. Whereas some studies suggest that adjustments are elicited by early error processing that occurs immediately after an error response, others concluded that adjustments are initiated by conscious error detection emerging around 300 ms later. We investigated the time course of attentional adjustments elicited by errors. Participants attended to one of two superimposed red and blue random-dot kinematograms (RDKs) in order to discriminate the direction (horizontal vs. vertical) of brief motion intervals of the target RDK, while ignoring concurrent compatible or incompatible motions of the distractor RDK. The RDKs flickered at different rates, thereby eliciting distinguishable steady-state visual evoked potentials (SSVEPs), allowing us to concurrently measure the time-course of attentional allocation to both RDKs. Attentional selectivity of SSVEPs was increased almost immediately after the error response. Moreover, this selectivity increase was driven by enhanced processing of the target. These data suggest that error-induced attentional adjustments start prior to conscious error detection, and hence, are most likely related to the earliest stage of error processing.

EXECUTIVE PROCESSES: Other

C56

RELATING CATECHOL-O-METHYLTRANSFERASE GENETIC VARIATION TO NEUROPSYCHOLOGICAL TEST PERFORMANCE Daniel A. Rinker[1], Neda Jahanshad[1], Derrek P. Hibar[1], The Alzheimer's Disease Neuroimaging Initiative, Paul M. Thompson[1]; [1]University of Southern California — The Trail Making Test (TMT) is a commonly used neuropsychological test that estimates processing speed, cognitive flexibility, scanning and executive function. The TMT is sensitive to various neurocognitive impairments and has been used to predict physical impairment and health status. Catechol-O-Methyltransferase (COMT) is a highly studied gene that has sometimes been associated with brain function in: schizophrenia, ADHD, personality, addiction and pain response. There is also some evidence linking COMT variation to differences in dopamine levels. There is no clear consensus on the putative mechanism for these associations, as evidence is mixed. Here we used multiple regression to test the effect of several COMT variants, and other variants associated with lower white-matter integrity on performance in TMT parts A and B in 124 participants (72.8 ± 7.3 years, 42 female) as part of the Alzheimer's Disease Neuroimaging Initiative (ADNI). One COMT single nucleotide polymorphism (SNP), rs4680, was significantly associated with time to completion on TMT-A in participants with mild-cognitive impairment (MCI) and healthy controls ($p < 0.05$), controlling for age and sex. Another sample of 394 participants, which included AD patients, showed similar significant results, in the same direction. These findings support the use of the TMT in neuropsychological batteries as a measure of biological substrates and add to the literature relating COMT status to neurocognitive health.

OTHER

C57

THE ROLE OF FEEDBACK CONTINGENCY IN PERCEPTUAL CATEGORY LEARNING Lauren E. Vucovich[1], F. Gregory Ashby[1]; [1]University of California, Santa Barbara — Recent research suggests that the effects of reward prediction error (RPE) on dopamine neuron firing may be modulated by reward contingency – that is, by the correlation between response confidence and reward valence. For example, when rewards are not contingent on behavior there is nothing to learn, and dopamine fluctuations carry no adaptive value. Two studies indirectly tested this hypothesis by examining effects of feedback contingency on perceptual category learning. In Experiment 1, participants learned either rule-based or information-integration category structures under conditions of either high or low feedback contingency. Rule-based categories can be learned via declarative memory, whereas information-integration categories require procedural memory. In both feedback conditions, the optimal Bayesian classifier would receive positive feedback on 80% of the trials. In high contingency conditions, probability of positive feedback decreased with categorization difficulty, whereas in low contingency conditions, probability of positive feedback was independent of categorization difficulty. Overall, results showed that learning was good for both types of category structures when feedback contingency was high. However, when feedback contingency was low, learn-

ing was poor or nonexistent with both category structures. Experiment 2 employed the same design, but included a "no-man's-land" so that no stimuli were near the optimal categorization bound in either condition. Results were consistent with Experiment 1, with significantly less learning in both low contingency conditions. Standard RPE models predict roughly equal performance with the two feedback types, so these results support a model in which the effects of RPE on dopamine fluctuations are modulated by feedback contingency.

EXECUTIVE PROCESSES: Other

C58

SIMULTANEOUS LEARNING OF HIERARCHICAL REWARD STRUCTURES AND CATEGORIES IN PROCEDURAL AND DECLARATIVE SYSTEMS

Stella S. von Meer[1], Vivian V. Valentin[1], F. Gregory Ashby[1]; [1]University of California, Santa Barbara — An armamentarium of studies support multiple systems in human category learning. A clear dissociation between procedural (stimulus-response association) and declarative (hypothesis testing) systems exists. Optimal performance in difficult real-world classification tasks often requires learning about task and reward structure, as well as category structure. In many cases, optimal performance requires learners to forsake small immediate rewards to subsequently achieve greater rewards. Are hierarchical reward structures (HRSs) of this type learned differently during procedural and declarative category-learning tasks? The behavioral experiments presented here compared learning of information-integration (procedural) and rule-based (declarative) categories (which were exactly matched on all category-separation statistics) when an embedded HRS required participants to make categorization errors on odd numbered trials (and therefore to suffer a small loss) to maximize overall reward. Almost all participants in the rule-based task learned this HRS (21/22), in contrast to only 2 of 22 participants in the information-integration task. Interestingly, when given explicit instructions regarding the HRS, participants frequently displayed optimal responding in the information-integration (11/13) task. In a follow-up experiment with a more difficult rule-based task, half the participants successfully learned the HRS. Therefore, learning HRSs appears more compatible with declarative learning systems than with the more phylogenetically conserved procedural system. These results are consistent with the hypothesis that HRSs are learned and managed within explicit structures that may share greater overlap with structures supporting the declarative than procedural category-learning system.

C59

ALPHA POWER CHANGES IN AMNESTIC MILD COGNITIVE IMPAIRMENT IN GO/NOGO TASKS INVOLVING SEMANTIC CATEGORIZATION

Lydia T. Nguyen[1], Hsueh-Sheng Chiang[2], Justin Eroh[2], Mandy J. Maguire[2], Michael A. Kraut[3], John Hart Jr.[2], Raksha A. Mudar[1,2]; [1]University of Illinois at Urbana-Champaign, [2]The University of Texas at Dallas, [3]The Johns Hopkins University School of Medicine — We examined behavioral (response times and error rates) and EEG (alpha power) measures of cognitive control using a visual Go/NoGo paradigm during semantic categorization in individuals with amnestic mild cognitive impairment (aMCI). Twenty-two aMCI (14 F; 68.8 ± 7.69 years) and 22 age-, education- and gender-matched healthy aging controls (16 F; 65.32 ± 6.84 years) performed two Go/NoGo tasks. The single car task (SiC) involved basic categorization and used single exemplars of a car (Go) and a dog (NoGo). The object animal task (ObA) involved superordinate categorization and used multiple exemplars of objects (Go) and animals (NoGo) across trials. The ObA task had longer response times than the SiC task for both groups. The aMCI group showed a larger difference between the commission and omission errors compared to the control group. EEG data revealed that in the -50-200 ms time period, frontal upper alpha band (10-12 Hz) power for the ObA task was lower compared to the SiC task in the aMCI group, whereas no such differences were found in the control group. Additionally, in the 250-750 ms time period, frontal lower alpha band (8-10 Hz) power for the NoGo trials was diminished in aMCI individuals compared to controls, but no such differences were observed during the Go trials. These findings suggest that distinct changes in frontal alpha power in relation to cognitive control during semantic categorization are noted in individuals with aMCI. These alpha power changes may serve as useful neural markers in early identification of cognitive deterioration.

C60

NMDA-RECEPTOR BLOCKADE ENHANCES CONTEXTUAL EXTINCTION LEARNING AND MODULATES ACTIVATION OF EXTINCTION-RELATED BRAIN REGIONS

Anne Golisch[1], Silke Lissek[1], Martin Tegenthoff[1]; [1]Department of Neurology, BG University Hospital Bergmannsheil, Bochum, Germany — The extinction learning process occurs in a distributed network of prefrontal, hippocampal and amygdalar regions, of which a subset participates in the phenomenon of the renewal effect. Renewal describes the recovery of an extinguished response in extinction recall if the context of extinction differs from the context of recall. The high density of N-Methyl-D-Aspartate (NMDA) receptors in these involved brain areas may be a modulator of extinction learning and renewal. Animal studies demonstrated that NMDA-receptor antagonism in prefrontal regions disrupted both extinction learning and processing of task context. In contrast, no deficits in retrieval of contextual fear memory were observed using NMDA-receptor blockades in the hippocampus. In this functional magnetic resonance imaging study, we investigated the role of the NMDA system for behavioral and brain activation correlates of extinction and renewal with a specific focus on extinction-related regions. Healthy human volunteers received the NMDA-receptor antagonist Memantine (30mg single dose) prior to extinction learning of previous acquired stimuli associations presented in either an identical or a novel context. The following recall phase was identical to the acquisition. We observed a better extinction learning performance in the NMDA group compared to the placebo group. However, NMDA did not affect renewal. In general, the NMDA group showed a deactivation in extinction-related brain regions particularly in the prefrontal cortex. In summary, preliminary results indicate that the NMDA system appears to be involved in extinction learning. We assume that the apparently contradictory results of the pharmacological intervention may be modulated by the body weight.

C61

DECISION MAKING BEHIND VEIL OF IGNORANCE IN MONKEY

Wei-hiang Hwang[1], Yi-Ta Lu[1], Tsung-Yu Ho[1], Yi-Tsung Hsieh[1], Jen-Te Wang[1], Tsung-Yang Ho[1], Chun-I Yeh[1], Chen-Ying Huang[1]; [1]National Taiwan University — The veil of ignorance (VOI), behind which people allocate resource prior to learning their social positions, was introduced by John Rawls (1971). In a world of two, a prince and a beggar, an equal distribution yields an even share of resource to them, whereas an unequal distribution gives the prince the majority and leaves little for the beggar, preference over distributions may depend on a decision maker's roles as a prince or a beggar. Decisions made before learning his roles are immune from being affected by his respective social position, and hence reflect what truly constitutes a just distribution. These are termed as preferences behind VOI, and they are therefore divided into two parts: the decision maker's inequity aversion and their risk preference. In other words, when making decisions behind VOI, they balance between the desired distribution and the risk of not obtaining the desired role. We study the behavior of non-human primate, Formosan Rock Macaque (Macaca cyclopis), in the face of food decision problems. We conduct a class of modified dictator games in which a proposer chooses between two food allocations, and measure subjects' preferences, including risk preference, inequity aversion, and preference behind VOI. Our data shows that subjects are strongly risk-loving and exhibit no inequity aversion. Also, social context did affect choice in hierarchy system.

C62

THE DEFAULT MODE NETWORK AND HOT EXECUTIVE FUNCTION IN A MIXED-CLINICAL ADOLESCENT POPULATION

Audreyana Jagger[1], Gregory Rose[1]; [1]Southern Illinois University-Carbondale — Hot Executive Function, or Hot EF, is an emotionally driven cognitive process (Zelazo & Carlson, 2012) that is often disturbed in mental disorders. The Default Mode Network (DMN) is a brain network, including the precuneus and medial prefrontal cortex (mPFC), which is active when an individual is relaxing at rest without any external demands. We wanted to determine if DMN connectivity "strength" was related scores in Hot EF. This study included 30 adolescents from a mixed clinical and control population. Each participant completed a 30 minute session in a 3T Siemens MRI scanner and 3 hours of neuropsychological testing. A scatter plot revealed a non-linear relationship between these two variables: both the lowest and highest

scores on a Hot EF scale (emotional control) were related to higher correlations between the precuneus and mPFC. Hierarchical regression was used to examine the significance of the non-linear effects. The first model, testing the linear relationship, was not significant $F(1, 28) = .13$, $p = .73$, and explained only .04 % of the variance. The second model, testing the nonlinear relationship, was significant $F(2, 27) = 8.07$, $p = .001$ and explained 39 % of the variance. This suggests that DMN connectivity strength is related in a complex way to the capacity to demonstrate Hot EF. Consequences for behavioral regulation and future directions will be discussed.

EXECUTIVE PROCESSES: Working memory

C63

MOTOR ENCODING DURING VISUAL WORKING MEMORY OF SENSORIMOTOR INFORMATION: EVIDENCE USING LATERALIZED READINESS POTENTIAL

Alejandro Galvez-Pol[1], Beatriz Calvo-Merino[1], Bettina Forster[1]; [1]City University London — New perspectives in working memory suggest similar neural processes underlying memory encoding and perception mechanisms. This provides sensory cortices with a determinant role in memory storage and cognition. In a previous study we showed that visual working memory of sensorimotor information (e.g. encoding hand postures) recruited cortical sensory regions functionally engaged with processing this sensorimotor information, beyond the already described visual cortices. Here, we test the involvement of motor cortices during visual encoding of sensorimotor information using a novel paradigm that combines lateralized readiness potentials (LRP) evoked with a task-irrelevant motor task, during a visual working memory task of hand postures and control condition (shapes). Visual evoked potentials (VEPs) showed a significant contralateral enhancement of mean amplitudes when memorizing increasing number stimuli over occipital electrodes, suggesting the presence of mnemonic activity over visual regions similar to what has been previously shown. Importantly, analysis of the LRPs locked to the motor response at the end of the encoding phase shows a lateralized enhancement of neural activity depending on the amount of information to be held in visual memory (load) only for the hand condition, and not for the control condition over frontal electrodes. These results provide evidence for a double dissociation between type of stimuli encoded, memory load, and neural location of the corresponding elicited response. Such activity suggests a functional specific underlying motor contribution to maintain in visual working memory sensorimotor information.

C64

COMBINING EXPLICIT COGNITIVE AND FUNCTIONAL ADAPTIVE EXERCISE TRAINING ENHANCES COGNITIVE PERFORMANCE IN AN UNPRACTICED COGNITIVE TEST

Teresa Hawkes[1], Adam Strang[1], Ed Downs[2], Mark Derisso[1], Erica Johnson[1], Major Steven Rau[1], Molly Fischer[1], Edward Eveland[1]; [1]Air Force Research Laboratory, [2]ProTerf — Exercise training enhances cognitive performance. Would exercise combined with explicit cognitive training better enhance cognitive performance compared to exercise training alone? A recent study at the Air Force Research Laboratory combined functional agility exercise training with explicit working memory and decision-making training, and evaluated its effect on performance in the unpracticed cognitive portion of a simulated battlefield obstacle course compared to traditional Air Force physical training (AFPT). We predicted the experimental group's cognitive performance would be significantly better than AFPT controls. Forty active duty Airmen (19 – 40 y) were tested in a pilot simulated battlefield obstacle course (training, n=27, controls, n=13). Prior to this test, experimental group participants underwent 8 weeks of agility-based physical training. Explicit cognitive training was included in every exercise session. The control group was instructed to complete their normal Air Force PT and report on their training activities every week for eight weeks. A battery of physiological and anthropometric tests administered pre-training indicated the two groups were statistically similar in physiological capacity. The experimental group out-performed controls on VO2max post-training. Performance in the battlefield obstacle course indicated both groups performed similarly on the physiological components, but the experimental group significantly outperformed AFPT participants on unpracticed cognitive tasks. Critically, unpracticed cognitive tests were performed at physical exhaustion. This suggests exercise training which includes explicit cognitive training may better enhance cognitive performance post-training compared to exercise training alone. This cognitive training may transfer to similar, unpracticed cognitive tasks, even at exhaustion.

C65

DELAY-PERIOD STIMULATION OF OCCIPITAL CORTEX IMPAIRS WORKING MEMORY MAINTENANCE

Amanda E. van Lamsweerde[1], Jeffrey S. Johnson[1]; [1]North Dakota State University — Recent evidence demonstrates that simple features of remembered stimuli can be decoded from patterns of activity in the occipital cortex during working memory (WM) maintenance and that classifier sensitivity is correlated with the precision of representations, but not capacity (Emrich et al., 2013). This suggests that visual cortex activity during maintenance may determine the precision of WM representations. In an earlier experiment, we tested this hypothesis by administering trains of 20 Hz rTMS to phosphene-localized visual cortex during working memory encoding or maintenance. Participants remembered three colors in the hemifield contralateral or ipsilateral to stimulation; TMS-related declines in performance were found at encoding (0ms after stimulus offset) and maintenance (500ms after stimulus offset). Contrary to our expectations, however, the decrease in performance was specific to the probability of guessing and not the precision of WM representations. However, it is possible that this task failed to capture changes in precision; between-subject performance was highly variable and effects on guess rate may be more likely when capacity limits are exceeded. To address this concern, in a second experiment, participants remembered the orientation of a single gabor patch over a two-second delay; rTMS was administered to occipital cortex either at low (45% of phosphene threshold) or high (100% of phosphene threshold) stimulation intensity, either 50 or 900ms after memory display offset. Results indicate that high-intensity TMS disrupted the precision of WM maintenance. Thus, these data are consistent with the prediction that visual cortex activity during maintenance affects the precision of WM representations.

C66

ECHOES OF CONCUSSION: CHRONIC EFFECTS ON VISUAL WORKING MEMORY.

Hector Arciniega[1], Dwight Peterson[2], Marian Berryhill[1]; [1]University of Nevada, Reno, [2]University of Missouri — Visual working memory (VWM) is essential for maintaining a coherent visual experience across interruptions such as eye movements. Importantly, VWM can be damaged by unforeseen circumstances such as neurodegenerative disorders, cerebrovascular accident, and traumatic brain injury (TBI). The most common form is mild TBI (mTBI), or concussion, is typically associated with a brief recovery period of several weeks to normal physical and cognitive function. However, this is largely an assumption. Here, we investigated the consequences of having a history of mTBI (3 months – 20 years prior) on VWM performance. In two different populations we found the same pattern of behavioral and EEG results. Behaviorally, in both a community sample (N = 43, mean age: 37.95) and in current undergraduates (N = 20, mean age: 21.05), those with a history of mTBI were significantly impaired at maintaining even a single item over a 1-second delay compared to age-matched controls. We calculated the contralateral delay activity (CDA), a slow potential showing increased amplitude with set size, to measure neural correlates associated with VWM maintenance and found the mTBI group had higher CDA amplitudes at set size 3 compared to controls. One interpretation is that the mTBI group expends greater effort in VWM maintenance compared to controls. These data point towards lasting cognitive consequences following mTBI and the importance of cognitive assessment in this population.

C67

WORKING MEMORY-BASED ACTION CONTROL: AN INTERFERENCE PARADIGM FOR NEUROIMAGING

Sabrina Bhangal[1], Andrew C. Garcia[2], Anthony G. Velasquez[1], Mark W. Geisler[1], Ezequiel Morsella[1,3]; [1]San Francisco State University, [2]University of Delaware, [3]University of California, San Francisco — Representations held in working memory can result in interference resembling that of distractors in response interference paradigms

such as the classic flanker task (Eriksen & Eriksen, 1974; Hubbard et al., 2013). We developed a paradigm in which participants (n = 16) pressed certain buttons in response to certain visual stimuli (letters). At the beginning of each trial, participants were presented with a letter pair (the memoranda), with one letter presented over the other and with the two letters separated by a horizontal bar. Participants held the letter pair in mind over a delay (4 s). Afterward, participants were presented with only one of the two letters (the Letter Cueing condition). In the Congruent condition, participants responded to this letter; in the Incongruent condition, participants responded to the other letter of the pair, which was not presented visually but held in memory. In a separate, Spatial Cueing condition, a non-letter cue (a dot) replaced the letter stimuli and was presented either above or below the horizontal bar, indicating the correct response. In the Congruent condition, participants responded to the corresponding letter; in the Incongruent condition, participants responded to the other (un-cued) letter. Response latencies were longer for Spatial Cueing than Letter Cueing $F(1,15) = 10.95$, $p < .01$. In the Spatial Cueing condition, latencies in the Incongruent condition were longer than in the Congruent condition $t(15) = 3.52$, $p < .01$. This paradigm is amenable to neuroimaging techniques that can elucidate the neural aspects of working memory-based action control.

C68

A NEURAL INVESTIGATION OF TEMPORAL DURATION COMPRESSION ACROSS BOUNDARIES

Brynn Sherman[1], Sarah DuBrow[1], Lila Davachi[1]; [1]New York University — The continuous stream of cognitive and perceptual inputs can be parsed into discrete events at boundaries or contextual changes between events (Zacks et al., 2007). Boundaries have been shown to decrease access to representations occurring just before the boundary, and, in the memory literature, this results in the expansion of perceived time across boundaries (Poynter, 1983; Ezzyat & Davachi, 2014). However, at a shorter time scale, perceived time has been shown to be compressed across segmented, as opposed to continuous, events (Liverence & Scholl, 2012). To investigate what neural processes underlie this opposite behavioral effect in perceptual temporal estimation, we developed a simplified task for fMRI scanning in which subjects view a colored square for a duration between 2 and 8 seconds and judge its duration after a variable short delay (2-6s). Critically, on 'boundary' trials, the square changed colors halfway through the interval. Participants were instructed to estimate the total time the square appeared on the screen regardless of color. In an initial behavioral study (N = 18), we found that participants rated boundary trials as significantly shorter than non-boundary trials. In a preliminary fMRI data set (N = 5), we replicated this boundary compression effect and found a network of regions including precuneus and lateral PFC that were more active during boundary compared to nonboundary trials. Furthermore, retrieval of longer versus shorter duration trials engaged lateral and medial PFC. Future analyses will examine neural activity related to temporal compression both during the encoding interval and specifically at boundaries.

C69

HIGHWAY TO (VERBAL) MEMORY: NEUROCOMPUTATIONAL CONSEQUENCES OF SPECIFICALLY HUMAN CONNECTIVITY IN PERISYLVIAN CORTEX

Malte R Schomers[1,2], Max Garagnani[1,3], Friedemann Pulvermüller[1,2]; [1]Brain Language Laboratory, Freie Universität Berlin, Germany, [2]Berlin School of Mind and Brain, Humboldt-Universität zu Berlin, Germany, [3]Centre for Robotics and Neural Systems, University of Plymouth, UK — Rich long-distance connectivity in the fronto-temporal perisylvian language areas by way of the dorsal arcuate fasciculus (AF) sets apart humans from other primates and appears to be crucial for verbal memory and thus word learning abilities in humans. But how come that a stronger AF entails better working memory and word learning? To investigate this, we used a neurophysiologically plausible computational model implementing Hebbian learning mechanisms (cf. Garagnani et al. 2008) to simulate major regions and relevant neuroanatomical connections of superior-temporal and inferior-frontal cortex. We compared models with links documented in macaques (monkey model, MM) vs. those plus additional ones of the AF recently reported in humans specifically (human model, HM). The models were presented with spoken 'words' coded as concurrent neural activity patterns in auditory and motor cortex. 24 randomly initiated networks (12 of each type), were trained with 14 'words' each and evaluated. Compared with the MM, HM models developed larger circuits with especially high circuit cell densities in the higher-association areas. Crucially, long-lasting memory activity was only seen in the HM circuits, whereas MM circuits lost their activation rapidly, thus giving little evidence of verbal memory processes. These functional differences did not depend on the amount of learning or other potentially relevant parameters. In summary, we show that the specific anatomical features of human cortex, especially the stronger connectivity within central perisylvian areas implicated by the human AF, contribute to better learning of spoken word forms and may explain the specifically human ability of verbal working memory.

C70

NEURAL MECHANISMS FOR THE BENEFITS OF STIMULUS-DRIVEN ATTENTION

Katelyn Wills[1], Jingtai Liu[1], Jonathan Hakun[2], David Zhu[1], Eliot Hazeltine[3], Susan Ravizza[1]; [1]Michigan State University, [2]Pennsylvania State University, [3]University of Iowa — It is well established that top-down control of attention benefits working memory. However, the role of bottom-up or stimulus-driven control of attention is less established. Oftentimes, the control of attention involves both top-down and bottom-up factors. For example, in contingent capture, top-down attention determines what is behaviorally relevant, and stimuli sharing those features can guide attention automatically. While this effect is typically disruptive to working memory (i.e. when peripheral distractors share features with a target), recent evidence suggests that stimulus-driven attention may benefit working memory when it is drawn to relevant information. Using a modified contingent capture paradigm developed by Ravizza and Hazeltine (2013), we replicated the behavioral finding that letters sharing a feature with a target in a secondary detection task were remembered better than letters of other colors. Regions in the right SPL and the left parietal operculum showed increased activity and suppression, respectively, for target versus control colored letters. A trial-by-error regression revealed that increased activity in the parietal operculum at retrieval predicted behavioral errors only in the salient letter condition, and a beta series correlation analysis revealed increased functional connectivity between our ROIs and dorsal frontoparietal regions during the encoding of salient relative to control colored letters. We conclude based on these results that the benefits to working memory from the addition of stimulus-driven attention factors to relevant information results from an enhancement of top-down rather than bottom-up aspects of the contingent capture paradigm.

LANGUAGE: Development & aging

C71

CEREBELLAR CONNECTIVITY AND GLUTAMATERGIC METABOLITE CONCENTRATION IN ASD AS ASSESSED BY FCMRI/MRS

David Beversdorf[1], Dylan Weber[1], John Hegarty II[1,2]; [1]University of Missouri, [2]Stanford University — Cerebellar pathology is observed in ASD, and atypical cortico-cerebellar functional connectivity is also seen, as well as an atypical excitatory-to-inhibitory (E/I) balance, with an imbalance between glutamate and GABA observed in brain regions including the cerebellum. We examined the relationship between E/I balance using magnetic resonance spectroscopy (MRS) and functional integrity of cerebrocerebellar connections in ASD for language-associated cerebellar regions and their cortical projections. Twelve adults with ASD and 12 individually matched controls participated. Social communication (SRS), maladaptive behaviors (ABC), and language competence (TLC) were assessed. MRI was performed at 3T and BOLD sequences were collected at rest. Functional connectivity (FC) analyses were performed with conservative motion correction. Single voxel spectroscopy spin-echo sequences were used to detect glutamate, and J-coupling edited sequences were used to detect GABA. Voxels were localized in each participant in the right postereolateral cerebellar hemisphere junction of crus I&II (RCere) and the left dorsolateral prefrontal cortex (LDLPFC). Metabolite levels were quantified with LCModel. ASD participants were impaired on the SRS, ABC, and TLC. Within the ASD group, LDLPFC-RCere connectivity was associated with listening comprehension ($r=0.588$, $p=0.027$). RCere-LFLPFC FC was significantly associated with RCere E/I, regardless of diagnosis. Literature varies regarding FC and MRS of glutamate and GABA in ASD. Our data suggests connectivity and pharmacopathology may be interrelated in ASD. Furthermore, this may

relate to behavior. Future studies will need to explore whether these might serve as markers for or predictors of response to pharmacological agents targeting E/I balance in ASD.

C72

NEURAL RESPONSES TO VOWEL STIMULI IN MONOLINGUAL AND BILINGUAL 3-TO 46-MONTH-OLD CHILDREN

Valerie Shafer[1], Yan Yu[2], Monica Wagner[2]; [1]The Graduate Center, CUNY, [2]St. John's University — Evidence has shown that language experience influences speech sound processing early in life at a behavioral level and at the neural level reflecting discrimination (influencing infant event-related potential (ERP), mismatch responses, MMRs). It is less clear how language experience modifies neural encoding; speech experience may influence early stages of encoding at the cortical level. Alternatively, cortical encoding may reflect acoustic properties of the signal. The current study used ERPs to examine whether there was evidence that experience with English vowels influenced temporal site measures (Na, Ta, Tb) in three- to 46- month old children with monolingual or bilingual Spanish-English experience. We had predicted that encoding, unlike discrimination, would be similar for the two groups. Data from 50 bilingual children and 49 monolingual children were analyzed. The results revealed a different pattern of maturation for bilingual compared to monolingual children. Latencies of the most prominent peak (Na) were delayed for bilingual compared to monolingual participants for the children under 12 months of age. However, the amplitude of the Na peak was also more negative, particularly at the left temporal site (T7). The older groups were more similar, but the bilingual children showed less asymmetry, again due to increased amplitude of the Na at the left site. Ta and Tb were identifiable in less than 2/3 of the children. These findings may indicate differences in encoding speech information or they may be related to differences in how bilingual and monolingual children attend to the stimuli.

C73

HIGH GAMMA POWER IN LEFT AUDITORY CORTEX AT 12 MONTHS-OF-AGE REFLECTS MAPPING OF NATIVE PHONEMES VARYING IN VOICE ONSET TIME (VOT)

Silvia Ortiz-Mantilla[1], Jarmo A. Hämäläinen[1,2], Teresa Realpe-Bonilla[1], Sree Rajendran[1], April A. Benasich[1]; [1]Rutgers, The State University of New Jersey, USA, [2]University of Jyväskylä, Finland — Across development, infants gradually move from an acoustic mode of processing incoming speech, to automatized processing of their native language as specific phonemic representations are constructed within acoustic cortex. Intracranial recordings in human postero-lateral Superior Temporal Gyrus indicate that VOT is tracked by high gamma power. Over development, perceptual narrowing promotes increasingly language-specific neural mapping, thus favoring native over non-native language processing. To explore oscillatory mechanisms underlying phonemic mapping, children born into English monolingual families, followed longitudinally at 6-, 12-, and 24-months, were presented with native and non-native syllables differing in VOT. Dense-array EEG/ERPs were mapped into age-appropriate brain templates; source modeling placed dipoles in auditory and frontal cortices. Temporal-spectral analyses were conducted in source space using 2-90Hz range over -300 to 930ms. Changes in frequency amplitude (power), and consistency of phase alignment were evaluated using temporal spectral evolution and inter-trial phase locking. Larger theta power and phase coherence were found at younger compared to older ages with larger power in left compared to right auditory sources. Native syllables elicited a high gamma response in frontal and left auditory sources at 12-months but not at 6-months-of-age. Our results suggest that as phonemic mapping progresses across age, processing of native information becomes faster and more efficient. Increases in processing speed are reflected in the shorter, more precise phase coherence seen in the theta range. The higher gamma power seen in left auditory cortex may signal representation of VOT, whereas frontal areas might be capturing attentional responses triggered by increasing native specialization.

C74

DEVELOPMENT OF NEURAL PROCESSES UNDERLYING LANGUAGE SUBSYSTEMS IN YOUNG CHILDREN FROM HIGHER AND LOWER SOCIOECONOMIC STATUS ENVIRONMENTS

Amanda Hampton Wray[1], Eric Pakulak[2], Yoshiko Yamada[2], Christine Weber[3], Helen Neville[2]; [1]Michigan State University, [2]University of Oregon, [3]Purdue University — Throughout preschool years, rapid development of language skills is accompanied by significant changes in neurodevelopment. Language input during development varies as a function of socioeconomic status (SES) in numerous ways, including the amount and type of language and the amount of child-directed speech (e.g., Hoff, 2013; Fernald et al., 2013). These differences, along with other factors, have been shown to contribute to reduced language abilities in children from lower SES environments. The present study extends the existing literature by evaluating longitudinal changes in neural processes underlying specific language subsystems in preschool-aged children as a function of SES. Typically developing children from higher and lower SES environments completed testing at age four and again at age five. Event-related potentials (ERPs) were acquired using an ecologically valid narrative cartoon overlaid with auditory sentences containing semantic and phrase-structure constraints. Results suggested more rapid maturation of neural processes underlying semantics and syntax in children from higher compared to lower SES backgrounds. While semantic anomalies elicited an N400 in both groups at age four, at age five, only children from higher SES households exhibited a biphasic N400/late positive component (LPC) pattern. Phrase structure violations elicited a negativity for both groups at age four, though at age five the higher SES group exhibited a P600, while the lower SES group continued to exhibit a broad negativity. These findings reveal differentiated developmental time courses for language processing in children from higher versus lower SES environments, which may inform interventions aimed at improving language abilities in at-risk children.

C75

LONGITUDINAL STUDY OF THE EMERGING LATERALIZATION OF THE LANGUAGE NETWORK DURING INFANCY

Robert Emerson[1], Wei Gao[2], Weili Lin[1]; [1]University of North Carolina at Chapel Hill, [2]Cedars-Sinai Medical Center, Los Angeles, CA — Strong left hemispheric asymmetry is a striking characteristic of the cerebral regions involved in the adult language network. Studies with adults have shown that stronger lateralization is associated with higher scores on tests of verbal ability; however, it is currently unclear how lateralization develops. In this study, we leverage a large sample of normally developing infants with multiple longitudinal rsfMRI scans to delineate the trajectory of language area lateralization in the first two years of life. We compared the trajectory of functional symmetry of the two hemispheres between language-related regions to regions that show high symmetry in adulthood, namely, sensory and visual cortices. Longitudinal models revealed a best fit with quadratic age terms and showed significant estimated coefficients of determination for both Wernicke's (R-squared=.261, p<.001) and Broca's (R-squared=.142, p<.001) regions. These inverse-U shaped functions peaked at approximately 11.5 months of age, indicating that the transition toward lateralization began in the second year. The shift toward lateralization was accompanied by an increase in the functional connectivity of these regions within the left hemisphere. Finally, we detected a significant association between the lateralization process of the Broca's area and language outcomes at 4 years of age (chi-squared=10.986, p=.011). Our results capture the developmental timeline of the language system's lateralization during infancy. More generally, our findings suggest that increasing functional symmetry in the first year might be a fundamental principal of the developing brain, governing different functional systems, including those that will eventually become lateralized in adulthood.

C76

EEG EVIDENCE FOR THE ABSENCE OF AUDIOVISUAL INTEGRATION IN APRAXIA OF SPEECH

Melissa Randazzo[1], Karen Froud[1]; [1]Teachers College, Columbia University — Speech perception is a unique audiovisual experience in part because timing of the speech signal is influenced by simultaneous overlapping gestures in coarticulation. Apraxia of speech (AOS) is a motor-planning disorder that impairs coarticulation. Imaging studies show that brain regions damaged in AOS are critical to audiovisual speech perception. Although AOS is a motor-planning disorder, individuals with AOS may have a disruption to the perceptual system for coarticulatory gestures. To evaluate this hypothesis we investigated audiovisual MMN responses in adults with damage to Broca's area (mild-moderate AOS, borderline-mild aphasia) compared to healthy age-matched

controls. We utilized the McGurk effect, in which incongruent auditory and visual information alters perception. Participants viewed videos of a speaker articulating the syllable /ba/ (standard) for 80% trials and /ga/ (deviant) 20% of the trials while the auditory stimulus /ba/ was consistent throughout. Responses to the audiovisual condition were compared to an identical visual-only condition without sound to control for evoked activity from change in visual stimulus. MMN was derived from high-density EEG recordings by averaging and subtraction of standard responses from deviant responses. The control group demonstrated MMNs to McGurk deviants in the audiovisual condition, indicating integration of audiovisual speech input, while the AOS group did not. Neither group showed an MMN to the visual-only condition, indicating that for controls, MMN activity was due to integration, not visual perceptual processes. We propose that these preliminary findings are consistent with a view that AOS is a disorder beyond motor planning, impacting higher-level cognitive and linguistic skills.

C77

DECONSTRUCTING THE LEXICALITY EFFECT ON N400 TO INVESTIGATE THE ACQUISITION OF ORTHOGRAPHIC RULES IN NORMAL DEVELOPING CHILDREN

Yu-Lin Tzeng[1], Chun-Hsien Hsu[2], Chia-Ying Lee[2]; [1]Institute of Neuroscience, National Yang-Ming University, Taiwan, [2]Institute of Linguistics, Academia Sinica, Taiwan — The lexicality effect on N400 has been used to index readers' ability of retrieving lexical representation. By using real character (RC), pseudo-character (PS) and non-character (NC), previous studies have found that reading ability shapes the pattern and topographic distribution of lexicality effects on N400. Adult and high reading ability children showed lexicality effects (PS>RC>NC) on central-posterior sites, while low reading ability children showed reversed lexicality effects (NC>PS>RC) in frontal-to-central sites. To investigate individual differences in reading development, this study examines lexicality effects on N400 of 53 Chinese children aged 8-12 years. Correlation analyses were performed based on scores of the Chinese Character Recognition Test (CCRT) and Digit Span Test and N400, which was decomposed into two frequency bands (1-3 Hz & 3–6 Hz). The data revealed significant positive correlations for the CCRT with lexicality effect (NC-RC) on both higher (max r=.42 at FZ) and lower frequency bands (Max r=.46 at C3). Children with high reading ability tend to reveal greater N400 to RC than to NC in the central-posterior sites. For the digit span, significant positive correlations were only found in frontal sites for high frequency band (Max r =.34 at FC3). Children with low digit span score tend to show greater N400 to NC than to PS. These findings support that N400 reflects two mechanisms, including directly accessing the stored lexical representation in the posterior regions, and effortful functions of selection and integration in the frontal regions.

C78

DISTINCT NEURAL ALTERATIONS OF HETEROGENEOUS DYSLEXIA RISK PROFILES

Ola Ozernov-Palchik[1,2], Meaghan Mauer[1], Elizabeth S Norton[3], Georgios Sideridis[1,5], Sara Beach[4,5], Maryanne Wolf[2], John D. E. Gabrieli[5], Nadine Gaab[1,5]; [1]Boston Children's Hospital, [2]Tufts University, [3]Northwestern University, [4]Massachusetts Institute of Technology, [5]Harvard University — The strongest pre-literacy predictors of dyslexia are rapid automatized naming (RAN), phonological awareness (PA), letter-sound knowledge (LSK), and working memory (WM). Studies in adults and school-age children demonstrated distinct cognitive and neural profiles of dyslexia subtypes. It remains unclear whether these subtypes emerge prior to reading instruction and whether they are associated with subtype-specific structural brain differences. A latent profile analysis was used to identify distinct patterns of performance on PA, RAN, WM, LSK, and IQ in 1,215 kindergarten and pre-kindergarten students from diverse backgrounds in New England. Six distinct profiles of performance emerged: average, high, LSK risk, PA risk, RAN risk, and multiple-risks. Alterations in gray matter volume were investigated in the four risk groups as compared to the average performers in a subset of participants (N=102). Compared to the average group, risk was associated with significantly reduced grey matter volume indices in the LSK group in the bilateral temporal-parietal regions, in the multiple-risks group in the right inferior temporal/hippocampal regions and precuneus, in the RAN group in the right middle-temporal regions, and in the PA group in the right inferior temporal/fusiform region and posterior parietal regions. These findings suggest that different subtypes of dyslexia risk profiles are associated with distinct neuroanatomical regions of the reading network in early kindergarten and highlight the heterogeneity of cognitive and neuroanatomical etiology of dyslexia.

LANGUAGE: Other

C79

THE EFFECTS OF GESTURE FREQUENCY ON DISCOURSE PRODUCTION IN ANOMIC APHASIA

Theodore Jenkins[1], Marie Coppola[1], Carl Coelho[1]; [1]University of Connecticut — Hand gestures are an ancillary and communicative modality that frequently adds visual information to a spoken utterance. Additionally, gesture has been shown to facilitative cognitive and linguistic processing, for example, in lexical retrieval. Individuals with aphasia often demonstrate increased gesture frequency, which has been characterized as a response to difficulties with lexical retrieval. However, if active hand gestures can facilitate lexical retrieval, could this indirectly affect the amount of cognitive resources available for sentential complexity and discourse organization? In a preliminary study of individuals with anomic aphasia, we examined whether gesture frequency had any affect on discourse production and organization. Using video data from an online database (AphasiaBank), we coded 41 anomic narratives for hand gestures, sentential complexity (i.e. number of subordinated clauses), and discourse organization (i.e. story grammar). Separating the participants into gesture frequency groups (Low, n=14; Mid, n=13; and High n=14), we conducted a one-way ANOVA on the discourse scores across gesture groups. Results indicated significant differences for increased story length (p=.000), complexity (p=.014), and organization (p=.001) in the high gesture group compared to the low gesture group. These findings suggest that frequent gesture in anomic aphasia may serve as a heuristic for language planning for discourse production.

C80

ENTRAINMENT OF LOW-FREQUENCY BRAIN OSCILLATIONS TO SPEAKING LIPS DURING CONTINUOUS AUDIOVISUAL SPEECH

Hyojin Park[1], Christoph Kayser[1], Gregor Thut[1], Joachim Gross[1]; [1]University of Glasgow — During continuous audiovisual speech, mouth movements contain rhythmic components that facilitate auditory speech processing. Here we investigated for the first time directly how these rhythms interact with neuronal oscillations in the brain. We recorded magnetoencephalography (MEG) signals from 44 participants while attending to movies of audiovisual speech. Auditory and visual stimuli were manipulated to be congruent or incongruent. We extracted time series characterizing mouth movements from the video and looked for common rhythmic modulations in mouth movements and recorded brain activity using coherence. Further, we identified its attentional modulation and effects on the speech comprehension. First, we report that the rhythms of mouth movements in natural speech entrain brain activity in speech processing areas, both sensory and higher-order regions. Second, attentional lip-reading showed left-lateralized visual and right-lateralized auditory entrainment. Third, considering the coherent nature of lip-sound speech signals, we partialled out the effect of sound speech signal in the observation of lip entrainment to examine the main effect of speaking lips. This revealed that left motor cortex is important for the tracking of lip movements suggesting the functional role of visual speech in top-down predictive timing. Finally, we revealed that tracking of speaking lips in motor cortex is critical for the high level of speech comprehension. Our results provide the first direct evidence that speaking lips entrain low-frequency brain oscillations in speech processing areas with a prominent engagement of left motor cortex. This likely represents an important mechanism for the optimal sampling and integration of sensory information across sensory modalities.

C81

N400 EVIDENCE FOR MUSICAL FACILITATION OF WORD BOUNDARY IDENTIFICATION IN SECOND LANGUAGE EXPOSURE

Dayna Moya Sepulveda[1], Josephine Ancelle[2], Karen Froud[3]; [1]Teachers College - Columbia University, [2]Teachers College - Columbia University, [3]Teachers College - Columbia University — Second language acquisition requires the ability to

identify word boundaries in a continuous auditory speech stream. This task is made more complex when incorporating a new phonemic system. Previous studies have shown that word boundary identification can be enhanced by pairing musical notes with native language phonemes. The objective of this study is to investigate whether musical tones also have this effect in a new pseudo-language, using non-native speech sounds. The N400, which has been reported to index familiarity and statistical regularities in pseudowords, provides an outcome measure in response to a lexical decision task. We presented typically developed English monolingual adults with language-like stimuli incorporating French phonemes. Participants were exposed to one of two conditions for 14 minutes: monotone presentation of the concatenated language-like stimuli; or the same speech stream with a musical tone associated with each syllable. The training protocol was based on Schön (2008), with an extended exposure time. Training was followed by a lexical decision task, requiring participants to distinguish "words" (heard during the training in a concatenated speech stream) from "part words" (end of one word and the beginning of another, crossing word boundaries). High density EEG was recorded during lexical decision. N400 responses suggest that both groups were able to distinguish words from part words, but the group who heard musical tones associated with the training syllables elicited a larger negativity in response to part words. These results suggest that musical tones might facilitate the identification of word boundaries in second language learning.

C82

DEVELOPMENT OF TRACT-SPECIFIC WHITE MATTER PATHWAYS DURING EARLY READING DEVELOPMENT IN CHILDREN AT FAMILIAL RISK FOR DYSLEXIA

Yingying Wang[1,2], Meaghan Mauer[1], Talia Raney[1], Barbara Peysakhovich[1], Bryce Becker[1], Danielle Sliva[1], Nadine Gaab[1,2,3]; [1]Division of Developmental Medicine, Boston Children's Hospital, Boston, MA 02115, [2]Harvard Medical School, Boston, MA 02115, [3]Harvard Graduate School of Education, Cambridge, MA 02138 — Developmental dyslexia is a neurodevelopmental disorder with a strong genetic basis. Previous studies observed white matter alterations in left posterior brain regions in adults and school-age children with dyslexia. However, no study has examined the development of tract-specific white matter pathways from the pre-reading to the fluent reading stage in children at familial risk for dyslexia (FHD+) versus controls (FHD-). This study examined white matter integrity at three reading stages (pre-reading, beginning, and fluent reading) cross-sectionally (n=78) and longitudinally (n=45) using an automated fiber-tract quantification method. Our findings depicted white matter alterations and atypical lateralization of the arcuate fasciculus at the pre-reading stage in FHD+ versus FHD- children. Moreover, we demonstrated faster white matter development in subsequent good versus poor readers and a positive association between white matter maturation and reading development using a longitudinal design. Additionally, the combination of white matter maturation, familial risk and psychometric measures best predicted later reading abilities. Furthermore, within FHD+ children, subsequent good readers exhibited faster white matter development in the right superior longitudinal fasciculus compared to subsequent poor readers, suggesting a compensatory mechanism. Overall, our findings highlight the importance of white matter pathway maturation in the development of typical and atypical reading skills.

C83

HOW SWITCHING DIRECTION AND FOREIGN ACCENTED SPEECH AFFECT LISTENING TO CODE-SWITCHED SENTENCES: AN ELECTROPHYSIOLOGICAL STUDY

Carla Fernandez[1], Janet G. van Hell[1]; [1]Pennsylvania State University — Code-switching, the interchangeable use of two languages within an utterance, is a hallmark of bilingualism. Although natural code-switching occurs more frequently in spoken than written communication, most studies on the comprehension of code-switched utterances presented sentences visually. In two Event-Related Potentials (ERP) studies, we investigated the auditory processing of code-switched sentences to examine the extent to which visual and auditory processing differ from one another and to identify the effects of accented speech on processing costs. In Experiment 1, Spanish-English bilinguals listened to code-switched sentences (switching from their dominant (L1) to weaker language (L2) or vice-versa) or non-switched sentences. We observed an LPC effect when switching from L1 to L2, while switching from L2 to L1 yielded a N400 effect, suggesting that switching into L2 impacts sentence-level restructuring and integration, and switching into L1 affects lexical-semantic integration processes. In Experiment 2, the code-switched sentences were spoken by Spanish-English bilinguals with a Spanish accent, to examine how foreign accented speech modulates switching costs. Overall, code-switched sentences elicited an enlarged N400 effect in the presence of an accent. Spanish dominant participants showed an increased N400 in both switching directions whereas English dominant participants showed an attenuated N400 when switching from L2 to L1 and an attenuated LPC effect when switching from L1 to L2. These findings indicate that listening to code-switched sentences in an accented condition entail different cognitive mechanisms than in a non-accented condition. The effects of accented speech on switching costs are dependent on switching direction and language dominance.

C84

THE NEURAL BASIS OF PERCEIVING SPEECH WITH A NON-NATIVE RHYTHM.

Kyle Jasmin[1], Sadao Hiroya[2], Samuel Evans[1], Saloni Krishnan[3], Cesar Lima[1], Marcus Ostarek[1], Dana Boebinger[4], Sophie K. Scott[1]; [1]UCL, [2]NTT, [3]Oxford, [4]Harvard — Rhythm is a natural part of speech. We normally understand spoken sentences in our native language's rhythm without effort. Speech perception studies have typically taken rhythm for granted, and we therefore know little about how rhythmic information affects activity in the speech perception network. We developed a novel method for decomposing speech signals in order to separate phonetic information from rhythmic structure. Audio recordings of English sentences spoken by a Japanese native speaker were manipulated such that their rhythm was stress timed (like English), mora timed (like Japanese) or had phonemes with equal durations. Noise-vocoding was used to minimize contributions of F0 and to control intelligibility across conditions. Spectral rotation was also used to create unintelligible control conditions. Twenty-one healthy right-handed participants underwent behavioural testing and fMRI scans. In behavioural testing, native English participants judged the naturalness of speaking rhythm of the sentences. Results confirmed subjects judged English sentences as being most natural. FMRI was used to image the brains of participants while they listened to the sentences. Result showed that supplementary motor area (SMA), a region involved in speech production, was sensitive to rhythm naturalness. This suggests that integrating non-native speech rhythm with native language speech may rely on increased auditory-motor processing.

OTHER

C85

FUNCTIONAL CONNECTIVITY PREDICTS "VISUAL" CORTEX PLASTICITY IN CONGENITAL BLINDNESS

Shipra Kanjlia[1], Connor Lane[1], Lisa Feigenson[1], Marina Bedny[1]; [1]Johns Hopkins University — How does input as opposed to intrinsic physiology determine cortical function? In blindness, "visual" cortices are recruited for non-visual functions, including language and numerical processing (e.g. Bedny et al., 2011, PNAS; Lane et al., 2015, JoN; Kanjlia et al., in-prep). We asked whether functional connectivity of visual cortex to non-occipital networks predicts functional plasticity within visual cortex. While undergoing fMRI, congenitally blind (n=17) and sighted adults (n=19) performed a math task and a language comprehension task. In the math task, participants judged whether the value of an unknown variable was the same across two equations (e.g. 7-2=x, 8-3=x). In the language task, participants answered yes/no questions about sentences. A subset of these blind (n=13) and sighted (n=9) adults completed a resting state scan. In blind individuals, separate regions of visual cortex responded to math and language tasks (Lane et al., 2015, JoN; Kanjlia et al, in-prep). Crucially, we find that this functional dissociation is predicted by functional connectivity. Activity in math-responsive visual cortex was more correlated with activity in math-responsive prefrontal cortex (PFC) than language-responsive PFC. The reverse was true for language-responsive visual cortex (seed-by-ROI interaction: $F(1,12)=25.22$, $p<0.001$). This dissociation was specific to the blind group (seed-by-ROI-by-group interaction: $F(1,20)=4.80$, $p=0.04$). Math- and language-responsive sub-regions within primary visual cortex, V1, exhibited the same dissociation pattern

(seed-by-ROI interaction: F(1,12)=13.90, p=0.003, seed-by-ROI-by-group interaction: F(1,20)=3.98, p=0.06). Thus, functional reorganization of deaf-frented visual cortex is predicted by functional connectivity. These results suggest that input plays a key role in determining cortical function.

LANGUAGE: Other

C86

A BEHAVIORAL AND FMRI EXAMINATION OF RHYTHMIC PRIMING ON SPEECH PRODUCTION

Layla Gould[1], Marla Mickleborough[1], Chelsea Ekstrand[1], Eric Lorentz[1], Ron Borowsky[1]; [1]University of Saskatchewan — Both speech and music perception/production involve sequences of rhythmic events that unfold over time. The presence of rhythm in both processes has motivated researchers to consider whether musical and speech rhythm engage shared neural regions (Patel, 2008), and whether musical rhythm can influence speech processing (Cason & Schön, 2012). The aim of these experiments was to explore the connection between rhythm and reading by examining whether reading aloud is affected by the presentation of a rhythmic prime that was either congruent or incongruent with the syllabic stress of the target letter string. We employed a new paradigm (Gould et al., 2015) in which target words have stress on the first syllable for nouns, and on the second syllable for verbs. Thus, our design used identical noun-verb word pairs (CONflict vs. conFLICT), as well as their corresponding pseudohomophones (KONflikt vs. konFLIKT). The results demonstrated that reaction times were faster when the rhythmic prime was congruent with the syllabic stress, and slower when the rhythmic prime was incongruent. The functional magnetic resonance imaging (fMRI) experiment aimed to identify the brain networks that underlie the priming effect of rhythm on speech, and particularly the putamen's involvement given recent research suggesting its role in phonetic decoding. We conclude that a rhythmic prime matched to the syllabic stress of a letterstring aids reading processes, and that a network involving the putamen and other regions is involved. These findings have implications for developing neurobiological models of reading, and may have clinical applications (e.g., Parkinson's disease).

C87

EXAMINING NARRATIVE DISCOURSE DEFICITS IN TBI USING COH-METRIX

Andre Lindsey[1], Carl Coelho[1], Frank Krueger[2], Jordan Grafman[3]; [1]The University of Connecticut, [2]George Mason University, [3]The Rehabilitation Institute of Chicago — Narrative discourse is a multifaceted process requiring active retrieval of stored information paired with coordinated linguistic output in which the speaker is actively accounting for the knowledge of the listener. Macrolinguistic discourse deficits are common sequela of traumatic brain injury (TBI) and are associated with memory and executive function impairments. Individuals with TBIs often produce narratives that lack critical story components and have reduced episode structure. Changes to language output following TBI reflect alterations to the neural system's ability to organize and efficiently produce pertinent content. 171 veterans of the Vietnam War (126 TBI) participated in a battery of neuropsychological testing and discourse analyses. Participants were asked to retell a wordless picture story immediately after viewing it and then again 30-minutes later. Utilizing Coh-Metrix, narratives were analyzed for referential cohesion, lexical diversity, and syntactic complexity. Significant within group and between group differences were observed for TBI and non-brain injured control (NBI) groups. TBI participants displayed difficulty retrieving and organizing information when immediately retelling the narrative. Following the 30-minute time delay, narratives produced by the TBI group resembled the NBI group. Discriminant function analyses (DFA) were employed to determine the accuracy of the selected measures in classifying the participants into their respective groups. Using Coh-Metrix measures of description, referential cohesion, and syntactic complexity, the DFA accurately identified 66.7% of TBI participants and 68.9% of NBI participants. These findings indicate that microlinguistic Coh-Metrix measures were not able to discriminate TBI and NBI groups as accurately as measures of story grammar and content.

C88

PHONEMIC RESTORATION IN ADULTS WITH SPECIFIC LANGUAGE IMPAIRMENT

F. Sayako Earle[1], Stephanie Del Tufo[1,2], Megan Speed[1], Emily B. Myers[1,2]; [1]University of Connecticut, [2]Haskins Laboratories — Individuals with developmental dyslexia and specific language impairment (SLI) have both been observed with deficits in identifying speech in noise (Ziegler et al., 2009; Ziegler et al., 2005). A prior investigation by Del Tufo and Myers (2014) demonstrated that adults with developmental dyslexia are less susceptible to the illusory effects of phonemic restoration (Warren, 1970) when compared to good readers. The salience of phonemic restoration is determined by the degree to which lexical information influences perception (Samuel, 1981); therefore, adults with dyslexia may be more reliant on low-level acoustic information in processing spoken language (which may account for difficulties in identifying speech in noise). In order to determine if speech perception deficits in SLI arise from similar over-reliance on bottom-up information, we extended the phonemic restoration paradigm from Del Tufo and Myers (2014) to adults with SLI and typical adults (TD). We performed a 2x3 Mixed ANOVA on performance measures (d' scores) by Group (TD and SLI) and restoration Condition (words, pseudowords, segments). Preliminary results indicate a main effect of condition (a greater illusory effect for words than isolated segments) but no main effect of Group nor interaction between Condition*Group. Therefore, those with SLI appear to restore phonemic information guided by lexical information similarly to TD adults. This may suggest that the speech perception deficits observed in SLI arise from a fundamentally different mechanism from the perceptual deficits observed in those with dyslexia.

LANGUAGE: Semantic

C89

THE EFFECTS OF DISTRACTING INFORMATION ON LANGUAGE PRODUCTION: THE NEURAL CORRELATES OF SEMANTIC INFERENCE, PHONOLOGICAL FACILITATION, AND TARGET PICTURE FREQUENCY

Avery Rizio[1], Michele Diaz[1]; [1]The Pennsylvania State University — Behavioral research indicates that naming is slowed when pictures are presented with unrelated words. This interference is exacerbated when the target and distractor are semantically related, but alleviated when they are phonologically related. Past research has explored the neural correlates of picture naming as a function of distractor type, but has yet to investigate how target characteristics may influence patterns of activation. The current study used fMRI and behavioral measures to investigate whether target frequency modulated brain activity as a function of distractor type in 20 healthy young adults. Successful picture naming with phonological distractors elicited greater activation in bilateral angular gyrus, left supramarginal gyrus, and left superior parietal lobe, compared to naming with unrelated distractors. Picture naming with semantic distractors elicited greater activation in bilateral angular gyrus and right superior and middle frontal gyri, compared to naming with unrelated distractors. Naming with phonological distractors, compared to semantic distractors, was associated with greater activation in right supramarginal gyrus, right insula, and left postcentral gyrus. Target frequency modulated activation in left paraphippocampal gyrus and middle and inferior temporal gyri, such that greater activation was associated with higher frequency targets only when semantic distractors were presented. Frequency also modulated activation in left superior temporal gyrus and orbitofrontal cortex such that greater activation was associated with lower frequency targets that appeared with a nonword distractor. All results were cluster corrected (FDR, $p<.05$). Results suggest that while higher frequency targets are associated with greater semantic interference, frequency does not affect phonological facilitation.

C90

WHEN LANGUAGE MEETS MEMORY: LANGUAGE USE MODULATES RELATIONAL SEMANTIC PROCESSING IN BILINGUALS

Eugenia Marin-Garcia[1], Pedro M. Paz-Alonso[1]; [1]Basque Center on Cognition, Brain and Language (BCBL) — Understanding the effects of the active use of a language in our everyday life on how we remember is a relevant goal in our growing bilingual world. Research evidence suggests that second language use changes the ability to access semantic representations in the native

language. However, the consequences of this effect on relational semantic processing and on episodic memory are unknown. Here, we examined the influence of language use on relational semantic processing utilizing the Deese-Roediger-McDermott (DRM) paradigm with highly proficient Spanish–Basque early bilinguals. Participants were divided in two groups based on their language use: balance bilinguals (BB), if they use both languages to the same extent; and unbalance bilinguals (UB), if they use more one of their languages. Participants studied DRM word lists that converge on a semantic theme captured in a critical word never presented in the list. The strength of semantic association among list items was manipulated (low, high). After encoding, participants performed an old/new recognition test that included studied words, critical lures, and unrelated lures. Participant underwent two experimental sessions in consecutive days that followed the same procedure, but encountering different language (Spanish or Basque) each day. BB exhibited more false memories to critical lures for high vs. low strength association lists across both languages. UB showed more false memories to critical lures only for the high strength association lists, in their less vs. more use language. These results may reflect a more active engagement in relational semantic processing for the less use language in UB.

PERCEPTION & ACTION: Other

C91

GENERALIZATION EFFECTS FOLLOWING A BRIEF TRAINING SESSION IN A VIRTUAL ENVIRONMENT

Justin Eroh[1], Omid Dehzangi[2], Nikki Shah[1], Roozbeh Jafari[1], Michael A. Kraut[3], John Hart Jr.[1]; [1]The University of Texas at Dallas, TX, [2]The University of Michigan at Dearborn, MI, [3]The Johns Hopkins Hospital, MD — Virtual environments (VE) provide multisensory interactions that mimic real-life situations and are effectively used for skill acquisition and rehabilitation. The degree to which the skills learned in VE generalize to untrained behaviors remains unknown. Our goal was to investigate whether one session of a VE task (sequentially pushing colored cubes), that provided visual and vibrotactile feedback related to performance, could promote behavioral and neurophysiological changes on an untrained behavior (response inhibition). Young adults completed either an easy, repetitive version of the VE task (N=12, mean age = 26, 3 males) or an adaptive version of the same task that forced participants to increase their performance to meet changing task demands (N=12, mean age = 23.5, 4 males). Immediately before the VE task (pre) and one day after (post), participants' EEG was recorded while completing two visual Go/Nogo tasks, which were unrelated to the VE task and required different levels of semantic processing (simple or superordinate). The simple version required distinction between a car (Go) and dog (Nogo), while the superordinate version required categorization of 200 objects to guide either execution or or inhibition of response. Both groups were significantly faster in the post-session superordinate Go/Nogo task, but the adaptive VE training group had significantly earlier and larger P300 for inhibition trials, indicating that VE training regimen we implemented affects neural circuits that are used to execute other complex tasks, with consequent generalization of improved performance in other cognitive domains.

LANGUAGE: Semantic

C92

RECALCULATING...PROCESSING WORDS, SCHEMAS, AND IMAGES OF SPATIAL DIRECTIONS

Steven Weisberg[1], Sam Trinh[1], Anjan Chatterjee[1]; [1]University of Pennsylvania — Describing spatial directions in language is difficult in part because words parse continuous angles into discrete categories. Schemas, simplified visual depictions of concepts (arrows in the case of spatial directions), provide a middle ground between words and images, maintaining the categorical nature of words, despite having a visuospatial format. Neuroimaging research on actions and prepositions has revealed distinct brain regions are engaged in processing schemas more than words and images (Amorapanth et al, 2012; Watson et al, 2014). In the present study, we investigated how images, schemas, and words are processed for spatial directions. We created 21 exemplars of seven spatial directions for words and schemas, by varying the color, font/style, and size, and images by collecting satellite images of roads. We presented stimuli serially in a continuous carryover sequence where each format (image, schema, or word) and spatial direction combination followed every other. Participants responded whether the spatial direction in the preceding trial matched the current trial. Eliminating incorrect responses (5.35%), we found an advantage for processing schemas over images $t(16) = 5.97$, $p < .001$, and words over images, $t(16) = 2.14$, $p = .048$. Additionally, the distance between the angle of the preceding trial and the angle of the current trial correlated negatively with reaction time for images, one-sample $t(16) = 3.29$, $p = .005$, but not for words or schemas (p's $> .41$). These data suggest that schemas of spatial directions are processed as quickly as words, and display response patterns consistent with categorical processing.

C93

PACE YOURSELF: INTRAINDIVIDUAL VARIABILITY IN CONTEXT USE REVEALED BY SELF-PACED EVENT-RELATED BRAIN POTENTIALS

Brennan Payne[1], Kara Federmeier[1]; [1]University of Illinois — Event-related potentials (ERPs) have revealed multiple mechanisms by which contextual constraints impact language processing, but little work has examined the trial-to-trial dynamics of context use. Recent reading time (RT) studies have revealed substantial intra-individual variability, suggesting that a reader may utilize multiple different sentence-processing strategies that wax and wane over the course of an experiment and may be obscured in averages. Such variability is overlooked in ERP studies that do not afford control over the rate of input. To assess intra-individual variability in context use, we utilized a concurrent self-paced reading and ERP paradigm. Participants read sentences that were strongly or weakly constraining and completed with an expected or unexpected word. Our findings revealed both quantitative and qualitative changes in the ERP as a function of target word RTs. Slower RTs were associated with a slightly smaller N400s. Additionally, prediction-related costs varied as a function of RTs. For faster RTs, a frontal positivity was seen to unexpected endings in strongly constraining sentences, replicating prior rapid-serial presentation results. Importantly, an anterior N200 was found among unexpected items that generated the slowest RTs, reflecting the cognitive control of motor execution. Collectively, our findings suggest that effects of context vary across trials within a single individual during the construction of message-level semantic representations. Co-registering behavioral and neural effects of context offers a window into these single-item dynamics.

C94

A BRAIN-BASED ACCOUNT OF "BASIC-LEVEL" CONCEPTS

Andrew J. Bauer[1], Marcel A. Just[1]; [1]Carnegie Mellon University — This study provides a brain-based account of how object concepts at an intermediate ("basic") level of specificity are represented, offering an enriched view of what it means for a concept to be a "basic-level" concept, a research topic pioneered by Rosch and others. Applying machine learning techniques to fMRI data, it was possible to determine the semantic content encoded in neural concept representations at different levels of abstraction. Rosch et al. (1976) proposed that a basic-level concept (e.g. "bird") summarizes its subordinates in terms of general properties (the fact that birds have feathers) and also in terms of more specific properties that frequently occur among its subordinates (a bird's sharp beak), whereas a subordinate-level concept (e.g. "robin") is defined primarily by specific properties (a robin's red breast). Both basic- and subordinate-level concepts were neurally represented in temporal and occipital cortex, which likely encode specific visual properties of the objects. Basic-level concepts additionally contained representational elements in frontal language and parietal association areas, indicating additional abstract or supramodal content. Furthermore, basic-level concepts (e.g. "fish") were representative of their category in that they were neurally similar to their typical but not atypical subordinate concepts (i.e. similar to "bass" but not "minnow"). These results provide a brain-based account of the advantage that basic-level concepts enjoy in everyday life over subordinate-level concepts: the basic level is a broad representation that encompasses both concrete and abstract semantic content.

C95

ACTIVATION IN SEMANTIC PROCESSING NETWORKS AND LANGUAGE SKILL IN BENIGN EPILEPSY WITH CENTROTEMPORAL SPIKES

Thomas Maloney[1], Jeffrey Tenney[1], Tracy Glauser[1], Diego Morita[1], Jennifer Vannest[1]; [1]Cincinnati Children's Hospital Medical Center — Children with

Benign Epilepsy with Centrotemporal Spikes (BECTS), a common pediatric epilepsy, have few seizures but frequent electrophysiologic abnormalities that may be associated with difficulties in language and other cognitive skills. We used functional MRI and a semantic decision – tone decision task to examine the effect of BECTS on activation in semantic processing networks. Language and cognitive skills were assessed using standardized measures. 27 children with BECTS (age 5-12, 12F) and 41 typically-developing children (age 5-12, 20F) participated. Groups did not differ in full-scale IQ (p>.40); but differed in language skill (Clinical Evaluation of Language Fundamentals, CELF; BECTS mean=96.1, control mean=102.6 [t(66)=2.08, p<.05]). Typical fMRI preprocessing (skull-stripping, slice timing correction, motion correction, normalization) was performed using FSL (FMRIB's Software Library). A GLM analysis was used to examine group composite activation in BECTS patients and typically-developing children for semantic>tones. Regions of significant activation (z>3.71, p<.05 corrected) included bilateral, but strongly left-lateralized inferior frontal gyrus, inferior/middle temporal gyri, frontal pole/anterior cingulate and subcortical regions. Regions more active for tones>semantic were bilateral auditory processing regions in planum temporale/planum polare. We also used regression analysis to examine the relationship between activation during the semantic task and CELF scores. No significant relationship was observed in typically-developing children. However, in BECTS patients, activation in left superior temporal and parietal regions, left pre/postcentral gyrus, anterior cingulate, and subcortical regions was associated with higher CELF scores (z>2.3, p<.05 corrected). This suggests that changes in networks supporting semantic processing underlie variability in language skill in BECTS.

C96

EFFECTS OF SENTENTIAL CONSTRAINT AND EXPECTANCY ON SUBSEQUENT MEMORY IN OLDER ADULTS

Joost Rommers[1], Ryan J. Hubbard[1], Kara D. Federmeier[1]; [1]University of Illinois — Research on sentence processing has revealed multiple strategies for using contextual information, which are differentially available to younger and older adults. Here, we used ERPs to investigate the impact of using these strategies on later memory. In a previous study, younger adults read expected or unexpected words in strongly constraining sentences ("The children went outside to play/look") or weakly constraining sentences ("Joyce was too frightened to move/look"). When their memory for words was tested, they false alarmed to lures that they had not seen but that fit in the context ("play" after reading "The children went outside to look"). In the present study, older adults also exhibited this behavior, but the brain activity at test was strikingly different. In young adults, distinguishing lures from old words was reflected in the N400, suggesting familiarity-based processing. In the older adults, distinguishing lures from old words was reflected in the LPC, suggesting recollective processing, which seemed to help overcome initial luring at the N400 stage. Responses to lures could also be traced back to sentence processing, where more positive-going frontal ERPs to unexpected sentence endings were associated with subsequent correct rejections of lures. Inconsistent with a prediction explanation, this effect did not differ by constraint. Taken together, the two age groups' different mechanisms for rejecting words that fit the context but were not experienced were evident during both reading and memory. Thus, older adults' different use of context affects not only their online processing of text, but also their later memory for it.

C97

REPEATED METAPHORICAL USE OF VERBS RESULTS IN ABSTRACTION OF MEANING

Anja Jamrozik[1], Andrew Bock[1], Lorna Quandt[1,2], Anjan Chatterjee[1]; [1]University of Pennsylvania, [2]Gallaudet University — Embodied cognition accounts posit that language comprehension relies on simulation of sensory and motor experiences. For example, to understand the sentence 'The crow flew into the nest', we would simulate experiences associated with flying. The same should be the case for metaphorical uses, such as 'The banker crawled through the contract'. Previous results are mixed. Some studies found equivalent activation in sensorimotor areas for both metaphorical and literal uses, while others found greater activation for literal compared to metaphorical uses. We hypothesize that metaphor familiarity may explain these differences: repeated metaphor exposure results in abstraction of word meaning and reduced sensorimotor simulation. To test this hypothesis, we familiarized participants to metaphorical and literal verb uses during an fMRI scan. Verbs had either a strong motion association (e.g., crawling) or auditory association (e.g., rattling). Each verb use was repeated five times. Functional localizers were used to identify cortical areas related to motor movement and visual-motion processing (for the motion verbs), and auditory processing (for the auditory verbs). We compared activation for metaphorical vs. literal sentences within these regions of interest for the first and fifth sentence exposures. Preliminary results support our hypothesis that repeated metaphor exposure results in abstraction and reduced sensorimotor simulation. Activation of sensorimotor areas was comparable for metaphorical vs. literal sentences during the first exposure. By the fifth exposure, however, sensorimotor areas were generally less active for metaphorical than literal sentences, suggesting decreased need for simulation.

LONG-TERM MEMORY: Development & aging

C98

FACTORS PREDICTING SUCCESSFUL VERBAL LEARNING IN OLD AGE

Jorge Yanar[1], Mark Albert[1], Carolyn Martsberger[1], Robert G Morrison[1]; [1]Loyola University Chicago — The ability to learn new information is critical for successful aging, and deficits in this ability is diagnostic for Alzheimer's disease and its precursor Amnestic Mild Cognitive Impairment. Research has suggested that executive function may be a critical factor affecting memory function particularly in the face of age-related of pathologic degeneration in the medial temporal lobe. To investigate the factors important for successful verbal learning in old age we recruited 54 older adults (65 - 91 YO) from the Northwestern University Cognitive Neurology and Alzheimer's Disease Center Clinical Core. In addition to completing the UDS neuropsychological battery (Weintraub et al., 2009) participants also learned visual categories via trial-by-trial feedback and performed a visual Go - No Go task. Verbal learning ability was assessed using the delay score from the Rey Auditory Verbal Learning Test (RAVLT). In order to determine which variables contributed strongly to the prediction of RAVLT, stratified K-folds cross validation with k = 6 (N = 54) was performed, and an optimal regularization parameter with which to do regularized linear regression (Lasso) was extracted. Category learning accuracy and No-Go accuracy were the best predictors of RAVLT score. Of the neuropsychological tests in the UDS, only the Boston Naming Task, a measure of verbal language functioning, survived as a strong predictor. The resulting model explained approximately 30% of the variance in RAVLT score. These results provide additional evidence that executive functions are likely critical for providing resilience to age related changes in the long-term memory system.

C99

RECOLLECTION-RELATED CHANGES IN CONNECTIVITY ACROSS THE ADULT LIFESPAN

Danielle King[1], Marianne de Chastelaine[1], Michael Rugg[1]; [1]University of Texas at Dallas — Healthy aging is marked by a decline in episodic memory, but the neural mechanisms underlying age-related differences are unclear. We previously demonstrated that young adults exhibit recollection-related increases in connectivity between a broadly distributed set of brain regions. Importantly, the magnitude of these effects correlated across individuals with recollection performance. Here, we investigated recollection-related changes in connectivity and their relationship with performance across three age groups. Young, middle-aged, and older adults were scanned while making associative recognition judgments about previously encoded word pairs. We parcellated the brain into 271 regions and used psychophysiological interactions (PPI) analysis to estimate the magnitude of recollection-related connectivity change between each pair of regions. For each pair of regions, a separate regression model tested the fraction of variance in connectivity change that could be explained by age group, recollection performance, and the age by performance interaction. The results revealed a significant age by performance interaction for a number of pairs of regions. In the vast majority of cases this was due to a weakening in the relationship between connectivity change and performance with increasing age. Other pairs of regions exhibited a main effect of age, most of which reflected increased connectivity change with increasing age. These findings demonstrate that when performance is

held constant, older adults show greater recollection-related connectivity change than younger adults, suggesting a possible age-related compensatory mechanism. The weaker relationship between performance and connectivity change in older individuals might reflect age-related decline in neuromodulatory input to the cortex.

C100

HEALTHY AGING INFLUENCES THE RELATION BETWEEN SUBJECTIVE VIVIDNESS AND NEURAL RECRUITMENT DURING EMOTIONAL MEMORY RETRIEVAL

Jaclyn Ford[1], Elizabeth Kensinger[1]; [1]Boston College — Age is associated with a behavioral shift toward more positive memory retrieval. Recent findings from our lab suggest that age-related increases in prefrontal activity and decreases in prefrontal-medial temporal lobe connectivity may support this effect during retrieval. In the current study, a parametric modulation analysis was conducted to examine the relation between neural activity and vividness ratings. Participants (ages 18-85) encoded visual images paired with verbal titles. During a scanned retrieval session, they were presented with titles and asked whether each had been seen with an image during encoding. Participants provided vividness ratings following retrieval of each image. Age was associated with greater decreases in vividness ratings for negative than for positive events, suggesting a selective weakening of subjective vividness for negative events. Neurally, age was linked with greater vividness-related recruitment of medial prefrontal cortex during retrieval of negative events. In other words, older adults were more likely to recruit medial prefrontal regions during retrieval of negative events that they later rated as less vivid compared to those that they later rated as more vivid, but this same relation did not exist in young adults. It is likely that these trial-by-trial changes ultimately contribute to decreases in negative event vividness in older relative to young adults. These findings are consistent with studies that reveal age-related enhancements in emotion regulation, and suggest that older adults may be engaging in these processes during retrieval of negative events.

C101

RELATIONAL MEMORY IN INFANTS: 9-MONTH-OLD INFANTS CAN ACTIVATE ASSOCIATED PROCESSING AREAS TO ONCE PRESENTED STIMULI

John Walker[1], Kathy Low[1], Neal Cohen[1], Monica Fabiani[1], Gabriele Gratton[1]; [1]University of Illinois at Urbana-Champaign — The point at which infants can start to create and utilize relational memories from single episodes has yet to be established. Some studies have been able to show that associations can be created as early as three months (e.g. Rovee-Collier et al., 1980), but it typically takes multiple trials for infants to learn these associations. Memory for associations formed after a single trial is normally attributed to well after the first year but there is eye tracking evidence that infants may demonstrate this type of memory (Nelson & Richmond, 2009). Here we tested the ability for 9-month-old infants to demonstrate relational memory using the Event-Related Optical Signal (EROS) technique. This optical imaging technique allows us to get cm precision on a ms timescale to examine whether infants can show the same type of relational activation to the presentation of one item in a episodically learned pair as is present in young adults (Walker et al., 2014). We had infants listen to nonsense sounds two times with the first presentation either by themselves or with a short video clip. We found that those sounds that were previously paired with movies activated visual cortices whereas the sounds that were not paired with movies showed no such activity demonstrating the first finding of single-trial relational memory in the brain in infants this young. Furthermore we found that infants look at the screen more for those sounds that were paired with movies, demonstrating that this brain activity also manifests in behavior at this age.

C102

THE EFFECT OF GENERATING ASSOCIATIONS ON FUNCTIONAL MAGNETIC RESONANCE IMAGING ACTIVATION IN MILD COGNITIVE IMPAIRMENT

Chris Foster[1], Shaina Garrison[1], Daniel Kaufer[1], Kathleen Welsh-Bohmer[2], Kelly Giovanello[1]; [1]University of North Carolina at Chapel Hill, [2]Duke University — Prior research has shown that relational encoding is supported by two mechanisms, binding and generation. Binding processes, supported by the hippocampus, degrade in both cognitively normal (CN) older adults and patients with mild cognitive impairment due to Alzheimer's disease (MCI-AD). Patients with MCI-AD also tend to show hyperactivation of the hippocampus during relational encoding. Generation processes are supported by frontal regions; however, substantially less work has been conducted on how the generation of associations are altered by MCI-AD. In the current study, we used functional magnetic resonance imaging to scan both MCI-AD and CN older adults during intentional encoding of word pairs. Participants either read a sentence or generated a sentence that associated the two words. We hypothesized that frontal activation would increase when participants generated their own sentences and that MCI-AD participants would show hyperactivity in frontal regions. Behaviorally, both MCI-AD and CN participants showed greater memory for word pairs in the sentence generation condition. Task based activation results were analyzed with an analysis of variance using group and encoding task as factors. Preliminary results showed a main effect of encoding task, where the generation of sentences showed greater recruitment of the left inferior frontal gyrus. The analysis also revealed a main effect of group, where MCI-AD participants exhibited hyperactivity in the bilateral hippocampus and several frontal regions including the bilateral inferior frontal gyrus. These results extend prior research by showing that both CN and MCI-AD older adults recruit frontal regions to support generation processes.

C103

THE DEVELOPMENTAL TRAJECTORY OF EMOTION EFFECTS ON SUBSEQUENT MEMORY: EVIDENCE FROM BRAIN AND BEHAVIOR

Anais Stenson[1], Jacqueline Leventon[2], Patricia Bauer[1]; [1]Emory University, [2]California State University, San Bernardino — Adults remember emotional events better than neutral events. This emotional memory enhancement (EME) effect appears in behavioral and neural measures. Children as young as 5 respond to emotion during encoding, yet EME effects on subsequent memory might emerge only later in childhood (Leventon, Stevens, & Bauer, 2014). To map emotion effects on memory across development, we examined EME effects in 8-10, 11-13, and 14-16-year-olds by recording event-related potentials (ERPs) and behavioral responses while participants viewed positive, negative, and neutral photographs. Two weeks later, we tested old/new recognition. The ERPs recorded during encoding were back-sorted according to subsequent memory performance. Corrected recognition performance (proportion of hits minus false alarms) differed significantly between emotions ($F(2,176)=79.6$, $p<.001$) but not age groups ($F(2,88)=.15$, $p=.86$). For correctly remembered pictures, ERPs in an early post-stimulus window (150-350 ms) differed significantly between age groups ($F(2,71)=3.56$, $p=.03$), but not emotions ($F(2,142)=.406$, $p=.67$). In contrast, late ERPs (1000-1500ms) differed significantly between emotions ($F(2,142)=7.01$, $p=.001$), but not age groups ($F(2, 71)=.892$, $p=.414$). Together, behavioral performance and the late ERP data suggest that the EME effect is largely consistent from childhood through the teenage years. However, age differences in the early ERPs indicate that the temporal dynamics of emotion processing continue to develop throughout this period. Forthcoming analyses will investigate how neural responses differ according to memory performance, emotion, age, time window, and recording site. Together, these data will provide insight into the developmental trajectory of emotional effects on memory.

C104

SEX-DEPENDENT AGE EFFECTS ON ANTERIOR HIPPOCAMPAL VOLUME AND AGE-DEPENDENT SEX EFFECTS ON SPATIAL MEMORY: COMPARING YOUNG, MIDDLE-AGED AND OLD ADULTS.

Kristin Nordin[1], Agneta Herlitz[2], Elna-Marie Larsson[1], Hedvig Söderlund[1]; [1]Uppsala University, Uppsala, Sweden, [2]Karolinska Institutet, Solna, Sweden — Age-related decreases are often observed in memory performance and hippocampal volume, although most studies compare only young and old groups, not including middle-aged adults. Here, 176 healthy men and women in three age-groups (young 20-35; middle-aged 40-50; old 60-70) underwent structural MRI and testing on spatial and episodic memory to establish a possible link between memory function and hippocampal volume in healthy aging. As it is unclear if the anterior and posterior regions of the hippocampus are affected differently by aging, and if these regions are differentially involved in spatial and episodic memory, they were here analyzed separately. Both spatial and episodic memory declined

with age, and this decline did not differ between men and women. Men outperformed women on spatial memory, but only in the young and middle-aged groups, indicating a possible age-related effect of sex in spatial memory. Episodic memory performance was equal in men and women. Unlike the effects in memory performance, voxel-based morphometry (VBM) analyses suggested sex-dependent effects of age on hippocampal volume; only men showed a reduction in volume, in bilateral anterior hippocampus. Although reductions in volume and a decline in memory performance were observed, there was no correlation between performance and hippocampal volume. We conclude that sex is important to consider when studying effects of age on hippocampal volume and that sex-differences in spatial memory might be age-related.

C105

CROSS-CULTURAL DIFFERENCES IN THE NEURAL CORRELATES OF SPECIFIC AND GENERAL RECOGNITION

Laura E. Paige[1], John C. Ksander[1], Hunter A. Johndro[1], Angela H. Gutchess[1]; [1]Brandeis University — Research suggests culture influences how people perceive the world. Western cultures exhibit analytical processing, focusing on central or object-based information, whereas Eastern cultures exhibit holistic processing, focusing on contextual information. Extant work has shown that cultural differences extend to memory specificity, such as how much perceptual detail is remembered. The present study investigated cross-cultural differences (Americans vs. East Asians) in the neural correlates of general versus specific memory. Using functional magnetic resonance imaging (fMRI), participants encoded pictures of everyday items in the scanner and 48 hours later completed a surprise recognition test. The recognition test consisted of same items (i.e., previously seen in scanner), similar items (i.e., same object name, different features), or new items (i.e., items not previously seen in scanner). Activation at encoding was analyzed as a function of recognition performance. We predicted greater activation in the right fusiform for Americans compared to East Asians, as this region was implicated previously in encoding perceptual details. In contrast, the left fusiform should be similarly engaged across both cultures, as this region contributes to general memory. Surprisingly, results revealed that East Asians activated the left fusiform more than Americans for correct "same" responses compared to correct "similar" responses. Interestingly, the observed left hippocampus activity differed between the two groups. East Asians engaged the left hippocampus more for correct "same" versus correct "similar" responses, whereas Americans engaged the hippocampus more for correct "similar" versus correct "same" responses. Taken together, this suggests that perceptual and memory systems differ by culture.

C106

SEMANTIC KNOWLEDGE SUPPORTS RELATIONAL INFERENCE IN AGING BUT NOT IN AMNESIA

Maria C. D'Angelo[1], R. Shayna Rosenbaum[1,2], Jennifer D. Ryan[1,3]; [1]Rotman Research Institute, Baycrest, [2]York University, [3]University of Toronto — Amnesia and aging are both associated with impairments in relational memory, which is critically supported by the hippocampus and its connections. By adapting the transitivity paradigm, we show that age-related impairments in inference are mitigated when judgments can be predicated on known pairwise relations. However, such advantages are not observed in amnesia. We report findings from an adult-onset amnesic case (D.A.), as well as findings from a developmental amnesic case (N.C.). Despite their differences in etiology and affected structures, N.C. and D.A. perform similarly on the task – both show impaired relational learning and transitive expression. Similar to other cases of developmental amnesia, N.C. shows intact access to semantic information. Although N.C. is able to use existing semantic information to support performance on known pairwise relations, his semantic knowledge was insufficient to support transitive expression. The present results suggest that the medial temporal lobe and its connections play a critical role in inference beyond learning of pairwise relations, and that inferential behaviour involves flexible probing of memory space as well as the establishment of new relations.

C107

OLD SCENES BIAS RECOGNITION OF NEW FACES DURING SOURCE MEMORY JUDGEMENTS: EVIDENCE FROM OLDER ADULTS AT-RISK FOR MCI

Celia Fidalgo[1], Iva Brunec[1,2], Lok-kin Yeung[1], Andy Lee[1,2], Morgan Barense[1,2]; [1]University of Toronto, [2]Rotman Research Institute — Associative memory deficits occurring with age are commonly attributed to decline of hippocampal integrity. This region supports recollection of episodic contextual details and scene recognition. Older adults with early mild cognitive impairment (MCI) additionally show decline in perirhinal cortex integrity, a region supporting stimulus familiarity and facial recognition. The current study examined the contributions of recollection and familiarity for scenes and faces in healthy older adults and older adults at risk for MCI, and examined whether memory judgments correlated with medial temporal lobe volumes. Participants completed a source memory experiment. During the study phase, participants encoded a series of face-scene pairs. At test, they made remember-know judgements (Yonelinas, et al., 1998) towards a single face or scene. Immediately following, participants viewed a face and scene side-by-side and answered "Were these images paired together at study?" We found that older adults had impaired recollection for scenes relative to young adults, and that the at-risk group had impaired familiarity for faces relative to their healthy counterparts. Perirhinal cortex volume correlated with familiarity judgments for faces, but not for scenes. Lastly, the at-risk group false alarmed more than the healthy group towards a face-scene pair when the scene was old and the face was new. This suggests that impoverished face representations allow intact scene memory to inappropriately bias at-risk older adults to falsely recognize novel faces.

C108

NETWORK ANALYSIS OF MEMORY DECLINE AND MAINTENANCE IN AGING

Matthew Stanley[1], Simon Davis[1], Ben Geib[1], Roberto Cabeza[1]; [1]Duke University — The billions of neurons in the human brain are organized into a complex system of local circuits and long range fiber pathways that can be conceptualized as a network. This complex network forms the fundamental infrastructure for distributed interactions among specialized brain systems thought to give rise to all cognitive processes. Using diffusion tensor imaging (DTI) to construct large-scale white matter networks, we used graph theory measures of degree and page rank centrality to investigate the relationship between age-related changes in nodal network properties and episodic memory performance. Results indicated that the frontal superior medial gyrus and right supplementary motor cortex had fewer connections to disparate brain regions among older adults compared to young adults, a pattern indicative of age-related decline irrespective of memory performance. However, page rank centrality tracked memory maintenance with age in the right anterior parahippocampal gyrus and the right temporal fusiform. There were no significance differences in page rank centrality for these nodes between high performing older adults and young adults; however, there was a significant difference in page rank centrality between low performing older adults and both high performing older adults as well as young adults. Sustained and high magnitude page rank centrality for the anterior division of the right parahippocampal gyrus and right temporal fusiform supports episodic memory maintenance in older adults. We utilize a valuable, new framework for investigating brain structure as a large-scale complex network with graph theory measures, which has the potential to expand upon our understanding of aging and memory.

C109

DEDIFFERENTIATION AND AGE-RELATED DECLINE IN ASSOCIATIVE MEMORY: A MULTIVARIATE FMRI INVESTIGATION

Alexandra Trelle[1], Richard Henson[2], Jon Simons[1]; [1]University of Cambridge, [2]MRC Cognition and Brain Sciences Unit — Aging is thought to reduce the specificity of neural representations across multiple cognitive domains. The present study explored the potential contribution of such dedifferentiation to age-related decline in memory for word-picture associations. Participants studied eight pictures from two categories (4 objects, 4 scenes) multiple times, on each occasion paired with a different word. Accordingly, some pairs were closely related in content (e.g., sharing the same picture), whereas others contained dissimilar content (e.g., an object versus a scene). At test, participants were presented a studied word together with a label corresponding to

one of the eight pictures, and decided whether they were previously paired together, or a novel combination. During study, we found evidence for reduced distinctiveness of neural representations with age across medial temporal and fronto-parietal regions for both closely related and dissimilar pairs, whereas analogous declines in occipito-temporal regions were evident only when pairs contained pictures from within the same category. During test, patterns of neural activity associated with endorsing studied pairs and rejecting rearranged pairs were less distinct in older adults across many brain regions, suggesting a failure to adaptively engage strategic retrieval processes, such as reinstatement and monitoring of retrieved content. Greater neural specificity with respect to both perceptual representations at study, and successful retrieval processes at test, was associated with better memory performance in older adults. Together, the results lend support to the proposal that dedifferentiation of neural responses contributes to age-related decline in associative memory.

LONG-TERM MEMORY: Episodic

C110

IMPAIRED EPISODIC PROSPECTION DOES NOT IMPEDE THE FLEXIBLE CONSTRUAL OF EVENTS ACROSS FUTURE TIME

R. Shayna Rosenbaum[1,2], Donna Kwan[1], Elisa Ciaramelli[3], Carl F. Craver[4]; [1]York University, Toronto, Canada, [2]Rotman Research Institute, Toronto, Canada, [3]Università di Bologna, Bologna, Italy, [4]Washington University, St. Louis, USA — Research shows that damage to the hippocampus and its connections can affect both the ability to remember past events and the ability to imagine or "pre-experience" future events. To what extent does impaired episodic prospection affect other types of future-oriented judgments and decisions? We examined whether people with impaired episodic memory and prospection retain normal effects of temporal construal on prospective judgements about the self – specifically, the tendency to construe the near future in concrete, detailed terms and the distant future in abstract, general terms. To do so, patients and controls were administered two measures known to be sensitive to manipulations of imagined temporal distance: prospective agency and prospective confidence. Results indicated that despite episodic amnesia, patients retained flexible construal of events as a function of temporal distance. Similar to controls, patients gave higher ratings of personal agency and prospective confidence for events and activities framed in the distant future than for those framed in the near future. These results suggest that at least some effects of temporal construal are independent of the role of episodic prospection in imagining the future.

C111

HUMAN HIPPOCAMPAL THETA DURING FEEDBACK ON A SPATIAL LEARNING TASK

Jessica Creery[1], David Brang[1,2], Vernon Towle[2], James Tao[2], Sasha Wu[2], Ken Paller[1]; [1]Northwestern University, [2]University of Chicago — Feedback provided during the course of learning provides an opportunity to modify incorrect associations. However, much remains to be learned about the neural mechanisms of feedback-based memory modification. Accordingly, we used intracranial recording methods to examine oscillatory activity in the human hippocampus following feedback on a spatial learning task. We recorded electrocorticographic (ECoG) responses from chronically implanted hippocampal depth electrodes in four patients with epilepsy as they learned object locations on a screen. First, objects were studied once, sequentially, with each object in a unique location. Patients then saw each object in the middle of the screen and used a mouse to attempt to place the object in the correct location. The objects were then shown in the correct location as feedback. This procedure continued until each object was placed in the correct location two times. We compared oscillatory activity in the hippocampus when each object was shown in the middle of the screen (during retrieval) and when each object was shown in the correct location (during feedback). Across patients, we consistently found that theta power (3-8 Hz) was greater during feedback than during retrieval. In contrast, during both feedback and retrieval there was an increase in high-frequency activity (70-200 Hz). Further analyses relate these findings to responses during initial encoding and to subsequent memory performance. Overall the results suggest that hippocampal theta activity during feedback is associated with the memory modification engendered by the delivery of new information.

C112

HIPPOCAMPAL ACTIVITY ASSOCIATED WITH EYE MOVEMENT MEASURES OF CUED RECALL

Alexandra M. Gaynor[1], Lisa A. Solinger[2], Elizabeth F. Chua[1,3]; [1]The Graduate Center, The City University of New York, [2]Washington University in St. Louis, [3]Brooklyn College, The City University of New York — Relatively few fMRI studies have investigated cued recall because of difficulties associated with collecting verbal responses during scanning. We used eye movements to index recall while participants completed a memory task in the scanner. Participants studied pairs of objects during an associative memory paradigm that resembles the board game "Memory". Participants were presented with a grid of face-down "cards". During each study trial, two unique, nonmatching cards were upturned. Like the game, participants were instructed to remember where matching cards were located and, in addition, to remember which cards were presented at the same time. Each test trial included a cued-recall phase—wherein a single card was upturned and participants were asked to look to the location of the card that appeared at the same time—followed by a 3-alternative forced choice recognition phase. In our analyses, an eye movement to the correct location indexed recall, whereas a lack of eye movements to the correct location indicated a failure to recall. Of all the trials that were correctly recognized, there was, surprisingly, less hippocampal activity during correctly recalled trials compared to non-recalled trials ($p<0.05$, corrected at the cluster level), with deactivation below baseline during recalled trials. Although recollection has often been associated with greater hippocampal activity at retrieval, our findings are consistent with a small number of studies that propose hippocampal deactivation may facilitate accurate retrieval of associative spatial memory, perhaps reflecting a suppression of the default mode network.

C113

AGE EFFECTS ON ENCODING-RELATED MODULATION OF HIPPOCAMPO-MEDIAL PREFRONTAL CONNECTIVITY

Erin Horne[1,2], Marianne de Chastelaine[1,2], Danielle King[1,2], Jonathan Siegel[1,2], Michael Rugg[1,2]; [1]University of Texas at Dallas, [2]Center for Vital Longevity — Successful episodic encoding has been associated with enhanced functional connectivity between the hippocampus (HC) and medial prefrontal cortex (mPFC). Here, we examined whether this subsequent memory effect for HC-mPFC connectivity differs across the lifespan. Samples of young (N=36), middle-aged, (N=36) and older (N=64) adults underwent fMRI scanning while they undertook a study task involving semantically unrelated word pairs. In a subsequent memory test, they discriminated between 'intact' and 'rearranged' pairs of studied items. The crucial fMRI contrasts were between study pairs that went on to be correctly judged intact or incorrectly endorsed as rearranged. Univariate subsequent memory (SM) effects (greater activity during successful relative to unsuccessful encoding) were identified in the left HC in all age groups. The effects did not differ according to age, and correlated positively across participants with later memory performance in an age-invariant manner. Using the left HC as a seed, psychophysiological interactions analysis (PPI) across all participants identified the mPFC as the principal region where connectivity was greater for successfully than for unsuccessfully encoded study items. This effect did not differ across age groups. The relationship across individuals between the effect and a diffusion tensor imaging measure of white-matter integrity (fractional anisotropy; FA) did differ significantly across groups however. There was a reliable positive relationship between hippocampal-mPFC connectivity change and FA of the anterior corpus callosum in young individuals only. By contrast, a positive relationship between FA of the left cingulum bundle and connectivity change was evident only in middle-aged and older participants.

C114

DISTRIBUTED CORTICAL REPRESENTATIONS OF VISUAL FEATURES AND ITEMS IN PERCEPTION AND MEMORY

Serra E. Favila[1], Rosalie Samide[2], Brice A. Kuhl[2]; [1]New York University, [2]University of Oregon — Neural activity patterns that reflect stimulus features during perception are reactivated when that stimulus is retrieved from memory. For example, reactivation of high-level visual category information has frequently been observed in ventral temporal cortex. However, recent evidence also indicates that reactivation of event-specific information may occur in lateral

parietal cortex. At present, there remains ambiguity regarding the nature of reactivated representations in lateral parietal cortex and how these representations relate to those in visual cortical areas. To address this question we had human subjects learn word-image associations for 32 unique object stimuli that varied in color and object category membership. We scanned subjects while they performed two different tasks involving these object stimuli: perception and cued retrieval. During perception runs, subjects viewed the objects while performing an orthogonal visual target detection task. During retrieval runs, subjects were presented with word cues and recalled the associated objects. We then analyzed fMRI activity patterns in occipital and lateral parietal areas estimated from each task. We found that color and object category information were represented in distinct occipital areas during both perception and retrieval. Additionally, comparison of neural activity patterns across perception and retrieval revealed item-specific reinstatement within lateral inferior parietal cortex. Finally, we show that reinstated item-level patterns in parietal cortex can be predicted from reinstated feature-level patterns in visual cortex. These findings suggest a role for parietal cortex in reading out and combining visual feature information during memory retrieval.

C115

SCANNING ALONG A LOGARITHMICALLY-COMPRESSED MEMORY REPRESENTATION

Inder Singh[1], Aude Oliva[2], Marc Howard[1]; [1]Boston University, [2]Massachusetts Institute of Technology — Why does it take longer to retrieve memories from further in the past? Distributed memory models assume that memory is a composite store containing a noisy record of features from all the studied items. In contrast, another class of models proposes that features are stored along an ordered representation of experience. Both these frameworks can support the increase in response time (RT) for older memories but make different predictions about the retrieval characteristics. More specifically, this manifests in a change in the shape of the RT distributions. We present the results from a continuous recognition experiment with the lag of a repeated stimulus ranged over more than two orders of magnitude from lag 1 up to lag 128. Highly memorable pictures were used to mitigate changes in accuracy and enable a detailed examination of the effect of recency on retrieval dynamics. Analysis of the RT distributions showed that the time at which memories became accessible changed with the log of the recency of the probe item (the distributions started from 0 at different times and varied as a function of recency). Additional analyses revealed that this effect was not attributable to an effect of immediate repetitions nor to increased processing fluency of the probe. These results suggest that visual memories can be accessed by sequentially scanning along a logarithmically-compressed representation of the past.

C116

RETRIEVING THE RIGHT MEMORY IN A REVERSAL LEARNING TASK IS PREDICTED BY STRUCTURAL CONNECTIVITY BETWEEN THE ORBITOFRONTAL CORTEX AND MEDIAL TEMPORAL LOBE

Kylie H. Alm[1], Ashley Unger[1], Tehila Nugiel[1], Hyden R. Zhang[1], Ingrid R. Olson[1]; [1]Temple University — Reversal learning (RL) tasks exemplify the close relationship between decision-making and memory given the repeated pairings of a stimulus choice with a rewarding or punishing outcome. Over time, participants learn to choose the stimulus that leads to more frequent rewards. After initial acquisition of learned pairings, the reward contingencies are reversed. The ability to readily adapt to reversals is believed to rely on a limbic circuit - the orbitofrontal cortex (OFC), amygdala, and hippocampus – because damage to these regions harms RL performance. We recently found that individual variation in a white matter tract connecting these regions – the uncinate fasciculus (UF) – predicted RL performance (Alm et al., 2015). However, UF variability did not predict acquisition performance, consistent with prior research demonstrating that damage to the OFC, amygdala, and hippocampus does not affect learning of simple stimulus-outcome contingencies. We hypothesized that the computational demands of different types of retrieval may call on different neural systems. Retrieval demands after reversal are unique, since interference from prior associations is high. To test this, we developed an RL task with multiple reversals in which retrieval competition was high during both acquisition and after reversal. Young adults learned to associate fractal patterns with asterisks in particular spatial locations through trial and error. Using diffusion imaging, we found that individual variation in UF microstructure significantly predicted performance during both the acquisition and reversal phases. We, therefore, argue that learning and memory tasks with high levels of retrieval competition call on the UF for resolution.

C118

JUDGMENT OF ENCODING SUCCESS ELICITS DIFFERENTIAL FUNCTIONAL RESPONSE IN POSTEROMEDIAL CORTICES AND HIPPOCAMPUS TO STIMULUS REPETITION

Patrizia Vannini[1,2], Donald McLaren[1,3,5], Kathryn Papp[2], Sarah Agjayan[2], Victoria Jonas[1], Molly LaPoint[1], Courtney Martin[1], Catherine Munro[1], Alvaro Pascual-Leone[4], Reisa Sperling[1,2,3]; [1]Athinoula A. Martinos Center for Biomedical Imaging and the Department of Psychiatry, Massachusetts General Hospital, Harvard Medical School, Charlestown, MA 02114, USA, [2]Center for Alzheimer Research and Treatment, Department of Neurology, Brigham and Women's Hospital, Harvard Medical School, Boston, MA 02115, USA, [3]Department of Neurology, Massachusetts General Hospital, Harvard Medical School, Boston, MA 02115, USA, [4]Berenson-Allen Center for Noninvasive Brain Stimulation and Cognitive Neurology Unit, Beth Israel Deaconess Medical Center, Harvard Medical School, Boston, MA 02115, USA, [5]Biospective, Inc., Montreal, Quebec H4P 2R2, Canada — Judgment-of-learning (JOL) is an aspect of metamemory whereby an individual evaluates whether he/she has successfully learned information. Successful episodic memory consolidation has been associated with repetition suppression in the hippocampus [e.g. Gonsalves et al., 2005], and repetition enhancement of the posteromedial cortex [e.g. Vannini et al., 2012] during encoding. It is unknown whether an individuals' judgment of encoding success elicits a comparable reciprocal pattern of functional response as successful encoding repetition. Here, we investigate the repetition-related changes for predicted encoding success using an fMRI experiment involving repetitive encoding of face–name pairs followed by a JOL task where the subject indicated if he/she learned the name well, not so well or not at all. During the first encoding trial, significant hippocampal activation was observed. The second encoding trial demonstrated a repetition suppression effect in the hippocampus, for "learned well" stimuli (pFDR<0.001). No repetition suppression was observed for "not learned well" or "not learned at all" stimuli. Furthermore, the posteromedial cortex demonstrated significant deactivation during the initial encoding trial. The second encoding trial demonstrated repetition enhancement for "learnt well" stimuli (pFDR<0.001). No repetition enhancement was observed in "not learnt well" or "not learnt at all" stimuli. These findings demonstrate the underlying encoding processes leading to a feeling that the information has been successfully learnt, which is similar to the reciprocal pattern of repetition suppression and repetition enhancement previously reported for successful episodic encoding. This information will be useful for understanding late-life amnestic disorders, when insight of memory performance might be compromised.

C119

AN EPISODIC SPECIFICITY INDUCTION IMPACTS ACTIVITY IN A CORE BRAIN NETWORK DURING THE CONSTRUCTION OF IMAGINED FUTURE EXPERIENCES

Kevin P. Madore[1], Karl K. Szpunar[2], Donna Rose Addis[3], Daniel L. Schacter[1]; [1]Harvard University, [2]The University of Illinois-Chicago, [3]The University of Auckland — People produce more episodic details about remembered past experiences and imagined future experiences after receiving an episodic specificity induction – brief training in recollecting the details of a recent experience – compared with control inductions not focused on episodic retrieval. Recent neuroimaging work also suggests broad overlap in a core network of regions recruited for remembering and imagining. In the current study, we examined the neural signature of the specificity induction effect for imagined future experiences and hypothesized that the induction would affect core network activity specifically. Using a within-subjects fMRI approach, 32 young adults received the specificity induction or a control induction before imagining future experiences and completing semantic object definitions during scanning. After receiving the specificity induction compared with the control, participants exhibited significantly increased activity in several core network regions for imagined experiences over object definitions, including the left anterior hippocampus, right inferior parietal lobule, right posterior cingulate cortex, and right precuneus. Functional connectivity analyses with hippocampal and inferior parietal lobule seed regions and the rest of the brain

revealed stronger core network coupling following the specificity induction compared with the control. In a post-scan interview, participants generated more episodic but not semantic details related to their imagined experiences from the specificity induction, and did not differ in details generated for object definitions as a function of induction, consistent with previous work. These findings provide novel evidence that an episodic specificity induction selectively targets episodic processes that are commonly linked to core network regions, including the hippocampus.

C120

EVIDENCE FOR THE STRATEGIC ORIENTING OF EPISODIC RETRIEVAL PROCESSES FROM PRE-STIMULUS NEURAL OSCILLATIONS

Mason Price[1], Emmitt Wright[1], Jason Iackey[1], Elizabeth Griffiths[2], Jeffrey Johnson[1]; [1]University of Missouri, [2]University of Surrey — Several EEG and fMRI studies have demonstrated that neural activity differs according to the type of memory trace (e.g., word or picture) sought in an episodic retrieval task. These 'retrieval orientation' (RO) effects have been shown with EEG to onset relatively early (by about 300 ms) and to be evident for new test items, suggesting that they effect reflect differential processing intended to maximize the overlap between cues and potential memory traces. If RO effects are indicative of preparatory processes that support retrieval, they should also be evident prior to cue onset. However, EEG studies have thus far focused on amplitude-based RO effects, thereby eliminating any pre-stimulus differences due to baseline correction. In the present study, we examined neural oscillations, which are relatively immune to amplitude differences, to determine whether RO takes the form of preparatory activity. Subjects encoded a series of intermixed words and pictures and then undertook exclusion memory tasks in which only one stimulus type was targeted at a time, while new stimuli and the other type had to be rejected. Oscillatory power in the theta and alpha ranges (4-12 Hz) differed over the posterior scalp according to the targeted stimulus type. Moreover, these differences were evident as early as 500 ms prior to stimulus onset, providing novel evidence that preparatory processing is differentially oriented according to retrieval demands. The findings are discussed in the context of determining the consequences of RO on successful memory retrieval and assessing the effectiveness of trained retrieval strategies.

C121

THE RETROSPLENIAL CORTEX: WHAT DOES IT DO?

Elizabeth Chrastil[1], Sean Tobyne[1], Rachel Nauer[1], Allen Chang[1], Chantal Stern[1]; [1]Boston University — Interest in the retrosplenial cortex (RSC) has undergone a renaissance in recent years. The role of RSC in episodic memory, spatial navigation, visual imagery, and scene perception has sparked intense interest and debate regarding its contributions to cognition and behavior. The lack of consensus in anatomical boundaries for localizing RSC complicates research into its function. Previously reported anatomical and functional definitions of retrosplenial cortex encompass a large area, suggesting potential gradations of function along medial-lateral or anterior-posterior axes, similar to those observed in the spatial scaling of hippocampal function, may be observed. We tested this hypothesis using fMRI meta-analysis and resting state functional connectivity (rsFC) methods. First, we used NeuroSynth to derive domain-specific regions where 101 previous studies consistently reported RSC activation; we linked those studies to the terms episodic memory, navigation, scenes, imagery, or pain and emotion. Next, we conducted meta-analyses using those domain-classified studies to localize areas within RSC that were associated with one or more domains. Results showed that left hemisphere medial RSC was closely tied to episodic memory. In contrast, posterior and lateral retrosplenial RSC was associated with both viewing scenes and navigation, although navigation was spread more diffusely. Finally, we used these meta-analysis derived subregions to conduct whole brain rsFC analyses using data from the Human Connectome Project. This analysis resulted in distinct connectivity patterns for the retrosplenial subregions that differed along functional and anatomical lines. These findings support the conclusion that the RSC can be subdivided along anatomical and functional boundaries.

C122

ASSOCIATIVE LEARNING, ASSOCIATIVE MEMORY, AND THE ROLE OF PRIOR KNOWLEDGE

Oded Bein[1], Niv Reggev[2], Anat Maril[2]; [1]New York University, [2]The Hebrew University of Jerusalem — What are the neural mechanisms that support learning and memory of new information? How does prior knowledge influence these mechanisms? Here, we utilized representational similarity (RS) analysis combined with a prior knowledge manipulation to track the learning of new associations. Participants learned repeating pairs of either two novel faces, or a famous face and a novel face. Behaviorally, learning was assessed by reaction times (RTs) during learning, and by a final associative memory test. The RS between faces was assessed before and after learning. We were interested in tracking two processes: A) learning of the mere association, measured by increased RS between faces that appeared together during encoding, versus pairs of faces that did not appear together. B) Mediation of explicit-memory, which was measured by a difference in RS between subsequently associative-hits and misses. It was found that a host of cortical regions, previously implicated in prior knowledge paradigms, exhibited learning-related increased RS, regardless of subsequent explicit memory. Additionally, in the hippocampus, pairs comprising subsequently associative-hits demonstrated higher similarity compared to misses, which in turn did not differ in their RS from items that were not studied together. Importantly, these effects were modulated by prior knowledge. These results nicely dissociate mechanisms that govern learning (cortex) and those that mediate explicit subsequent memory (hippocampus). Furthermore, they reveal a distinction between the processes that underlie forming a thoroughly new association vs. adding new information to an already-existing knowledge structure.

C123

DOES THE FN400 REFLECT MORE THAN FAMILIARITY? ERP EVIDENCE FROM VIEWING PRE-EXPERIMENTALLY FAMILIAR AND UNFAMILIAR PRODUCT IMAGES.

Heather Bruett[1], Jenna Krizan[1], Brittany Mok[1], Danielle Stepien[1], Ana Veloso[1], P. Andrew Leynes[1]; [1]The College of New Jersey — A prior study provided evidence that pre-experimental familiarity can influence later recognition memory judgments because pre-experimentally familiar products (i.e., name-brand) elicited a greater FN400 than off-brand, novel products (Bruett & Leynes, 2015: Neuropsychologia, 78, 41-50). Because the name-brand products could be matched to off-brand counterparts (e.g., "Dr. Skipper" is an off-brand version of "Dr. Pepper"), three ERP studies tested whether viewing a name-brand product would prime the off-brand counterpart and whether priming would affect the FN400. Off-brand primed FN400 amplitudes were predicted to be more positive than off-brand products if the FN400 reflects conceptual implicit memory (e.g., Voss et al., 2012), whereas equivalent FN400 amplitudes were expected for both novel, off-brand product types if the FN400 reflects familiarity (e.g., Rugg & Curran, 2007). All three experiments report evidence that name-brand products prime off-brand products (i.e., faster response times) and elicit more positive FN400 ERPs than off-brand products, which supports the conceptual implicit memory hypothesis. However, meaningless image ERPs provided a baseline comparison that uncovered variations in name-brand FN400 amplitude across the three experiments that co-varied with number of name-brand products in the test sequence. Collectively, this evidence suggests that the FN400 reflects both conceptual implicit memory and fluid, online monitoring influenced by expectations. Consequently, a more general characterization of cognitive processing associated with the FN400 is needed to explain the results because 'familiarity' or 'conceptual implicit memory' hypotheses are incomplete.

C124

NETWORK PROPERTIES OF THE HIPPOCAMPAL SUBNETWORK CONTRIBUTE TO SUCCESSFUL EPISODIC MEMORY RETRIEVAL

Benjamin R Geib[1], Mathew L Stanley[1], Nancy Dennis[2], Marty Woldorff[1], Roberto Cabeza[1]; [1]Duke University, [2]Pennsylvania State University — Multivariate functional-connectivity analyses of neuroimaging data have revealed the importance of complex, distributed interactions between disparate yet interdependent brain regions. Recent work has shown that certain configurations of functional brain networks aid cognitive functioning. Networks supporting healthy, successful, cognitive functioning should exhibit high-levels of both segregation (local processing) and integration (global processing).

After constructing functional brain networks derived from an event-related fMRI study of memory retrieval, we examined differences in topological properties between successful and unsuccessful memory retrieval. Multivariate graph-theory analyses showed that successful memory retrieval was associated with the left hippocampus becoming both more locally segregated and globally integrated. Follow-up analyses revealed that, between successful and unsuccessful memory-retrieval conditions, the left hippocampus significantly reorganized its set of direct connections. Subsequent bivariate functional-connectivity analyses indicated that with retrieval success the left hippocampus showed stronger interactions with a diverse group of brain regions, including the left precuneus, left caudate, bilateral supramarginal gyrus, and bilateral dorslolateral superior frontal gyrus. This collection of regions was identified as a left hippocampal subnetwork. While many of the nodes in the subnetwork had increased segregation and integration from unsuccessful to successful retrieval, the integrative properties of the subnetwork (with or without the left hippocampus hub) were most important in predicting individual subjects' memory performance. These findings underscore the potential of multivariate brain-connectivity research for providing valuable new insights into the neural bases of memory processes, emphasize the importance of integrative processing in the brain, and complement prior work using bivariate connectivity methodologies.

C125

THE ROLE OF GENETIC VARIATIONS IN DOPAMINE TRANSPORTER AND D2 RECEPTOR GENES ON ERP AND OSCILLATORY CORRELATES OF RECOGNITION MEMORY

Robert Ross[1], Paolo Medrano[1], Andrew Smolen[2], Tim Curran[2], Erika Nyhus[3]; [1]University of New Hampshire, [2]University of Colorado at Boulder, [3]Bowdoin College — Dopamine has been related to multiple facets of memory. Specifically, allelic variations of both the dopamine transporter (DAT) and dopamine 2 (D2) receptor genes influence recognition memory processes. Event-related potentials (ERPs) and oscillatory activity underlie successful memory retrieval. Therefore, individual differences in memory performance may be driven by genetic variation in dopamine related genes through changes in ERP and oscillatory activity. EEG, genetic, and behavioral data were collected from sixty participants as they performed an item recognition task. Participants studied and encoded 200 words, which were then mixed with 200 new words during retrieval. Participants were monitored with EEG during the retrieval portion of the task. Three ROIs were established and ERP mean amplitudes and oscillatory activity when correctly remembering old items (hits) and recognizing new items (correct rejections) were compared as a function of DAT and D2 genetic group. Results show that participants homozygous for the 10-repeat allelic variant of the DAT gene (10/10 homozygotes), which results in increased dopamine transporter expression, are significantly slower performing an item memory recognition task and show decreased ERP amplitude during hits over left parietal scalp locations. Additionally, 10/10 homozygotes show a decrease in beta oscillatory power during hits and an increase in alpha oscillatory power during correct rejections over prefrontal scalp locations. In contrast, polymorphisms of the D2 gene did not influence behavior, ERP, or oscillations during item memory. These results show how DAT, but not D2, genetic variation influences the electrophysiological dynamics associated with recognition memory.

C126

SHIFTING THE BALANCE BETWEEN PATTERN SEPARATION AND COMPLETION: RECENT MEMORY RETRIEVAL INCREASES PEOPLE'S SUBSEQUENT ABILITY TO RECALL ASSOCIATIONS

Anuya Patil[1], Freha Mian[1], Jihad El Sheikh[1], Katherine Duncan[1]; [1]University of Toronto — Emerging evidence suggests that recent exposure to novelty can influence how people subsequently use their episodic memory. Much of this work has focused on novelty's influence on encoding, so here we designed an experiment to identify how recent novelty and familiarity judgments influence different aspects of memory retrieval, namely, associative memory retrieval and item recognition memory. Participants (N=29) studied words paired with trial-unique images of either objects or scenes. They then made memory decisions, which simultaneously assessed whether they thought the images were 'old' or 'new' (recognition memory) and if they could remember the word associated with each image (associative retrieval). Critically, we manipulated whether each retrieval decision occurred after an unrelated novel or familiar image. We found that recently identifying an image as familiar rather than novel improved participants' subsequent ability to recall word associates (beta=0.29, SE=0.07, p=0.0001). Importantly, this boost in associative retrieval was not driven by response priming or conceptual priming; the preceding image had always been studied in a separate block and contained distinct material (objects vs. scenes). In contrast to enhancing associative memory, recent familiarity judgments may have impaired participants' ability to identify old images (beta=-0.15, SE=0.1, p=0.15), indicating that familiarity does not improve subsequent memory retrieval as a whole. In conclusion, familiarity's power to facilitate subsequent associative retrieval is consistent with the proposal that familiarity elicits a lingering processing bias toward pattern completion whereas novelty elicits a bias towards pattern separation (Duncan, Sadanand, & Davachi, 2012).

C127

A SYSTEMATIC MEASURE OF PERCEPTUAL RELATEDNESS IN FALSE MEMORIES

Indira Turney[1], Nancy Dennis[1]; [1]Pennsylvania State University — Previous memory research has exploited the perceptual similarities between lures and targets in order to evoke false memories. While some studies have attempted to use lures that are objectively more similar than others, no study has systematically investigated the role perceptual relatedness plays in accounting for the false alarm rate or the neural processes underlying perceptual false memories. The current study looked to fill this gap in the literature by using face morphing to systematically vary the amount of perceptual overlap between lures and targets. Our results converge with previous studies in finding that true and false memories engage many of the same neural regions, including frontal, parietal, and visual cortices, as well as a common pattern of differences wherein true memories exhibit increased activation in medial temporal lobe and early visual cortex and false memories exhibit increased activity in prefrontal and lateral temporal cortices. Expanding upon this work, parametric analyses found that activity within bilateral middle temporal gyri and right medial PFC increased with respect to the similarity between lures and targets. Moreover, this pattern of activation was unique to false memories and could not be accounted for by relatedness alone. Interestingly neither the medial temporal lobe nor the fusiform face area exhibited modulation as a function of target-lure relatedness. Collectively, results provide great insight into understanding the computational processes of different regions within the false memory network and further enhance our understanding of the role perceptual similarity plays in mediating false memories.

C128

FEATURES IN PRIOR NIGHT'S SLEEP RELATE TO THE NEURAL REPRESENTATION AND BEHAVIORAL MEASURES OF NEW MEMORIES

Emily Cowan[1], Anli Liu[2], Sanjeev Kothare[2], Orrin Devinsky[2], Lila Davachi[1]; [1]New York University, [2]NYU Langone School of Medicine — Systems memory consolidation theories posit that memories are stabilized as they become distributed throughout the cortex. Prior work has linked sleep architecture with successful memory consolidation, but relatively little is known about the role of a prior night's sleep on new encoding. Initial evidence shows specific features of sleep are related to post-nap learning, and that sleep deprivation has a detrimental effect on subsequent encoding. However, the aspects of a prior night's sleep architecture related to the neural representation and behavioral expression of subsequently encoded information remain unknown. To investigate this relationship, we designed a three-day experiment utilizing overnight measurements of polysomnography, fMRI, and behavior. Subjects were asked to encode sets of word-image pairs before sleeping overnight (Sleep List) and also upon waking the next morning (New List). Later that day, subjects restudied all word-image pairs in an fMRI scanner. Cued source recall was probed both immediately following the scan and after a 24-hour delay, providing a measure of memory across time. Analysis of fMRI data demonstrated a positive correlation between duration of Stage 2 sleep and univariate activity in ventromedial prefrontal cortex, hippocampus, and perirhinal cortex, specifically for the successfully recalled New List pairs. Activity in the medial temporal lobe regions significantly correlated only with immediate memory performance. These findings suggest duration of Stage 2 sleep may benefit encoding and the

immediate use of this information. Additional analyses will focus on the relationship between other oscillatory signals during sleep with the neural representation and behavioral expression of memory traces.

METHODS: Neuroimaging

C129

SPONTANEOUSLY ORGANIZED BRAIN STATES REVEALED BY DYNAMIC MULTIVARIATE PATTERN ANALYSIS OF RESTING STATE FMRI

Richard Chen[1], Kaustubh Kulkarni[1], Takuya Ito[1], Michael Cole[1]; [1]Rutgers, the State University of New Jersey - Newark — Resting state functional connectivity MRI is increasingly used to characterize functional networks in the human brain. We recently found that the resting state network architecture is present across a wide variety of tasks, suggesting the general functional relevance of resting state networks. This illustrates the importance of better understanding the processes underlying the organization of resting state neural activity. Recent literature has focused on resting state dynamics – variability in the structure of resting state activity across time. However, current methods use arbitrary temporal window lengths to characterize network configurations, despite rapid and variable transitions in spontaneous activity. Furthermore, we hypothesized that spontaneous dynamics are not restricted to functional connectivity changes – that they likely extend to distributed multivariate activation pattern changes as well. We therefore developed a dynamic multivariate pattern analysis (dMVPA) approach, based on the popular MVPA approach used for task neuroimaging, to characterize global brain state transitions during resting state with fMRI (functional MRI). This revealed rapid transitions across distinct but stable brain states. When observing non-contiguous time points we found that many of these multivariate patterns repeated across time (and across subjects), suggesting some brain states are spontaneously "revisited". In addition to increasing our understanding of resting state dynamics and brain state transitions, this approach may open possibilities for future research by bringing a powerful class of methods developed for task neuroimaging to investigate resting state neuroimaging data.

C130

FUNCTIONAL CONNECTIVITY-BASED PARCELLATION OF THE HUMAN FRONTAL POLE CORTEX

Sehyun Kong[1,2], Yoonjin Nah[2], Sanghoon Han[1,2]; [1]Department of Cognitive Science, Yonsei University, Seoul, Korea, [2]Department of Psychology, Yonsei University, Seoul, Korea — The frontal pole (FP, Brodmann area 10) of human brain has been known to be involved in higher order cognition, however, little is known about the subdivisions of the regions. We used resting-state functional magnetic resonance imaging (rsfMRI) of 33 subjects with unsupervised clustering methods for the parcellation based on intrinsic functional connectivity pattern between FP and all other AAL labeled whole-brain voxels. K-means clustering algorithm was applied to the distance measure (1 – the correlation between FP and all other AAL voxels) and performed parcellations of K clusters of voxels with similar connectivity profiles. In order to decide optimal K, we computed variation of information (VIs) by applying K (K = 2, 3, ...,10) to the randomly separated two groups and comparing one's K with the other's with the highest stability. Results showed that clusters from frontal pole cortex appear to have the direction of separation from medial to lateral with hemispheric symmetry. Positive and negative resting-state functional connectivity with these subdivisions as seeds revealed segmented patterns of networks involving different brain regions. To further investigate whether these clusters of frontopolar cortex are functionally heterogeneous regions, each cluster was adopted as region of interests (ROI) for various independent data set of task runs in which higher-order functions such as integration or joint consideration of intermediate decisions, comparison of relational judgments was manipulated across conditions. Extracted parameter estimates from the general linear models demonstrated that FP's parcellated subdivisions are also related to the levels of higher-order functional roles.

C131

WHEN THE GOING GETS TOUGH, THE LOW CHOLINERGIC STOP GOING: CHOLINERGIC GENETIC VARIATION AND RIGHT PREFRONTAL ACTIVATION, SIGNAL DETECTION, AND REAL-WORLD DISTRACTION.

Alexandria Caple[1], Ziyong Lin[1], Anne Berry[2], Martin Sarter[1], Randy D. Blakely[3], Cindy Lustig[1]; [1]University of Michigan, Ann Arbor, [2]Life Sciences Division, Lawrence Berkeley National Laboratory, Berkeley, [3]Vanderbilt University School of Medicine — Right middle/inferior frontal gyrus activation has been linked to "attentional effort", the motivated recruitment of attention and cognitive control. Parallel rodent and human studies suggest that cholinergic inputs to right PFC make a critical contribution to the increased activation seen in human fMRI studies during demands on attention (see Lustig & Sarter, in press, for a recent view). We previously reported that a genetic polymorphism thought to reduce cholinergic efficiency (Ile89Val variant of the presynaptic choline transporter gene, rs1013940) was associated with reduced right PFC activation during a perceptual-attentional challenge (Berry et al., 2015). Here we report secondary analyses more closely examining the relationship of right PFC activation and connectivity to behavior. In contrast to controls, Ile89Val participants failed to activate right PFC in response to a perceptual-attentional challenge. A sizable proportion (30%) showed a reverse effect, with less right PFC activation in the challenge condition than in the control condition. For Ile89Val participants, reduced or reversed right PFC activation was associated with reduced performance, specifically an increase in false alarms and in response-time variability during correct rejections. These results suggest that reduced cholinergic function and right PFC activation lead to a decrease in attentional effort in challenging conditions, and instead an increased reliance on bottom-up salience. Consistent with this hypothesis, reduced right PFC activation during the challenge condition also correlated with self-report measures of real-world distractibility. Ongoing analyses examine right PFC – parietal connectivity to test the hypothesis that these univariate results reflect reduced recruitment of parietal regions.

C132

COMPLEMENTARY DTI FINDINGS RELATED TO LEARNING AND MEMORY IMPAIRMENT IN SEPARATE MS AND TBI SAMPLES

Mark Zuppichini[1,2], Joshua Sandry[1,2,3], Kathy Chiou[1,3], Helen Genova[1,3], Nancy Chiaravalloti[1,3]; [1]Kessler Foundation, [2]Montclair State University, [3]Rutgers - New Jersey Medical School — Neurological insult results in negative consequences for cognitive functioning including difficulty learning and remembering new information. The aim of the present study is to use diffusion tensor imaging to investigate structural white matter differences related to learning and memory impairment. Specifically, we investigated whether there are common white matter differences in two memory-impaired populations; individuals with multiple sclerosis (N=30) and individuals with traumatic brain injury (N=16). Multiple sclerosis and traumatic brain injury participants were classified as either memory-impaired or memory-intact using the Open-Trial Selective Reminding Test, a neuropsychological assessment of learning and memory. The multiple sclerosis and traumatic brain injury samples remained separate for all analyses. Fractional anisotropy (FA) values were compared between memory-impaired and memory-intact participants in the multiple sclerosis and traumatic brain injury samples, respectively. Results revealed that participants with memory impairment from both clinical samples showed similar patterns of lower FA in the right anterior thalamic radiation, forceps major and forceps minor. These findings suggest there are common patterns of white matter involvement that are associated with learning and memory impairment in neurological patients.

C133

EVALUATING ATYPICAL PRESENTATIONS OF ALZHEIMER'S DISEASE WITH AMYLOID POSITRON EMISSION TOMOGRAPHY (PET) IMAGING AT AN ACADEMIC COGNITIVE NEUROLOGY CENTER

Julie Ciardullo[1], Effie Mitis[1], Heidi A Bender[1], Lale Kostakoglu[1], Josef Machac[1], Jane Martin[1], Margaret Sewell[1], Amy S Aloysi[1], Mariel B Deutsch[1], Clara Li[1], Mary Sano[1], Samuel Gandy[1]; [1]Mount Sinai Medical School — BACKGROUND: Positron emission tomography (PET) amyloid imaging is a newly-available

clinical tool for evaluating patients with cognitive impairment or dementia. Most importantly, amyloid imaging may improve certainty of etiology in situations where the differential diagnosis cannot be resolved on the basis of standard clinical and laboratory criteria. RESULTS: A case series of 54 consecutive patients (age 57-90; 30M, 24F) were evaluated at a cognitive center of a major urban academic medical center and referred for amyloid PET imaging as part of a comprehensive dementia workup. Evaluation included neurological examination and neuropsychological assessment by dementia experts. Amyloid PET scans were read by trained nuclear medicine physicians using the qualitative binary approach. Scans were rated as either positive or negative for the presence of cerebral amyloidosis. We compared clinical diagnosis with that of amyloid scan result. For purposes of this study, presentation was reported as either typical or atypical for Alzheimer's disease. Typical presentations were highly correlated with a positive amyloid scan. Of the 28 typical presentations, 24 patients (86%) had a positive amyloid scan. Even among the atypical presentations, positive amyloid scans were frequent. Of the 26 atypical presentations 12 (46%) had a positive amyloid scan. CONCLUSIONS: The development of clinical application of amyloid PET imaging has introduced a wide range of utilization challenges, from diagnostic interpretation to complex cost-benefit economic individual and public health policy decisions. Results suggest that amyloid PET imaging is especially helpful in diagnosing Alzheimer's disease when the presentation is atypical.

C134

COMPARATIVE RESTING-STATE MRI EFFECTIVE CONNECTIVITY IN AUTISM SPECTRUM DISORDER

Madelyn Glymour[1,2], Ruben Sanchez-Romero[1,2], Joseph D. Ramsey[1,2], Clark Glymour[1,2]; [1]Carnegie Mellon University, [2]Center for Causal Discovery, U.Pitt-CMU — Comparative functional connectivity studies between autism spectrum disorder (ASD) individuals and controls have focused on quantifying differences in correlation coefficients, network metrics, or topographies. In contrast, little work has been done in estimating effective connectivity to explore discrepancies in neuronal causal mechanisms underlying observed behavioral differences. To narrow this gap we study resting-state MRI effective connectivity with the causal search algorithm GES and its group-analysis version IMaGES together with non-Gaussian directionality rules, applied to two ASD datasets from the ABIDE project and 108 ROIs of the AAL atlas spanning the whole brain. Robustness tests were performed to assess the effect in the estimation of effective connections of three preprocessing procedures (spatial smoothing; FSL's cleaning tool FIX; and MNI normalization with spline interpolation) that may alter the joint distributions of ROIs from which causal information is inferred. Our tests show that combined use of smoothing and FIX produces highly robust connectivity graphs while the use of MNI normalization produced mixed results. Individual-level results show that within-group variability in connections and directions is consistently greater in ASD groups than in controls, in left-, right- and whole-brain networks. Group-level connectivity results show that control groups produce more robust graphs than ASD groups, reflecting the greater variability in effective connections of individuals with ASD. These results are consistent with previous studies, but add new and detailed causal connectivity information useful to better characterize relevant differences in neuronal mechanisms underlying ASD behaviors.

C135

IDENTIFYING LATENT SEMANTIC GROUPS OF STUDIES AND THEIR CORRESPONDING BRAIN REGIONS FROM THE NEUROSYNTH DATABASE

Fahd Alhazmi[1], Derek Beaton[1], Hervé Abdi[1]; [1]The University of Texas at Dallas — In recent years, numerous meta-analytic and data basing resources for neuroimaging literature have been created. Typically, these resources—such as NeuroSynth—relate studies' topics to their corresponding brain regions. Our aims in this work were to (1) reveal the latent semantic structure of the neuroimaging literature, (2) identify semantically defined domains within the literature, and (3) illustrate brain regions most associated with these domains. To do so, we used Correspondence Analysis (CA)—which generalizes principal components analysis to categorical data and counts—on the NeuroSynth database. After preprocessing, the data were co-occurrences between 10,898 studies and 3,163 keywords (from abstracts). CA identified 3 reliable components via split-half resampling. Next, we identified 10 reliable word clusters (via factor scores) that regrouped the words similarly used across studies. Cluster centers were then used as fixed points to assign studies (i.e., using k-nearest neighbors). Finally, we identified—from our groups of studies—the voxels selectively associated with each group. Here, we highlight two of those clusters: (1) the "fear, reward, addiction, pharmacology, and punishment" word cluster, which was associated with striatal regions on Components 1 and 2, and thalamus, insula, and cingulate cortex on Component 3, and (2) the "gray and white matter structural imaging in neuro-pathology and -development" word cluster, which was associated with the striatum, left amygdala, and cingulate for Component 1, thalamus, insula, striatum, and medial temporal lobes for Component 2, and posterior and anterior cingulate, hippocampus, and other subcortical structures for Component 3.

C136

CORTICAL NETWORK EFFICIENCY UNDERLIES INDIVIDUAL DIFFERENCES IN VISUAL PROCESSING SPEED

Lyndahl Himes[1], Nicholas Hubbard[1], Monroe Turner[1], Bart Rypma[1,2]; [1]University of Texas at Dallas, [2]University of Texas Southwestern Medical Center — Previous work has shown that neural activation efficiency benefits cognitive task performance. Less is known regarding whether neural network efficiency similarly benefits performance. We investigated whether network efficiency, measured by functional connection density, changed from rest to a visual processing-speed task (the digit-symbol substitution task; DSST). Further, we assessed whether such connection-density changes could predict individual differences in visual processing speed. Nineteen healthy adults (ages 21-66; Mean = 43.53) underwent fMRI at rest and during DSST performance. Whole-brain, voxel-wise analyses were used to calculate node degree (i.e., the number of connections) of each voxel during rest and DSST. Density-change percentage was calculated from rest to DSST. Voxel-wise analysis showed significantly higher connection density at rest than during DSST performance throughout the brain (all ps < .05). However, voxels within the occipito-parietal dorsal visual system were hyper-connected compared to other regions during DSST. Next, we assessed where these hyper-connected voxels were connected. Seed-based analyses showed connectivity increases during DSST only for inter-connections within dorsal visual system. Individual differences in DSST processing speed were also mapped onto average DSST vs. rest node degree maps. Increases in node degree from rest to DSST in prefrontal, temporal, and parietal nodes predicted slower processing speed. These results suggest that connectivity within a brain-wide network becomes largely specialized during visual processing. Increases in the efficiency of these connections might underlie greater cognitive efficiency.

C137

EVALUATING THE IMPACT OF SCAN STATE ON THE RELIABILITY OF INTER-INDIVIDUAL DIFFERENCES IN FULL-BRAIN FUNCTIONAL CONNECTIVITY

David O'Connor[1,2], Natan Vega Potler[1], Tamara Vanderwal[3], Lucas Parra[4], Samantha Cohen[4], Satrajit Ghosh[5], Jasmine Escalera[1], Natalie Grant-Villegas[1], Yael Osman[1], Megan Kovacs[1], Cameron Craddock[1,2], Michael Milham[1,2]; [1]Child Mind Institute Healthy Brain Network, New York, [2]Nathan Kline Institute, Orangeburg, New York, [3]Yale University, New Haven, Connecticut, [4]City College of New York, New York, [5]Massachusetts Institute of Technology, Cambridge, Massachusetts — FMRI is a powerful tool for mapping functional interactions within the human connectome. However, the optimal state to acquire reliable data from individuals remains unclear given factors such as participant compliance and cognitive load. To this end, a growing number of scan conditions are being suggested, ranging from task-free rest to active task performance. Intermediate to these are naturalistic viewing paradigms, which can either be highly engaging movies or sequences of abstract shapes (e.g. "Inscapes"). These states appear to reduce scanner motion and increase tolerability, relative to the more popular task-free resting state. While clear consensus exists regarding the presence of systematic differences between states, it is not clear how much they impact the detection of inter-individual differences in full-brain connectivity patterns. In preparation for the Child Mind Institute Healthy Brain Network, a large-scale multimodal data acquisition focused on child mental health, the present work aims to evaluate the impact of four scan states on inter-individual differences in full-brain (200-unit) functional connectivity patterns (ages 18-45). Community-recruited adults are being scanned 12 separate times

under the following conditions: rest, Inscapes, movie excerpts, and flanker task. Among the 12 sessions, each of 3 movies, Inscapes, or flanker task trial orders repeat 4 times. Initial results from 5 participants found significantly greater similarity of connectivity matrices obtained from the same individual (mean r=0.659;SD=0.123), regardless of acquisition condition, relative to those obtained from differing individuals (mean r=0.466;SD=0.044) – even when matched for condition. All data generated in the present initiative will be openly shared.

PERCEPTION & ACTION: Audition

C138

LISTENING TO 'WOB WOB' AND 'WAH WAH' - THE EFFECTS OF EXPERTISE IN BEAT BOXING AND GUITAR PLAYING ON PERCEPTION NETWORKS.

Sophie Scott[1], Saloni Krishan[1], Cesar Lima[1], Tom Manly[1], Samuel Evans[1], Harry Yeff[2]; [1]Institute of Cognitive Neuroscience, UCL, London, [2]Get Involved LTD — Multiple fMRI studies have shown that motor areas are activated when passively listening to speech or music. Yet, it is unclear whether this activation is shaped by previous auditory-motor learning. We study beatboxers and guitarists to explore whether their distinct motor experiences lead to separable profiles of neural activation when listening. The groups are selected for their selective motor expertise - while playing the guitar involves skilled hand movements, beatboxing involves complex manipulation of the vocal tract. We scanned 20 guitarists, 20 beatboxers and 20 non-musicians in a 1.5T scanner (sparse acquisition, TR = 9.5s; TA = 3.4s) as they listened to technically demanding guitar and beatboxing excerpts. Results revealed expertise-related activation in guitarists and beatboxers in bilateral precentral and inferior frontal gyri, inferior parietal lobules and supplementary motor areas when listening to music. Beatboxers showed greater activation in these areas when listening to beatboxing relative to guitar pieces; guitarists showed the opposite pattern. Non-musicians did not show increased activation in either condition. These findings clearly indicate that auditory-motor experience influences neural activation for listening, and that some neural markers of expertise during listening generalise over these different auditory-motor experiences.

C139

NEURAL RESPONSES DURING MOVEMENT WITH AUDITORY RHYTHMS

Caroline Palmer[1], Brian Mathias[1], Anna Zamm[1], Bernhard Ross[2]; [1]McGill University, [2]Rotman Research Institute, University of Toronto — Auditory-motor synchronization tasks (such as tapping to a beat) involve both auditory and sensorimotor neural networks. Electrophysiologically-recorded steady-state evoked potentials have shown enhanced amplitudes at specific stimulus frequencies during listening and tapping to external rhythms. We attempted to distinguish neural responses to percepts and actions during an auditory synchronization task, and to compare them with behavioral synchronization measures. Neural responses during Synchronization were compared with those during Listen-only (no movement, same stimulus) and Motor-only (no stimulus, same movement) tasks. Twenty-five right-handed musicians tapped to a rhythmically regular stimulus as their electroencephalogram (EEG) was recorded. The Synchronization stimuli varied in rhythmic complexity from low complexity (stimulus-to-tap ratio of 1:1) to moderate (1:2) and high complexity (3:2); thus, the tapping frequency was held constant while the stimulus rate varied. Participants synchronized with the stimulus (Synchronize), listened to the same stimulus rhythms (Listen-only) and detected occasional missing beats, or tapped at the same rate (Motor-only). As the rhythmic complexity increased across conditions, behavioral asynchrony (measured as tap onset minus stimulus onset times) increased, and peak amplitudes in the EEG power spectra at tap frequencies decreased. The Synchronize condition elicited greater ssEP peak amplitudes than Listen-only and Motor-only conditions at both stimulus and tap frequencies. Individuals' entrainment strength in low complexity (1:1) was predictive of their entrainment in high complexity (1:2, 2:3) rhythms. An additional ssEP component emerged in the 3:2 condition at unique frequency where stimulus and taps aligned, suggesting neural interactions between auditory and sensorimotor networks during auditory-motor synchronization.

C140

CORTICAL MECHANISMS OF AUDITORY-VOCAL INTEGRATION IN PARKINSON'S DISEASE

Hanjun Liu[1], Xi Chen[1], Xiyan Huang[1], Nan Yan[2], Emily Wang[3]; [1]The First Affiliated Hospital of Sun Yat-sen University, [2]Shenzhen Institutes of Advanced Technology at Chinese Academy of Sciences, [3]RUSH University Medical Center — Motor speech disorders are highly common in individuals with Parkinson's disease (PD). The underlying mechanisms, however, remain poorly understood. Our goal is to examine the integration of auditory and vocal motor systems for speech motor control in PD. In the present event-related potential (ERP) study, 18 individuals with PD and 18 healthy controls were exposed to frequency-altered feedback (FAF) (-200 cents) while producing a sustained vowel and listening to the playback of self-produced vocal production. Behavioral results revealed that individuals with PD produced significantly larger vocal compensation for pitch feedback errors than healthy controls, and exhibited a significant correlation between vocal response magnitude and the baseline voice variability. At the cortical level, larger P2 responses were observed for individuals with PD as compared to healthy controls. In the sLORERA analysis, this effect was due to enhanced activity in superior, middle, and inferior frontal gyrus, inferior parietal lobule, and superior temporal gyrus. Individuals with PD also exhibited larger P2 responses during speaking vs. listening, which was due to enhanced activity in inferior frontal gyrus, precental gyrus, postcentral gyrus, and middle temporal gryus. This enhanced effect, however, was not observed for healthy controls. These findings demonstrate that individuals with PD are associated with abnormal auditory-vocal integration for voice control at the levels of behavior and cortex, which may be caused by their deficits in the detection/correction of errors in voice auditory feedback.

C141

NEURAL CORRELATES OF ENDOGENOUS RHYTHMS IN PERFORMING MUSICIANS

Anna Zamm[1], Caroline Palmer[1], Anna-Katharina R. Bauer[2], Martin G. Bleichner[2], Alexander P. Demos[1,3], Stefan Debener[2,4]; [1]McGill University, [2]University of Oldenburg, [3]University of Illinois at Chicago, [4]Cluster of Excellence Hearing4all — Rhythmic behaviours, from circadian sleep-wake cycles to solo music performance, are often characterized by endogenous rhythms: intrinsic periodicities that occur in the absence of external stimuli. We address the neural mechanisms that support endogenous rhythms in self-paced music performance, a naturally rhythmic behavior for which humans show a wide range of endogenous frequencies. Previous evidence suggests that exogenous (externally paced) timing is supported by cortical oscillations that respond to frequencies of external stimuli. We investigate whether endogenous rhythms are characterized by cortical oscillations at the frequency of one's own behavior. Forty skilled pianists completed a self -paced piano performance task in which they continuously performed a melody at a comfortable rate while electroencephalography (EEG) was recorded. Each pianist's endogenous rhythms were assessed in terms of their solo performance rate (number of tone onsets per second). Cortical oscillations were assessed by computing EEG power spectra at each channel from the pianists' performances. The pianists' individual spectra were normalized relative to a fixed window surrounding each pianist's endogenous frequency, to allow comparison of spectral power associated with different performance rates. A significant spectral peak was found at the frequency of the solo rate across channels , with maximal power at fronto-central channels. Further analyses showed that the observed scalp distribution could not be accounted for solely by head movement or other motion artefacts. This finding provides the first evidence that production of endogenous rhythms is supported by increased power of cortical oscillations corresponding to the frequencies of each musician's performance.

C142

THE EFFECTS OF STROKE ON CENTRAL AUDITORY PROCESSING ABILITIES IN CHRONIC STROKE PATIENTS

Claudia Freigang[1], Kie Honjo[2,3], Takako Fujioka[4], Joyce Chen[2,3,5], Sandra Black[2,3,5], Bernhard Ross[1,5]; [1]Rotman Research Institute, Baycrest, Toronto, ON, Canada, [2]Sunnybrook Research Institute, Toronto, ON,Canada, [3]HSF Canadian Partnership for Stroke Recovery, Toronto, ON, Canada, [4]Department of Music and Stanford Neu-

roscience Institute, Stanford University, California, USA, [5]University of Toronto, Toronto, ON, Canada — Stroke affects a large number of elderly people, and is a major cause for adult disability. To help stroke patients return to an independent lifestyle, patients need to actively participate in interventions. This requires patients to be able to understand speech in noisy environments that may occur during therapy. Unfortunately, hearing is not routinely assessed in stroke patients, and thus the relationship between central auditory processing (CAP) and stroke is not clear. Additionally, undetected CAP deficits may also add to primary effects of stroke on cognitive function. In our present study, we investigated CAP in chronic stroke patients with motor impairment in the upper limb. We hypothesized that hearing sensitivity alone does not predict CAP. To test our hypothesis, we recorded magnetoencephalography to complex acoustic stimuli in 28 chronic stroke patients (18 right-hemispheric, 2 cerebellar, 8 left-hemispheric lesions) with clinically normal audiograms. In our analysis, we focused on the evaluation of the event-related fields (ERF) P1m, N1m, and P2m, which are thought to represent distinct processing steps in integrating sound information in auditory cortex. In six patients with normal symmetric hearing thresholds only one auditory cortex was functional. In patients with bilaterally functional auditory cortices, ERFs amplitudes and latencies differed between hemispheres. Most importantly, this study shows that stroke can affect the functionality of the central auditory system, and that an audiogram is not sufficient to evaluate CAP. Our results highlight the importance of assessing CAP after a stroke, and they reveal the need to systematically assess this relationship further.

C143

TRANSCRANIAL ALTERNATING CURRENT STIMULATION BENEFIT DEPENDS ON SPECTRO-TEMPORAL COMPLEXITY OF SOUNDS

Anna Wilsch[1], Toralf Neuling[3], Christoph S. Herrmann[1,2]; [1]Department of Psychology, Cluster of Excellence "Hearing4all", European Medical School, Carl von Ossietzky University, Oldenburg, Germany, [2]Research Center Neurosensory Science, Carl von Ossietzky University, Oldenburg, Germany, [3]Department of Psychology, University of Salzburg, Salzburg, Austria — Entrainment of neural responses to the spectro-temporal features of auditory information is crucial for successful auditory perception. Auditory stimuli can vary in their spectro-temporal complexity and so does the concomitantly entrained neural response. For example, detection of low-complex auditory sounds depends on the neural phase in auditory cortex entrained to a sinusoidal signal. Intelligibility of more complex signals such as speech depends on the entrainment of neural oscillations in auditory cortex to the more complex spectro-temporal features of the acoustic signal. Besides perceptually evoked neural entrainment, transcranial alternating current stimulation (tACS) entrains neural oscillations by applying an electric signal to the brain. Accordingly, tACS-induced neural entrainment in auditory cortex has been shown to improve auditory perception. However, it is unclear in how far tACS-induced entrainment modulates perception of auditory signals with increasing/varying spectro-temporal complexity. Therefore, we applied tACS while presenting auditory stimuli of different spectro-temporal complexity. Complexity varied from low-complex sounds (e.g., pure tones) to medium-complex sounds (e.g., speech-like amplitude modulation) to high-complex sounds (e.g., real speech). The tACS signal was aligned with the stimuli's spectro-temporal features. Our results show that tACS improves auditory perception of stimuli with low spectro-temporal complexity. Perception of high-complex speech stimuli is not affected by tACS. Thus, tACS-induced neural entrainment appears to be beneficial for the perception of low-complex auditory stimuli. However, with increasing spectro-temporal complexity, tACS-induced entrainment to the spectro-temporal features of the stimulus might not be sufficient to improve stimulus perception. The tACS benefit seems to depend on spectro-temporal complexity of sounds.

C144

A NEW FRAMEWORK TO INVESTIGATE HEMISPHERIC ASYMMETRIES IN SPEECH

Adeen Flinker[1], David Poeppel[1,2]; [1]New York University, New York, USA, [2]Max Planck Institute for Empirical Aesthetics, Frankfurt, Germany — The left and right hemispheres have been argued to have different sensitivities to temporal and spectral auditory information, but the underlying cortical mechanisms remain unknown. Two related models posit that asymmetries arise from a relative difference in temporal integration windows (i.e. AST, Poeppel 2003) or a difference in spectral versus temporal resolution (i.e. Zatorre et al. 2002). Here we examine a unifying scheme based on the modulation power spectrum (MPS) of speech, providing a novel framework to parametrically manipulate speech stimuli and test psychophysical and neurophysiological responses. In contrast with a spectrogram, which represents the signal's amplitude across time and frequency, the MPS is a second order representation that assesses how the time-frequency power is modulated across the spectral and temporal axes. We propose that the two hemispheres integrate different ranges of spectral and temporal modulations. In order to address this hypothesis, we implemented a new filtering technique and varied the degree of spectral and temporal modulations in the signal to produce new sentences materials. We characterized the modulation space as a function of intelligibility as well as pitch (here: gender) identification. Neurophysiological responses (MEG power 0.1-8 Hz) across sensors correlated significantly with the temporal and spectral modulation space. The spatial distribution of sensors was more left lateralized for the temporal modulation axis and more right lateralized for the spectral modulation axis. Behaviorally, the fine-graded parametric steps reveal a sharp intelligibility cutoff, a right ear dichotic advantage as well as an influence of spectral modulation on pitch perception.

C145

PERCEPTUAL ASYMMETRY ASSOCIATED WITH P3 AMPLITUDE DURING ROVING AUDITORY SEQUENTIAL SEARCH.

Elizabeth G Blundon[1], Samuel P Rumak[1], Lawrence M Ward[1,2]; [1]University of British Columbia, [2]UBC Brain Research Centre — Previously, we observed asymmetry in auditory and visual sequential search using oddball stimuli. Consistent with simultaneous search asymmetry (e.g., Treisman), RT and P300 latencies were shorter to oddball targets (20%) that contained a feature that standards (80%) did not (feature-present) than to targets that lacked a feature that standards had (feature-absent). Although parallel search for popout targets was ruled out by the serial nature of the task, it remained unclear whether the asymmetry arose from perceptual or attention processes, as a diffuse attention strategy could still have been used for feature-present targets. The present study aimed to uncover the locus of the effect by forcing participants to apply a single focused-attention strategy to detect both feature-present and feature-absent targets. Participants identified rare targets consisting of two different types of five-tone runs: flat runs (five identical pure tones, feature-absent when targets) and change runs (four identical tones plus a different-frequency fifth, feature-present when targets). The base acoustic frequency varied (roved) so that no specific tone frequency differentiated the target, forcing the use of focused attention in both conditions. RT and P300 latencies were not different between conditions but accuracy and P300 amplitude were greater for feature-present than for feature-absent targets. This suggests that perceptual asymmetry persisted, but the reduced salience of the unique feature in the feature-present condition eliminated the RT and P300 latency asymmetry. The perceptual asymmetry manifests as RT and P300 latency differences only when targets contain a rare, salient, unpredictable feature that elicits a substantial P3a subcomponent.

C146

DIFFERENCES IN T-COMPLEX MEASURES OF VOWEL SOUNDS IN BILINGUAL AND MONOLINGUAL SCHOOL-AGED CHILDREN

Hia Datta[1], Arild Hestvik[2], Valerie Shafer[3]; [1]Molloy College, [2]University of Delaware, [3]The Graduate Center, City University of New York — The T-complex is a series of negative-positive-negative (Na, Ta, Tb) responses to auditory stimuli such as tones and speech that peak between 70-140 ms in adults. They are measured at lateral sites T7 and T8 and indexes the maturation of auditory cortex (Tonnquist-Uhlen et al., 2003; Shafer, Yu & Wagner, 2014). The goal of this study was to examine if the nature of language experience in school-aged children impacts the amplitudes and/or the latencies of the peaks within the T-complex as well. Fifteen English-speaking monolingual and 15 Spanish-English-speaking bilingual children, 8-10 years of age were participants in the study. They listened to repetitions of a 50 ms-long English vowel [ɛ] sound while Event Related Potentials (ERPs) were recorded from 64-channels via the Geodesic system. All bilingual participants were exposed to both Spanish and English prior to 5 years of age. Overall, results suggested that the T-complex in the right hemisphere was more stable than

that in the left hemisphere. Na was the most robust peak for both groups appearing 100% of the time in T8. The amplitudes and latencies of Na, Ta and Tb for both language groups were extremely similar. However, the bilingual children demonstrated a much higher variability in their latencies of the Na-Ta-Tb peaks than the monolingual children, particularly in the left hemisphere. This suggests that differences in amounts of English/Spanish language use modulates the auditory cortex as well, impacting early even auditory evoked potentials such as the T-complex.

C147

EARLY AND ASYMMETRIC SENSITIVITY TO PHONOLOGICAL BOUNDARIES AND WITHIN-CATEGORY VARIATION ACROSS HEMISPHERES

Laura Gwilliams[1,2], Tal Linzen[1], Kyriaki Neophytou[2], Lena Warnke[1], David Poeppel[1,3], Alec Marantz[1,2]; [1]New York University, [2]NYUAD Institute, [3]Max-Planck-Institute, Frankfurt — Speech processing requires mapping continuously variant acoustic signals to discrete phonological categories. Previous studies suggest that this is achieved through the identification of phonetic features and neutralisation of within-category variance by ~100ms after phoneme onset. What happens, however, when a sound is consistent with more than one category? 22 native English speakers performed forced-choice consonant identification on consonant-vowel syllables during magnetoencephalography data acquisition. Stimuli were natural speech pairs, digitally morphed to span an 11-step continuum of voice onset times (VOT; p-b, t-d, k-g) and places of articulation (PoA; p-t, t-k). The behavioural results replicated previous findings: Consonant selection was sharply categorical, and reaction-times increased at the boundary between phonological categories. Activity in left (but not right) Heschl's gyrus increased with proximity to the phoneme boundary ~50ms post-onset, mirroring reaction-time data and suggesting that phonological categories are relevant to speech processing earlier than previously considered. Amplitude of the left M100 increased as VOT decreased, and was modulated by categorical PoA: bilabial stops (/b/, /p/) elicited more activity than alveolar and velar stops. Peak latency of the right M100 corresponded to participants' binary classification of the VOT continuum: latency was shorter for stimuli identified as voiceless (~110ms) than voiced (~125ms), and displayed no sensitivity to PoA or within-category variation. The data suggest that (1) neural sensitivity to categorical ambiguity in left Heschl's gyrus can be observed before the time-window previously thought to reflect phonetic feature identification; (2) phonological discretisation evokes bilateral responses, but with a differential sensitivity and temporal profile across hemispheres.

PERCEPTION & ACTION: Vision

C148

VISUAL PROCESSING ABNORMALITIES IN LOW-FUNCTIONING INDIVIDUALS WITH AUTISM MAY NOT BE DUE TO LOW-LEVEL DEFICITS: A VISUAL EVOKED POTENTIAL/SPECTRAL ANALYSIS STUDY

Kyongje Sung[1], Barry Gordon[1]; [1]The Johns Hopkins University School of Medicine — While it is generally accepted that sensory processing is often abnormal in individuals with autism, the evidential basis for this conclusion is actually inconclusive. Studies have been limited by great inter-individual variability, and their generalizability questionable due to their exclusion of low-functioning individuals with autism (LFA). We investigated the visual-evoked potential (VEP) at Oz, responding to a 100msec presentation of a checkerboard stimulus during the course of shape discrimination trials. Subjects were six low-functioning individuals with autism (LFA), five high-functioning individuals with autism (HFA), and six normal controls (NC). Artifacts were cleaned using Independent Component Analysis (ICA). Results: As a group, LFA showed significantly reduced P2 amplitude and delayed peak latency, compared to NC and HFA. There was a tendency for faster peak latency of P1 in the LFA, but with great individual variability. HFA fell in between NC and LFA in VEP statistics. Importantly, NC and HFA showed significantly enhanced theta (4-7Hz) and beta (14-30Hz) band activities and reduced alpha (8-13Hz) after stimulus onset. LFA showed no sign of alpha reduction and no beta enhancement. Individually, NC and HFA participants showed a consistent pattern of VEP and power spectra that matched their group averages. LFA demonstrated great variability in those measures. Our results are more consistent with a deficit in the triggering of higher-level perceptual and attentional processes in LFA than they are with a low-level sensory deficit as has generally been assumed by the sensory deficit theory of autism.

C149

ACQUIRED CROWDING DYSLEXIA

Roberta Daini[1,2], Emanuela Bricolo[1,2], Andrea Albonico[1,2], Manuela Malaspina[1,2], Lisa Arduino[3,4], Marialuisa Martelli[5,6]; [1]Università di Milano-Bicocca, Milan, Italy, [2]Milan Centre for Neuroscience, Milan, Italy, [3]LUMSA University, Rome, Italy, [4]ISTC-CNR, Rome, Italy, [5]Sapienza University of Rome, Rome, Italy, [6]Neuropsychology Unit, IRCCS Fondazione Santa Lucia, Rome, Italy — Martelli et al (2011) suggested that error type analysis of the reading impairment after right brain damage is diagnostic for the mechanisms involved. Letter substitution errors may, indeed, relate to a difficulty in segregating letters. In fact, increasing letter spacing restores recognition. This is related to crowding, a psychophysical phenomenon that characterizes normal periphery, where letters are unrecognizable because surrounded by nearby letters. Here we tested the hypothesis that a specific type of acquired dyslexia, mainly characterized by substitution errors, involves the same mechanisms underlying crowding, i.e. is an acquired crowding dyslexia. To this aim we selected ten right brain damaged patients, who failed in reading single words and pseudowords. Patients' eye movement behaviour was recorded and compared with that obtained by ten neurologically healthy participants. Three experiments (i.e. visual pursuit, text reading, spaced and unspaced pseudowords reading) were conducted. Three out of ten patients, one with and two without unilateral spatial neglect, 1) showed a majority of reading substitution errors; 2) were sensitive to letter spacing, reducing the number of errors by increasing letter spacing; 3) showed preserved eye movements in a visual pursuit task; 4) showed a lower number and a higher fixation duration of than controls, consistent with the effect of crowding on eye-movements (Bricolo et al, 2015). We conclude that the reading errors of patients that substitute letters are due to crowding. We speculate that the effect might depend on attentional difficulties needed to define the optimal fields of integration for letter identification.

C150

THE EFFECT OF RTMS OVER RIGHT PARIETAL CORTEX ON RESTING-STATE EEG OSCILLATORY DYNAMICS

Silvia Savazzi[1], Chiara Bagattini[2], Sonia Mele[3], Paolo Manganotti[1], Javier Sanchez Lopez[1], Chiara Mazzi[1]; [1]University of Verona, Italy, [2]IRCCS Centro San Giovanni di Dio Fatebenefratelli, Brescia, Italy, [3]University of Ferrara, Italy — A significant reduction of cortical excitability was recently shown following low-frequency (1Hz) rTMS over right posterior parietal cortex (rPPC). This effect was found both underneath the stimulated site and in the interconnected contralateral homologous areas. The present study aims at testing whether the same protocol affects the cortico-cortical functional coupling at rest by measuring coherence among areas. Two min of resting state EEG were recorded in 14 healthy participants before and after 30 min of rTMS at 1 Hz (or sham stimulation) over the rPPC (electrode position P6). Real stimulation was performed at 90% of motor threshold. Coherence was calculated considering the three nearest electrodes to the stimulated site (i.e. P4, P8, and CP6) with all pairwise combinations with the remaining EEG channels by using bootstrap statistical methods. Frequency bands analyzed were delta (0.5–4Hz), theta (4–8Hz), alpha (8–12Hz), low beta (12–20Hz), high beta (20–30Hz) and gamma (30–50Hz). Coherence analyses suggest a greater functional coupling of rPPC with right frontal sites reflecting the activation of the fronto-parietal network within the right hemisphere. Importantly, rTMS enhanced coherence between rPPC and contralateral homologous sites. These changes were most prominent in theta, alpha and beta frequency bands. Summarizing, results confirmed the neuromodulatory effects of rTMS enhancing cortico-cortical inter- and intra-hemispheric connectivity along circumscribed functional networks as measured by the enhancement in coherence among these areas. Moreover, the present results further confirm previous evidence indicating that the increase of coherence values is related to inhibitory effects of rTMS.

C151

THE P3B COMPONENT OF THE EVENT-RELATED POTENTIAL REFLECTS THE SUBITIZING / COUNTING DISTINCTION IN NUMEROSITY PERCEPTION

Mark Schmidt[1]; [1]Columbus State University — Subitizing and non-verbal counting are mechanisms proposed for numerosity perception of small item sets. Subitizing (1-3 items) is fast and accurate; non-verbal counting (4-6 items) is systematically slower and less accurate. The P3b component of the event-related potential (ERP) is a large positive deflection with onset / offset latencies 300 - 900 ms post-stimulus and maximum amplitude over Pz. P3b amplitude and latency are thought to reflect aspects of stimulus processing, with large amplitudes associated with better discrimination, and short latencies associated with faster evaluation time. In the current study, it was predicted that P3b amplitude and latency would reflect the distinction between subitizing and non-verbal counting typically seen with accuracy and response time measures. ERPs were recorded at Pz, Cz, Fz in response to briefly presented dot displays varying in numerosity (1-7). Dots were presented for 150 ms in six "odd-ball" tasks in which target numerosity (1-6) occurred on 14% of trials. Participants (N=12) responded by pressing one of two buttons (target / non-target) and were instructed to emphasize accuracy and speed in responding. P3b difference waves (DW) were obtained from target and non-target waveforms at Pz and the jackknife-based scoring method was used to compare DW amplitude and latency across target numerosities. Larger P3b amplitudes and shorter P3b latencies were found in the subitizing range compared with the non-verbal counting range. These results extend previous findings on the subitizing / counting distinction, and provide additional support for P3b as a measure of stimulus discrimination and evaluation time.

C152

DISTRIBUTED NEURAL REPRESENTATIONS FOR VISUAL CATEGORIES

Zarrar Shehzad[1], Gregory McCarthy[1]; [1]Yale University — Neural representations of visual categories such as faces are found in ventral visual cortex. Here, we examine whether category information within ventral cortex is localized or distributed. We measured trial-by-trial activity using fMRI (N=20) for visual stimuli from four categories (faces, letters, fruits, vehicles). Our analyses focused on six category-selective regions: right fusiform-face area (FFA), left/right parahippocampal place area (PPA), left/right lateral occipital complex (LOC), and left visual word form area (VWF). We selected voxels whose patterns of activity predicted visual categories using a regularized regression (elastic-net), which controls for redundant information between brain areas by removing correlated and/or uninformative voxels. First, when considering activity patterns in each region separately, we found significant category classification in each region ($p<0.05$; mean accuracy 34%, chance 25%) except L PPA ($p=0.06$; accuracy 31%). Second, we combined the five significant regions into one model and eliminated uninformative regions to find those with unique category information. We found a subset of three regions (R FFA, R PPA, L VWF) that together best-predicted category membership (accuracy 45%). For each category, classification accuracy for this model was significantly greater than in any individual-region model or an all-region model. Finally, using the three-region model, we found: 32% of voxels did not predict any category, 33% of voxels predicted only one category, and 34% of voxels predicted two or more categories. Thus, our results show a distributed subset of voxels in three regions (not just one region or across all regions) best predicts category representations in the ventral cortex.

C153

VISUAL TRAINING IMPROVES PERCEPTUAL GROUPING BASED ON BASIC STIMULUS FEATURES

Daniel Kurylo[1], Richard Waxman[2], Steven M. Silverstein[3], Rachel Kidron[2]; [1]Brooklyn College CUNY, [2]Touro College, [3]Rutgers University — Training on perceptual tasks has been shown to improve performance on basic visual and auditory capacities over time. Such improvement has been linked to changes in connectivity among mediating neurons. We investigated whether similar training effects occur for perceptual grouping, in which components of visual stimuli are perceptually integrated. It was hypothesized that repeated engagement of integration mechanisms will strengthen connections among associated units, thereby enhancing grouping processes. Participants underwent 15 sessions of training on a visual discrimination task that required perceptual grouping. Four stimulus dimensions were trained, in which grouping was based on similarity in luminance, color, orientation, and motion. Psychophysical thresholds of grouping were assessed before and after training. Results indicate that performance in all four dimensions improved with training. Training on a control condition, which paralleled the discrimination task but without a grouping component, produced no improvement. In addition, training on only the luminance and orientation dimensions improved performance for those stimuli as well as color, on which training had not occurred. However, improvement from partial training did not generalized to motion. Results demonstrate that a training protocol emphasizing stimulus integration enhanced perceptual grouping. Further, neural mechanisms mediating grouping by common luminance and/or orientation contribute to those mediating grouping by color, but do not share resources for grouping by common motion.

C154

THE NEURAL REPRESENTATION OF OBJECTS FORMED THROUGH THE SPATIOTEMPORAL INTEGRATION OF VISUAL TRANSIENTS.

Gideon Caplovitz[1], Gennady Erlikhman[1], Gennadiy Gurariy[1], Ryan Mruczek[1,2]; [1]University of Nevada Reno, [2]Worcester State University — Oftentimes, objects are only partially and transiently visible as parts of them become occluded during observer or object motion. The visual system can integrate such object fragments across space and time into perceptual wholes or spatiotemporal objects. This integrative and dynamic process may involve both ventral and dorsal visual processing pathways, along which shape and spatial representations are thought to arise. We measured fMRI BOLD response to spatiotemporal objects and used multi-voxel pattern analysis (MVPA) to decode shape information across 20 topographic regions of visual cortex. Surprisingly, object identity could be decoded throughout visual cortex, including intermediate (V3A, V3B, hV4, LO1-2,) and dorsal (TO1-2, and IPS0-1) visual areas. Shape-specific information, therefore, may not be limited to early and ventral visual areas, particularly when it is dynamic and must be integrated. Contrary to the classic view that the representation of objects is the purview of the ventral stream, intermediate and dorsal areas may play a distinct and critical role in the construction of object representations across space and time.

C155

ACTION EXPECTANCY GENERATION DURING EVENT COMPREHENSION IN SEQUENTIAL IMAGES

Neil Cohn[1], Martin Paczynski[2], Marta Kutas[1]; [1]University of California, San Diego, [2]George Mason University — Research has shown precursors to the neural activation associated with viewing action events (1). We hypothesized (2) that such pre-activation indexes expectancies generated for discrete actions (throwing a ball, punching) from viewing preparatory postures (e.g., reaching back an arm to throw or punch) leading to the culminating action. Participants' event-related brain potentials (ERPs) were recorded for viewing action sequences in wordless comic strips. We expected greater processing of action preparatory agent panels (ex. reaching back an arm to punch) than those with non-preparatory agents (ex. arm to the side) or patients (receiver of actions), given the additional pre-processing of event structures. We expected the inverse costs for processing completed action panels (ex. agent punching patient). In Experiment 1, preparatory agents elicited a greater frontal positivity (600-900ms) than either non-preparatory agents or patients, whereas completed actions panels in preparatory agent strips elicited an attenuated frontal negativity, compared to those with the other agent condition. Experiment 2 inserted a blank panel just prior to the completed action, aimed at disrupting the action expectancy generation. A left central negativity (300-900ms) was elicited by blank images in strips with preparatory agents compared to those with non-preparatory agents. As this negativity preceded the completed action, we take it to reflect the disruption of an action expectancy generated by preparatory postures. Taken together, these results indicate that the processing of completed actions ultimately benefits from pre-processing and expectancies generated from preparatory postures. (1) Zacks, et al. Nature Neuroscience 2001. (2) Cohn & Paczynski. Cognitive Psychology 2013.

C156

SURPRISE SPREADS ACROSS DIFFERENT FEATURES OF AN OBJECT TO FORM OBJECT-LEVEL EXPECTATION IN VISUAL COGNITION

Jiefeng Jiang[1], Christopher Summerfield[2], Tobias Egner[1]; [1]Duke University, [2]University of Oxford

— Object recognition greatly benefits from the contextual expectations of the objects' multiple features. For example, a soccer player must form expectations about both the motion of surrounding players and the color of their jerseys, in order to quickly and accurately distinguish trajectories of teammates versus opponents. However, little is known about how expectations of multiple features of an object interact to shape its processing in the visual brain. We compared three plausible models of how expectations for multiple object features might interact: the "independence model" assumes no interaction between feature expectations; the "reconciliation model" assumes that prediction error (violation of expectation) of one feature spreads to the other feature to form an object-level expectation; and the "segregation model" assumes that prediction error of one feature breaks the processing of the object as a whole into segregated features. We adjudicated between these models using computational modeling and empirical data from two experiments that orthogonally manipulated color-expectation, motion-expectation, and feature-based attention. Specifically, each model generated "neural activity" for each experimental condition in simulated primary and higher-level (V4, MT+) visual regions. These simulated activity patterns were then compared with behavioral data and neural patterns extracted from fMRI data. In three independent comparisons, the reconciliation model outperformed the two other models in accounting for behavioral and neural patterns of color- × motion-expectation interaction, and multi-feature expectation × attention interaction. These results strongly favor the hypothesis that different features of an object "mix" their prediction errors to form an object-level expectation that facilitates object recognition.

C157

TASK-BASED MODULATION OF FUNCTIONAL CONNECTIVITY IN THE HUMAN BRAIN

Frank Garcea[1,2], Roger Vargas, Jr.[4], Quanjing Chen[1], Darren Narayan[4], Bradford Mahon[1,2,3]; [1]Department of Brain & Cognitive Sciences, University of Rochester, USA, [2]Center for Visual Science, University of Rochester, USA, [3]Department of Neurosurgery, University of Rochester Medical Center, USA, [4]Rochester Institute of Technology, USA

— A great deal is known about the relation between resting functional connectivity and stimulus preferences—far less is known about how different tasks may differentially engage subnetworks within a broader set of regions. The network of brain regions that supports the ability to identify and use manipulable objects according to their function is an excellent model system within which to study how task effects may affect network cohesiveness. We designed a functional magnetic resonance imaging (fMRI) experiment in which undergraduate participants pantomimed object use or visually identified manipulable objects. A sparse design was used in which 45 seconds of fixation was interposed between each stimulus in the experiment—this allowed us to analyze functional connectivity as a function of both task (pantomiming or object identification) and stimulus (pre-stimulus functional connectivity, stimulus-driven functional connectivity). During object pantomiming there was an increase in functional connectivity between ventral stream regions and left parietal and left motor regions. During object viewing there was an increase in functional connectivity among ventral stream regions. Graph theory analyses over the functional connectivity data indicated that the left parietal cortex and left premotor cortex were hub-like (increased betweenness centrality) during object pantomiming, while the left middle temporal gyrus and left medial fusiform gyrus were hub-like during object identification. These results suggest that cortical representations of manipulable objects differentially depend on interactions with dissociable subnetworks within the broader set of regions that underpin our ability to recognize and use manipulable objects.

THINKING: Decision making

C158

EXPERIENTIAL FORAGING IN HUMANS: BEHAVIORAL AND IMAGING COMPARISON ACROSS SPECIES

Angus MacDonald III[1], Samantha Abram[1]; [1]University of Minnesota

— Foraging provides an important perspective on naturalistic decision-making. Computational accounts of foraging reflect how humans and other animals allocate resources, such as time, to maximize food, money, or drug rewards. One challenge in this domain is the paucity of translational tasks to examine consistency across human and animal choices. We drew on Information Foraging Theory and the internet-usage literature to develop WebSurf (Abram, et al., 2015), a human analogue of an assay for rat foraging, Restaurant Row (Steiner & Redish, 2014). Whereas rats passed feeders with different food rewards at differing delays, humans in WebSurf received offers at a serial set of video galleries with different rewarding video clips that played after differing delays. In both cases, participants made a stay/go decision, reflecting their willingness to wait for that reward at that delay, indicating their particular preferences and their providing them with real-time experiential rewards. The current study examined 64 undergraduates who performed the task and four who performed the task during 3T functional MRI (45'; TR=720ms; 2mm3). WebSurf captured individual differences in preferences as measured by delay thresholds and within-subject consistency with self-reported category preferences. Like rats, humans actively made decisions with each offer and this reflected the participants' overall strategic framework. Multivoxel pattern analyses (MVPA) of fMRI data demonstrate that the four reward categories were reliably separable, allowing the examination of category-specific anticipatory decision-making. WebSurf provides an experiential foraging paradigm that can be expanded to study foraging problems, as with addictions.

C159

WHAT IS AUTOMATIZED DURING PERCEPTUAL CATEGORIZATION?

Jessica Roeder[1], F. Gregory Ashby[2]; [1]University of Texas, Austin, [2]University of California, Santa Barbara

— An experiment is described that tested whether stimulus-response associations or an abstract rule are automatized during extensive practice at perceptual categorization. Twenty-seven participants each completed 12,300 trials of perceptual categorization, either on rule-based (RB) categories that could be learned explicitly or information-integration (II) categories that required procedural learning. Each participant practiced predominantly on a primary category structure, but every third session they switched to a secondary structure that used the same stimuli and responses. Half the stimuli retained their same response on the primary and secondary categories, and half switched responses. Performance on the primary categories met the standard criteria of automaticity by the end of training. Additionally, for the primary categories in the RB condition, accuracy and response time (RT) were identical on congruent and incongruent stimuli. In contrast, for the primary II categories, accuracy was higher and RT was lower for congruent than incongruent stimuli. These results are consistent with the hypothesis that rules are automatized in RB tasks, whereas stimulus-response associations are automatized in II tasks. A cognitive neuroscience theory is proposed that accounts for these results. Briefly, early II learning depends on the basal ganglia to learn stimulus-response associations, while automatic II categorization is mediated entirely within cortex, and the development of II automaticity is associated with a gradual transfer of control from the striatum to cortical-cortical projections from relevant sensory areas directly to premotor areas that initiate behavior. Likewise, in RB learning, behavioral control gradually passes from prefrontal cortex to rule-sensitive neurons in premotor cortex.

C160

GENERALIZATION IN GOAL-DIRECTED LEARNING: BENEFITS OF INDEPENDENT CLUSTERING OF WORLD-MODEL AND GOALS

Nicholas Franklin[1], Michael Frank[1]; [1]Brown University

— A hallmark of goal-directed behavior is the ability to combine information about the effects of actions with motivation to plan a novel course of action. This is particularly adaptive in unfamiliar contexts where habitual actions may be less relevant. However, this poses the additional challenge that it is often unclear how knowledge of one context generalizes to another. Previous behavioral and

EEG data suggest that rather than learning about specific contexts, humans build abstract task structures and then learn to link contexts to these structures. Computational models further suggest this process involves context popularity-based clustering, such that task structures that are most popular across contexts are more likely to be revisited in new contexts. However, in ecological settings, often a novel context indicates that some aspects of task structure – such as what effects actions have on subsequent states – should be generalized from one previous context whereas other aspects – such as the value of those states – might generalize from other contexts. Here, we consider how a non-parametric Bayesian agent can learn and cluster latent structures in action-effects and outcome-values separately, as opposed to unitary task structures associated with both. We show this leads to qualitatively different predictions in behavior than considering both together. We develop a novel task to investigate how people can discover latent structure and generalize this knowledge in a flexible and goal-directed way. We provide preliminary experimental evidence for this model of generalization and show that people generalize transition structure independently of reward value.

C161

ADULT AGE DIFFERENCES IN THE INFLUENCE OF FINANCIAL SKEWNESS ON CHOICE AND NEURAL ACTIVITY

Kendra Seaman[1], Josiah Leong[2], Charlene Wu[2], Brian Knutson[2], Gregory Samanez-Larkin[1]; [1]Yale University, [2]Stanford University — Older adults are disproportionately targeted by financial fraud attempts that promise rare opportunities for high returns (positively-skewed risks). Sensitivity to skewed risks may be a factor that contributes to vulnerability to fraud. Here we examined adult age differences in choice and neural activity while 34 individuals chose to reject (certain $0) or accept symmetric (50% chance of modest win or loss), positively skewed (25% chance of large gain), or negatively skewed (25% chance of large loss) risky gambles while undergoing fMRI. Logistic regression analyses of the behavioral data revealed that older adults relative to younger adults were more likely to accept positively-skewed gambles and less likely to accept negatively-skewed gambles. Replicating previous research in young adults, there were main effects of nucleus accumbens (NAcc) and anterior insula (INS) activity on choice such that increased neural activity in the NAcc increased acceptance of gambles while increased neural activity in the INS increased rejection of gambles. However, both of these main effects were qualified by significant interactions with age such that the effects of activity in both of these regions on gambling were reduced in older adults. Whole-brain analyses revealed age by condition (positive vs. negative skew) interactions in dorsolateral and inferior frontal cortical activity but activity in these regions did not significantly predict choice. Collectively, these results suggest that age influences the willingness to accept skewed gambles, and that age-related differences in the responses of the NAcc and INS may underlie age differences in skewed choice.

C162

COMPUTATIONAL MODEL AND ERP ENABLED PREDICTION OF SINGLE TRIAL BEHAVIOR ON A NUMERICAL COMPARISON TASK

Richard Prather[1], Sara Heverly-Fitt[1], Hyunjae Kim[1], Ihechi Akwuole[1], Samantha Mutai[1]; [1]University of Maryland - College Park — In the canonical number comparison task the distance between the two numerosities affects participant response time, accuracy and neuroimaging measures. These variations are referred to as the distance effect. In this study a non-symbolic number comparison task used to observe behavioral and electrophysiological (EEG) distance effects. Sixteen participants performed a number comparison task, while reaction time, accuracy, and electrophysiological data were recorded. Mean ERP amplitude within the time window of 280-380ms was extracted for two conditions of trial difficulty (difficult and easy trials). Data were analyzed using repeated measures ANOVA, with trial difficulty being the within-subjects variable. Analyses revealed a significant effect of trial difficulty on mean ERP amplitude $F(1, 15) = 25.58$, $p < .001$. This neural distance effect between difficult and easy magnitude comparison trials was present in the occipitoparietal area, replicating effects in existing literature on numerical processing. We then used a dynamic systems model with evolutionary genetic algorithm updating to predict participants behavior trial-by-trial. Average ERP amplitude across occipitoparietal areas were used as model input in addition to participant response and reaction time. Computational Modeling fit individual participant responses separate. Accuracy in predicting individual participant response ranged from 82% to 89%. Deviation of reaction time prediction ranged from 220ms to 400ms (mean 285ms). Correlation between participant and model reaction times varied between R = -0.09 and R = 0.30. We discuss potential applications of computational modeling enabled prediction of individual behavior on the number comparison task; potential improvements and possible limitations of the model.

C163

THE MOTIVATION-COGNITION INTERFACE IN DECISION-MAKING: EFFECTS OF MOTIVATIONAL MODE, AGE, AND VALUE.

Jessica A. Cooper[1], Darrell Worthy[2], Sharon Noh[1], W. Todd Maddox[1]; [1]The University of Texas at Austin, [2]Texas A&M University — We examined the effects of motivational focus, age, and value on a dynamic decision-making task that requires participants to forego an immediately rewarding option in favor of increased long-term rewards. First, we examined the effect of chronic motivational mode of the individual (regulatory focus, measured with the Regulatory Focus Questionnaire) on decision-making performance in young adults, finding that individuals in a match between chronic regulatory focus and task reward structure perform better and utilize goal-directed strategies while those in a mismatch use reward-based strategies. Next, we examined shifts in motivation and subsequent performance associated with age. Previous work has suggested that age affects the strategies that participants implement in this task, with older adults more often utilizing simple heuristics than younger adults. We used a combination of behavioral analyses, imaging, and computational modeling to show that older adults' performance at lower levels of difficulty is moderated by changes in state, with activation in the right dorsolateral prefrontal cortex correlating with performance. Older adults can perform well in simpler versions of this task, but their performance decreases at higher levels of task difficulty due to a shift to reward-based strategies (Worthy et al., 2014). In our final experiment, we sought to improve older adults' performance in the difficult version of the task by increasing motivation and effort using high-value framing. We found that high-value framing improved older adult performance. These studies suggest that decision-making performance results from an interaction of age, task reward structure, and situational and individual aspects of motivation.

C164

DECONSTRUCTING THE AESTHETIC BRAIN: EFFECTS OF PREFRONTAL DAMAGE ON THE WEIGHTING OF ART ATTRIBUTES DURING VALUE JUDGMENT

Avinash Vaidya[1], Marcus Sefranek[1], Lesley Fellows[1]; [1]Montreal Neurological Institute, McGill University — Whether browsing the rarefied galleries of the Metropolitan Museum of Art or the mass manufactured plastic sculpting of the newest high-tech contraptions, we are continuously exposed to varied and complex aesthetic experiences. Despite the ever-present role of aesthetics in modern life, little is known about the neuropsychological bases of aesthetic judgment. Imaging work has pointed to role for the ventromedial frontal cortex (VMF) in processing the 'value' — or subjective rewarding properties of artwork. However, it remains unclear what specific role this region plays in the construction of value assessments for such stimuli. Here, we examined the information underlying the value judgments made by 33 subjects with focal prefrontal damage. Artwork stimuli were rated on twelve attributes from the Assessment of Art Attributes (Chatterjee et al., 2010) by a group of art experienced healthy subjects. A principal component analysis revealed that three components could explain most of the variance in these attributes, approximately corresponding to the 'concreteness,' 'energy' and color (warmth/saturation) of these stimuli. Healthy, older control subjects assigned higher value ratings to more concrete artwork with cooler and less saturated colors. The relationship between concreteness and value ratings was significantly diminished, and frequently reversed, in the VMF damaged group, but not other prefrontal (PFC) damaged subjects. However, PFC damaged subjects did not differ in weighting color in their value ratings. These results indicate a critical role for VMF in the value assessment of artworks based on representational information, but not perceptual features.

PERCEPTION & ACTION: Development & aging

C165

THE IMPACT OF AGING ON HIGH-LEVEL POSTURAL FEEDBACK PROCESSING

Cameron Hassall[1], Gail Eskes[2], Olave Krigolson[1]; [1]University of Victoria, [2]Dalhousie University — Detecting and correcting postural errors is an essential part of postural control, and is of particular importance to older adults, who are at greater risk of falling compared to younger adults. Deficits in postural control in older adults have been well documented, mostly from the traditional position that postural control relies on reflexes alone. However, cognitive factors such as high-level feedback processing have also been shown to impact our ability to maintain an equilibrium position while standing. A high-level postural error (failure to achieve a postural goal) elicits a negative deflection in the human event-related potential (ERP) known as the feedback-related negativity (FRN), thought to index a generic learning system within medial-frontal cortex. We tested the impact of aging on high-level postural feedback processing by recording electroencephalographic data while older adults performed a postural targeting task. Participants were given feedback after attempting to move their centre of mass into one of four target locations while standing on a balance board. The size of the targets was adjusted using a staircase procedure in order to ensure an even split of correct and incorrect feedback types. Compared to younger controls, older adults displayed poorer overall performance (i.e. larger target sizes) and greater centre of mass variability. Older adults also had a reduced FRN, suggesting a cognitive component of the impact of aging on postural control.

C166

MEG RECORDINGS IN PRESCHOOL AGE CHILDREN REVEAL DEVELOPMENTAL CHANGES IN PRIMARY MOTOR CORTEX

Cecilia Jobst[1], Rita Al-Loos[1], Wei He[2], Huizhen Tang[2], Blake Johnson[2], Douglas Cheyne[1,3]; [1]The Hospital for Sick Children, Toronto, Canada, [2]Macquarie University, Sydney, Australia, [3]University of Toronto, Toronto, Canada — We recently reported differences in movement-related MEG fields in preschool age children (mean age 4.8 years) compared to those typically observed in adults, using a customized paediatric MEG system (Cheyne et al., 2014). High-frequency (70–90Hz) motor cortex gamma oscillations, which may play an important role in sensory guided action and error processing, were also observed, but at a lower frequency range around 30–60Hz in some of the children. These findings suggested that maturation of the motor system is still incomplete in the late preschool years. Here we report the results of follow-up recordings in the same children performing the same task two and one-half years later (mean age 7.3 years). These results showed changes in the event-related movement field waveforms, with emergence of adult-like pre-movement and movement-evoked field components. Moreover, the follow-up data exhibited increases in the frequency of sensorimotor cortex rhythmic activity, including a shift in gamma oscillations to the adult frequency range. This provides further evidence of functional changes in motor circuits during early childhood that impact both motor field components and the frequency "tuning" of oscillatory activity in motor cortex. To our knowledge, this is the first longitudinal MEG study demonstrating changes in neural activity in the motor cortex during early childhood. Such changes may reflect the maturation of cortical motor circuits that underlie the development of motor skills during early childhood, and could potentially serve as a biomarker for the remission or persistence of certain motor disorders (e.g., developmental stuttering) into adulthood.

C167

MATURATION OF SPEECH DISCRIMINATION AND ATTENTIONAL REQUIREMENTS IN LATE CHILDHOOD

Judith A. Iannotta[1], Valerie L. Shafer[1], Brett A. Martin[1], Hilary Gomes[1]; [1]The Graduate Center of the City University of New York — The ability to perceive speech sound contrasts is refined throughout development. While emerging models suggest that development is characterized by shifts from an attentionally-demanding mode of processing speech sounds to one that occurs relatively automatically, the specific developmental time-course of these changes remains unclear. This experiment used Event-Related Potential (ERP) measures, to examine developmental changes in automaticity to native language speech sounds in 10 to 17 year old children. ERPs were recorded to a difficult English vowel contrast, (apa versus aepa) under different attentional conditions in an oddball design. Attention was drawn towards or away from the auditory stimuli via a visual memory task. The mismatch negativity (MMN) discriminative component was expected to be larger in the auditory attend than the visual attend tasks for the youngest children, but with increased automatization of processing, older children and adults were expected to show little difference across tasks. Consistent with our prediction, we found greater attention-related modulation of the MMN for younger than older children. We also found evidence of age-related difference in the late discriminatory negativity and P3b. Specifically, the late negativity and P3b were larger with increasing age. These findings confirm that native language speech perception is not fully mature, even into the teenage years.

THINKING: Development & aging

C168

PREDICTIVE VISON: PREFRONTAL CORTEX DRIVES VISUAL RECOGNITION NETWORKS IN OLDER BUT NOT YOUNGER ADULTS

Jessica Gilbert[1], Rosalyn Moran[1]; [1]Virginia Tech Carilion Research Institute, Roanoke VA — Predictive coding models of visual perception account for an agent's experience with his sensory environment and propose that top-down cortical signals promote efficient neural codes by carrying predictions of what might be observed next. We hypothesized that older, compared to younger brains, would employ these codes more prominently given their longer repertoire of sensory experience. Electrophysiological recordings were collected using a 64-channel EEG system while participants performed a repetition-priming task. Behaviorally, both younger (N=23, mean age=23.8 years) and older (N=21, mean age=73.7 years) participants demonstrated intact priming for repeated (N=50) compared with novel (N=50) pictures. Using dynamic causal modeling (DCM) we measured the effective connectivity underlying stimulus-evoked responses in cortical visual networks during the task. We found that in young adults, signals propagated from early visual regions and reverberated along reciprocal connections to temporal, parietal and frontal cortices. In contrast, the dynamics of visual recognition in older brains was driven by both early visual and prefrontal cortical inputs to the same distributed network. Our findings are supported by previous anatomical and functional studies of so-called 'gist' pathways that describe the influence of ascending magnocellular projections to PFC on early visual stimulus processing. While previously thought of as exceptions to the rule of bottom-up hierarchical signal propagation, our results emphasize a prominent role for prefrontal-driven vision in aged brains and suggest that perceptual networks reorganize over the lifespan in line with predictive coding accounts of neural processing.

C170

MEDICATED HYPERTENSION IMPROVES LEARNING FROM POSITIVE PROBABILISTIC FEEDBACK IN OLDER AFRICAN AMERICANS

Ravi B. Sojitra[1], Christina Inyang[1], Ashlee Shaw[1], Mark A. Gluck[1]; [1]Rutgers University-Newark — While it is well established that improvements in cardiovascular fitness can yield cognitive benefits, past literature has focused on improvements in the frontal lobe and hippocampus. The effect of exercise on striatal (i.e., probabilistic) learning is comparatively unclear. Studies show that older adults learn worse from probabilistic feedback compared to younger adults; it is not clear to whether these observed differences are due to modifiable changes in cardiovascular fitness versus healthy neurobiological changes. As part of a larger, ongoing study of exercise-mediated cognitive aging in African Americans (who are at increased risk of hypertension and hypertension-related disease), we tested older adults, ages 53-89, on a probabilistic category-learning task that distinguishes positive (reward) from negative (punishment) feedback learning. Stimuli in the positive feedback condition gave either positive feedback or no feedback and stimuli in the negative feedback condition gave either no feedback or negative feedback; each type of feedback was reliable on 90% of trials. We found that among those who were being medicated for hypertension, those with a systolic blood pressure (BP) of <140 mmHg learned better from reward than those who had a systolic BP ≥140 mmHg. Additionally, those

who were medicated and had a systolic BP<140 mmHg learned better from reward than those who were un-medicated, including those with a systolic BP of <140 mmHg. There were no significant differences in learning from negative feedback. These results suggest that medicating hypertension may yield reward-learning benefits, underscoring the role of health disparities in cognitive research.

C171

NEUROMAGNETIC CORRELATES OF NUMEROSITY TRAINING IN CHILDREN WITH DYSCALCULIA

Vera Dehmelt[1,2], Jörg-Tobias Kuhn[1], Christin Schwenk[1], Julia Raddatz[1], Heinz Holling[1], Christian Dobel[1,3]; [1]WWU Münster, [2]Max Planck Institute for Empirical Aesthetics, [3]Universitätsklinikum Jena

— Poor numeracy, the ability to competently deal with numbers, has been related to earlier school drop-out, low economic well-being, and depression. Developmental dyscalculia (DD), a severe form of poor numeracy, shows prevalence rates similar to those of dyslexia while being widely unrecognized by the general public. The present study employed magnetoencephalography to evaluate a computer-based training (CODY- training) aimed at improving basic numerical processing as assessed with several measures of mathematical skills and reaction times (numerical distance effect, NDE). The NDE reflects the notion that larger magnitude distances correspond to faster RTs than smaller distances in magnitude decision tasks. It often serves as a core measure for magnitude processing. Primary school children suffering from DD received either the CODY- training or a training of deductive thinking. The size of the NDE within the CODY- group increased from pre- to post- training indexing more efficient processing. Increased NDE correlated with gains in tests of mathematical performance. Both training groups showed a modulation of neurophysiological activity by numerical distance in a right parietal and a left temporo-parieto-frontal region. Activity within those regions was sensitive to training and these changes were predictive of posttest- performance on math skill measures. The study underscores the effectiveness of CODY training in DD and corresponding changes in a neurophysiological network underlying mathematical functions.

C172

AGE-RELATED CHANGES IN THE NEURAL CORRELATES OF REMEMBERING, IMAGINING, AND MENTALIZING

Elizabeth DuPre[1], Amber W. Lockrow[1], Wen-Ming Luh[1], R. Nathan Spreng[1]; [1]Cornell University

— The default network has been reliably implicated in self-generated thought, including autobiographical memory, prospection, and theory-of-mind. Aging has been observed to affect these forms of cognition as well as the integrity of the default network. To investigate how age-related changes might impact these processes, functional neuroimages were collected in 31 younger (M=22y, SD=3.3y) and 30 older (M=68y, SD=6y) adults. Imaging data were submitted to partial least squares analysis to detect shared and unique patterns of neural activation and connectivity between age groups. Relative to a sensory-motor control condition, in both groups, all three forms of self-generated thought engaged medial prefrontal cortex (PFC), precuneus, lateral temporal lobes, and the inferior parietal lobule, consistent with the default network. Additional activity was observed in lateral PFC, the dorsal anterior cingulate, and anterior insula –regions typically affiliated with the salience network. A second latent variable dissociated autobiographical remembering and imagining from theory-of-mind reasoning, a dissociation that was attenuated in older adults. Here, autobiographical remembering and imagining engaged medial PFC, retrosplenial cortex, and hippocampus. Theory-of-mind reasoning engaged the superior temporal sulcus bilaterally and the right temporoparietal junction. Functional connectivity of the ventromedial PFC showed an age effect for autobiographical memory, imagining, and theory of mind. Young adults demonstrated greater connectivity with posterior hippocampus and inferior frontal gyrus; older adults showed greater connectivity locally within ventromedial PFC and dorsal precuneus. Overall, we were struck by the degree of preserved function in healthy aging. However, subtle age-related changes were observed, particularly in functional connectivity.

C173

AGE DIFFERENCES IN BOLD ACTIVATION ASSOCIATED WITH CHANGES IN DECISION-MAKING STATES

Bo Pang[1], Darrell A. Worthy[1], Tyler Davis[2], Jessica Cooper[3], Kirsten Smayda[3], Kaileigh A. Byrne[1], W. Todd Maddox[3]; [1]Texas A&M University, [2]Texas Tech University, [3]University of Texas at Austin

— We examined whether older or younger adults would be more sensitive to state-change information by employing a state-based task where participants were provided with cues that readily aligned with the dynamic states of the task environment while undergoing fMRI. Younger adults outperformed older adults, which suggests that they more readily utilized the state-cues. We regressed BOLD activation on three measures from a reinforcement learning model. We utilized an expected value regressor that measured the difference between the immediate and long-term value of the selected option at the time of choice, and a state-change regressor that represented the degree to which the selected option led to an improvement or decline in state at the time of feedback. Additionally, a time-lagged state-change regressor indicated the state-change signal from the last trial when the chosen option was selected. This served as a metric of the chosen option's value in terms of recently inducing an improvement or a decline state. Consistent with previous results, younger adults were responsive to expected value-based signals which modulated activation in ventral striatal and medial PFC regions, while older adults were sensitive to recent state-change signals which modulated activation in right dorsolateral PFC. For time-lagged state-change signals, however, activation in striatum, ventromedial and dorsolateral PFC showed age-related decreases, reflecting age-related decline in the use of recent state-change information at the time of choice. These findings indicate that older adults were responsive to state information, but only during feedback while younger adults utilized state information at the time of choice.

Poster Session D

ATTENTION: Spatial

D1

MEMORY SYSTEMS MAY BE INTEGRAL IN SPATIAL FUNCTION AND SPATIAL NEGLECT. A. M. Barrett[3], Karl Hoegler[1,2,3]; [1]Kessler Foundation, [2]Kessler Institute for Rehabilitation, [3]Rutgers-New Jersey Medical School — Spatial neglect is pathologic spatial bias, causing functional disability. Recent evidence suggests therapeutic recovery of "Aiming" spatial neglect, a directional, hemispatial and left body action deficit after right brain stroke, may be critically supported by the medial temporal complex. This region plays a critical role in declarative and even motor sequence learning. We wished to learn if verbal memory was associated with spatial neglect, and if motor learning slows with increasing spatial neglect symptoms. In 240 stroke survivors (mean age = 66.8), verbal recall was correlated with two spatial neglect tests (Catherine Bergego Scale and Behavioural Inattention Test; r = -0.35 and 0.48, both p = 0.01), however factor analysis yielded 3 separable components. In 15 of these people with right stroke and spatial neglect, who were treated with prism adaptation, we examined motor learning by dividing patients into those with increasing (poor motor learning) versus decreasing errors (good motor learning) over a training session. Those with good motor learning had less neglect (CBS mean = 9.84) than those with poor motor learning (CBS mean = 12.41, $p < 0.05$). BIT did not differ by motor learning rate. Similarly, the rate of motor learning (error slope) tended to be correlated with CBS ($p < .10$), but not BIT ($p = 0.45$). This data is consistent with memory impairment in spatial neglect. Memory and spatial function may simply be "good neighbors," drawing upon the same neural substrate. Alternately, body-spatial processing might contribute to verbal memory.

D2

METHYLPHENIDATE MODIFIES ATTENTIONAL ORIENTING BIAS IN HEALTHY INDIVIDUALS Rachel Tomer[1], Hagar Gelbard[1], Noa Brande-Eilat[1], Shirel Dorman[1], Polina Zozulinsky[1], Hila Gvirts[2], Aviv Segev[2], Kfir Feffer[2]; [1]University of Haifa, Israel, [2]Shalvata Mental Health Care Center, Israel — Attention Deficit Hyperactivity Disorder (ADHD) is characterized by rightward bias when performing a spatial orienting task, which may reflect reduced dopamine signaling in the right hemisphere. Methylphenidate (MPH) increases extracellular levels of dopamine, and was found to reduce the spatial attention bias in ADHD patients, suggesting that this drug corrects a unilateral dopamine deficit by differentially increases dopamine level in the right hemisphere. Orienting bias can also be seen in healthy individuals and the differences in direction and magnitude of this bias have been shown to reflect the individual's asymmetric dopamine signaling. To clarify whether MPH acts preferentially on the right hemisphere in healthy subjects, we examined the effects of a single dose of MPH (20 mg) on orienting bias in 36 healthy individuals (18 females; age: 24 + 2.3) who performed the Greyscales task in a double-blind, placebo-controlled, within-subject design. Under placebo, 24 subjects showed a leftward bias, whereas the other 12 showed a rightward bias. MPH had a differential effect on attentional bias, depending on the initial preference of the individual: subjects with leftward bias under placebo made fewer left choices after receiving a single dose of MPH, while a similar dose of MPH resulted in fewer right choices among individuals showing rightward bias under placebo. These results support the hypothesis that, in the healthy brain, MPH reduces bias by increasing DA levels asymmetrically, with greater increase in the hemisphere with lower baseline DA level.

D3

TOP-DOWN CONTROL OF VISUAL ALPHA OSCILLATIONS: SOURCES OF CONTROL SIGNALS AND THEIR MECHANISMS OF ACTION Mingzhou Ding[1], Chao Wang[1], Rajasimhan Rajagovindan[1], Sahng-Min Han[1]; [1]J Crayton Pruitt Family Department of Biomedical Engineering, University of Florida, Gainesville, FL 32611 — Alpha oscillations (8 to 12 Hz) inversely correlate with cortical excitability. In visual spatial attention, alpha over the attended location decreases, signifying increased excitability to facilitate the processing of impending stimuli. In contrast, in retention of verbal working memory, alpha over visual cortex increases, signifying decreased excitability to input to protect the information held online from sensory interference. According to the prevailing model, this goal-oriented biasing of sensory cortex is effected by top-down control signals from frontal and parietal cortices. The present study tests and substantiates this hypothesis by (a) identifying the signals that mediate the top-down biasing influence, (b) examining whether the cortical areas issuing these signals are task-specific or task-independent, and (c) establishing the possible mechanism of the biasing action. High-density human EEG data were recorded in (1) a trial-by-trial cued visual spatial attention task and (2) the Sternberg verbal working memory task. Applying Granger causality to both sensor-level and source-level data we report the following findings. In covert visual spatial attention, regions exerting top-down control over visual activity are lateralized to the right hemisphere, with the right frontal eye field and the right inferior frontal gyrus being the main sources of top-down influences. During retention of verbal working memory, regions exerting top-down control over visual activity are lateralized to the left hemisphere, with the left middle frontal gyrus being the main source of top-down influences. In both experiments, top-down influences are mediated by alpha oscillations, and the biasing effect is likely achieved via an inhibition-disinhibition mechanism.

D4

INCENTIVE SALIENCE PRODUCES EARLY ATTENTION ALLOCATION: AN ERP INVESTIGATION Constanza de Dios[1], Geoffrey Potts[1]; [1]University of South Florida — This study used event-related potentials (ERPs) to study how expected value influences spatial attention. The medial frontal negativity (MFN) indexes expected value, being negative to unexpected punishments and positive to unexpected rewards. The P1 indexes spatial attention, being larger to stimuli in attended locations. This design attached value to locations by making one visual hemifield economically rewarding (greater probability of a rewarding outcome) and the other punishing (greater probability of a punishing outcome). Keypresses to a dot probe following a reward-signifying stimulus were awarded money if correct, and penalized following a punishment-signifying stimulus if incorrect. We predicted that the MFN would be most negative to punishing outcomes in the rewarding hemifield and most positive to rewarding outcomes in the punishing hemifield. We also predicted that the P1 would be larger and keypresses faster to probes appearing on the same side as an outcome that violated expected value, indicating attention allocation to a location where expectation was violated. Consistent with our hypothesis, in a sample of 20 participants, the MFN was most negative to punishments in the rewarding hemifield and most positive to rewards in the punishing hemifield, indicating that value was attached to location. Contrary to our prediction, the P1 was larger and keypresses faster to the probes when the preceding outcome did not violate expected value, indicating attention was allocated to locations where economic expectation was confirmed. This suggests that incentive salience directs spatial attention, but to expectation confirmation, differently from perceptual salience, which attracts attention to expectation violation.

D5

THE TIME COURSE OF HEMISPHERIC ASYMMETRY TO CONFIGURAL AND FEATURAL FACE PROCESSING IS GATED BY SPATIAL ATTENTION Hailing Wang[1], Shimin Fu[1]; [1]Tsinghua University — Face recognition requires both configural (second-order relations) and featural processing. Previous studies have shown that configural face processing relies more on the right hemisphere, whereas featural face processing involves more the left. However, it is unclear about the temporal sequence of these lateralized processing. Spatial attention paradigm was employed to instruct participants to attend the face location (attended condition) or house location (unattended condition). The interaction from attention, face processing type and hemisphere on P1 and P2 components indicates the different mechanisms of configural and featural face processing as a function of spa-

tial attention. Specifically, configural face processing had a larger posterior P1 (approximately 100 ms) than featural face processing on the right hemisphere, whereas the P2 (approximately 220 ms) was larger for featural than configural face processing on the left hemisphere, both under attended condition. In contrast, when unattended, the P1 was larger for featural than configural face processing on the left hemisphere, whereas P2 was larger for configural than featural face processing on the right hemisphere. These results suggest that configural and featural processing involve different neural mechanisms, and more importantly, the time course of hemispheric asymmetry on configural and featural face processing are differently modulated by spatial attention.

D6

CORTICAL THICKNESS AND SPATIAL FREQUENCY PROCESSING DURING NATURAL SCENES PERCEPTION IN CHILDREN

Nicolas Poirel[1,2], François Orliac[1], Katell Mevel[1], Grégoire Borst[1], Julie Vidal[1], Arlette Pineau[1], Sonia Dollfus[3,4], Olivier Houdé[1,2], Carole Peyrin[5], Grégory Simon[1]; [1]LaPsyDÉ, UMR 8240, CNRS, Université Paris Descartes, Université de Caen, PRES Sorbonne Paris Cité, France, [2]Institut Universitaire de France (IUF), France, [3]ISTS, UMR 6301, CNRS, CEA, Caen, France, [4]CHU de Caen, Service de Psychiatrie, Centre Esquirol, Caen, France, [5]LPNC, UMR 5105, CNRS, Université Pierre Mendès France, France — Scene recognition is processed in terms of spatial frequencies. Low spatial frequencies (LSF) first allow rapid scene recognition whereas high spatial frequencies (HSF) subsequently carry fine details. The present Magnetic Resonance Imaging study investigated how cortical thickness covaried with LSF/HSF processing abilities in ten-year-old children and adults. Participants indicated whether natural scenes filtered either in LSF or in HSF were outdoor or indoor, while reaction times (RTs) were recorded. In adults, faster RTs for LSF and HSF were always associated with an increase in cortical thickness (parahippocampal, middle frontal gyrus, precentral and insula regions for LSF; parahippocampal, fronto-marginal and supramarginal gyri for HSF). On the other hand, in children, faster RTs for HSF were associated with increases in cortical thickness (posterior cingulate, supramarginal and calcarine) whereas faster RTs for LSF were associated with decreases in cortical thickness (subcallosal and insula). Increases in cortical thickness in adults and children could correspond to an expansion mechanism linked to the efficiency in processing visual scenes, whereas the decrease in cortical thickness associated to LSF efficiency in children could correspond to a pruning mechanism reflecting an ongoing maturational process, in agreement with the view that LSF efficiency continues to refine during childhood. In children, variations in cortical thickness were particularly present in anterior regions of the brain, in line with the view of a postero-anterior gradient in brain development. Taken together, our results highlight the brain dynamic processes that allow children and adults to perceive a visual natural scene in a coherent way.

D7

INVESTIGATING THE FUNCTIONAL ANATOMY OF VISUAL AWARENESS: A MULTIVARIATE FMRI STUDY

Jiaqing Chen[1], Edward B. O'Neil[1], Andy C. H. Lee[1,2], Matthias Niemeier[1,3]; [1]University of Toronto Scarborough, [2]Baycrest Centre for Geriatric Care, [3]Centre for Vision Research, York University — The right hemisphere is dominant for spatial attention and visual awareness. For example, patients with spatial neglect after right-brain damage to ventral parietal, temporal, and/or ventral frontal areas ignore the left side of space and show pathological biases to the right. In contrast, healthy participants show complementary biases to the left, called pseudoneglect, such as in perceptual judgement tasks. Pseudoneglect has been previously proposed to be associated with dorsal regions, especially in parietal cortex, known to activate in tasks of visual exploration and attentional shifts. However, this might reflect a confound because perceptual judgement tasks might have required shifts of attention whereas control tasks might not. Therefore, here we used a "grating-scales task" (GST) that requires participants to make perceptual judgements about the high (GST-HI) or low spatial frequency components (GST-LO) of the same stimuli, where both tasks afford similar amounts of attentional shifts, but only the GST-HI induces pseudoneglect. As expected, we found that participants exhibited pseudoneglect only during the GST-HI but not during the GST-LO. Imaging results showed that dorsal areas such as the intraparietal sulcus activated bilaterally. However, areas in inferior and medial frontal cortex as well as insula cortex activated more on the right side during the GST-HI. Our data suggest that pseudoneglect activates a network of areas in the right hemisphere associated with portions of the ventral attentional network. These areas are consistent with some of the lesion sites observed in patients with spatial neglect.

D8

ATTENTION TO ONGOING STIMULI MODULATES FEEDFORWARD PROCESSING IN HUMAN PRIMARY VISUAL CORTEX

Ashley Royston[1], Jaime Napan[1], Kira Anderson[1], Aviel Haberman[1], Steven J. Luck[1], Steven A. Hillyard[2], W. Martin Usrey[1], George R. Mangun[1]; [1]University of California, Davis, [2]University of California, San Diego — By enabling efficient selection of task-relevant information and suppressing irrelevant information, selective attention drives successful goal-directed behavior. Traditionally, visual selective attention is probed using briefly presented stimuli, yielding reliable attentional modulations of visual evoked activity. However, these classic designs fail to capture the complexity of continuously-visible real world visual scenes, leaving open questions concerning the application of these findings to more natural viewing scenarios, and perhaps failing to reveal key mechanisms. For example, although electrophysiological studies in nonhuman primates and fMRI studies in humans have reported replicable effects of spatial selective attention in striate cortex and LGN, ERP studies in humans have yielded inconsistent results. We hypothesize that in natural vision, the presence of continuous inputs may trigger an attention-related engagement of reafferent circuitry in V1 such that subsequent feedforward inputs benefit from enhanced attentional modulation at this early cortical locus. To test this, we presented bilateral stimuli to human subjects who covertly attended to one hemifield in order to detect occasional targets under ongoing and classic conditions. The results we obtained support our hypothesis, showing a significant modulation of ERPs generated in V1 (i.e., the C1 component of the visual ERP) in the ongoing stimulus condition compared with the classic condition. Our findings suggest that attentional engagement of reafferent circuitry enhances processing of feedforward inputs in human V1 during selective attention to ongoing stimulation, which is more similar to the conditions faced in natural vision.

D9

CUEING ATTENTION WITHOUT AWARENESS USING OBJECT-SUBSTITUTION MASKING

Charles M. Giattino[1], Zaynah M. Alam[1], Marty G. Woldorff[1]; [1]Duke University — The relationship between attention and awareness is not well understood, especially to what extent they are dissociable and the neural underpinnings of each. Here we examined the orienting of visual attention in an exogenous cueing paradigm while using object-substitution masking to manipulate participants' awareness of the cues. A delayed-offset mask was used on each trial, and awareness of the cues was based on behavioral report at the end of each trial. Neurophysiological (EEG) data was recorded during the task, from which we extracted event-related potential (ERP) responses. Behaviorally, results showed that participants were unaware of the cue on 58% of trials. On cue-aware trials, there was a 50ms validity effect (invalidly- minus validly-cued trials); interestingly, on cue-unaware trials, participants still had a clear, although somewhat reduced, validity effect (21ms). There was little indication of an effect of cue awareness on early sensory ERPs (P1/N1), but instead manifested in later differences, starting with a parieto-occipital negativity from 200-300ms, suggesting the involvement of a reentrant process in cue awareness. An N2pc to the cue, indexing the lateralized focusing of attention, was observed for cue-aware but not cue-unaware trials, despite the latter still showing a clear behavioral validity effect. Finally, in response to the targets, validity effects were observed at both the P1 and P2 latencies for cue-aware trials, with similar but smaller effects on the cue-unaware trials. These results suggest that shifts of visuospatial attention can be triggered by unperceived stimuli, but through somewhat different mechanisms than shifts triggered by perceived stimuli.

D10

NEUROMODULATION OF COGNITIVE CONTROL: DIFFERENT EFFECTS OF LEFT AND RIGHT PARIETAL TDCS ON STIMULUS-RESPONSE ASSOCIATIONS

Elisa Di Rosa[1], Lara Bardi[2], Margherita Forgione[1], Fabio Masina[1], Carlo A. Umiltà[1], Daniela Mapelli[1,3]; [1]Department of General Psychology, University of Padua, Padua, Italy, [2]Department of Experimental Psychology, Ghent University, Ghent, Belgium, [3]Human Inspired Technologies Research Center, University of Padua, Padua, Italy — Several neuroimaging and neuropsychological data sustained the involvement of bilateral intraparietal sulcus (IPS) in number processing. At the same time, results of brain stimulation studies are divergent: while some findings supported a left lateralization, others sustained that the integrity of the right IPS is essential in number discrimination. Posterior parietal cortex, however, is well known to be involved in spatial attention and in cognitive control mechanisms, often implicated in numerical tasks. The goal of the present study was to gain insight into the existence of hemispheric asymmetries underlying number processing, investigating the effect of parietal transcranial direct current stimulation (tDCS) on stimulus-response associations related to magnitude and parity evaluation. Thirty subjects were tested: 15 received tDCS on the right IPS and 15 have been stimulated on the left IPS, during the performance of a parity judgment task. Every subject underwent anodal, cathodal and sham stimulation on the target site (P3 for left IPS and P4 for right IPS), while the reference electrode was placed on the contralateral supraorbital region. Our results revealed that the stimulation of left and right IPS have different effects on participant's performance. More specifically, while the stimulation of the left IPS modulated both the magnitude and the parity evaluation, the stimulation of the right IPS influenced only the processing of parity information. These results, which appear in contrast with the hypothesis of a bilateral involvement of IPS in magnitude processing, are discussed in the context of the parietal asymmetry in salience-based selection in stimulus-response association effects.

D11

READING AND SCENE EXPLORATION DEFICIT IN NEGLECT PATIENTS: AN EYE MOVEMENT IMPAIRMENT

Lisa Arduino[1,2], Silvia Primativo[3], Roberta Daini[4], Maria De Luca[5], Carlo Toneatto[4], Marialuisa Martelli[5,6]; [1]Lumsa University - Rome, Italy, [2]Institute of Cognitive Sciences and Technologies, CNR - Rome, Italy, [3]Dementia Research Centre, University College London, GB, [4]Department of Psychology, University of Milano-Bicocca, Milan, Italy, [5]Neuropsychology Unit, IRCCS Fondazione Santa Lucia, Rome, Italy, [6]Department of Psychology, Sapienza University of Rome, Rome, Italy — Around 40% of patients with unilateral spatial neglect (USN) show also a reading impairment (i.e., Neglect Dyslexia, ND). In Primativo et al. (2013) we proposed a new theoretical account by showing that ND is the consequence of the concomitant presence of USN plus a non-lateralized eye movement deficit. In the present study we aimed at clarifying the features of the altered eye movement pattern. We present the results of seven experiments, showing how an impaired eye movement pattern affects scene perception, reading, and simple saccadic tasks in a large proportion of neglect patients. Using the eye movement performance of a group of controls during a scene description task, USN patients were divided according of their fixation location pattern, which was compared to that of controls. Patients identified as having an impaired eye movement behaviour in the scene exploration task and in the saccadic tasks, produced left lateralized errors also in reading words. The abnormal oculomotor behaviour during reading confirmed the group distinction based on scene exploration. Also, we showed that the disorder extends to the vertical meridian and is independent from a possible attentional engagement problem. We conclude that the eye movement disorder, which is present in a larger proportion of USN patients, reflects a general oculo-motor disorder and affects both reading and scene perception. The results are discussed within a new theoretical model of neglect dyslexia and its relations with unilateral spatial neglect.

D12

ELECTROPHYSIOLOGICAL CORRELATES OF VISUAL BINDING ERRORS AFTER BILATERAL PARIETAL DAMAGE

Elena Pedrazzini[1], Julia Fellrath[1], Radek Ptak[1]; [1]Laboratory of Cognitive Neurorehabilitation, Department of Neuroscience, University of Geneva, Switzerland — The most dramatic expression of binding failures in vision are illusory conjunctions (e.g. the confusion between the shape of one stimulus with the color of another stimulus). Illusory conjunctions may be observed in healthy participants when exposure is limited or during free viewing in patients with parietal damage. Previous studies have attributed illusory conjunctions to failures of spatial localization of the stimuli. However, it is unknown whether such failures reflect the impairment at the level of early or late stages of visual processing. Here, we examined the time-course of visual processing using evoked potential measures in a patient with bilateral damage to the posterior parietal cortex presenting prominent binding failures. The patient was asked to identify either one colored letter briefly flashed to the left or right hemifield, or two simultaneously presented letters. In unilateral presentation she adequately identified either the color or the shape of left or right letters. In contrast, during bilateral presentation she either showed complete extinction of the left letter or an illusory conjunction between right letter shape and left letter color. Evoked potential analyses revealed an electrophysiological signature starting ~70 ms after stimulus onset that was specific to the occurrence of an illusory conjunction. These findings indicate that illusory conjunctions reflect failures of early stages of spatial processing relying on the posterior parietal cortex.

D13

TRAIT IMPULSIVITY DIMINISHES THE INHIBITION OF RETURN EFFECT

Grace Whitaker[1], Ellen Poliakoff[1], Joanna Neill[1], Wael El-Deredy[1]; [1]The University of Manchester — Inhibition of return (IOR) is an attentional mechanism that impedes the re-inspection of spatial locations, making search more efficient. IOR is proposed to reflect both prioritisation of 'the new' and inhibition of 'the old'. The phenomenon is observed by measuring slower reaction times (RTs) to targets appearing in the same spatial location as a cue (cued trial) compared to a different location (uncued trial). The difference in RT to cued and uncued trials provides a measure of IOR magnitude. How the personality trait of impulsivity affects IOR is unclear. On the one hand, Impulsive individuals may fail to inhibit the old location, reducing their IOR magnitude. On the other hand, they may over-prioritise novel spaces, increasing their IOR magnitude. This study explored the relationship between measures of impulsivity and IOR magnitude to test these conflicting hypotheses. Seventy-two healthy participants (ages 18 – 35, 42 female, 30 male) completed the Barratt Impulsivity Scale (BIS-11), the Conner's Adult ADHD Rating Scale (CAARS) and performed the Conner's Continuous Performance Test (CPT) to measure impulsivity. Participants' IOR magnitude was then ascertained using a classic visual cue-target IOR task. Linear regression analysis using the impulsivity measures as factors demonstrated that cognitive instability (from the BIS-11) was the strongest predictor of IOR magnitude: $F(1, 70) = 9.960$, $p = 0.002$; R Square = .125. Scores in this aspect of impulsivity were negatively related to IOR magnitude. This study demonstrates that the inhibitory mechanisms necessary for IOR are impaired in impulsive individuals.

D14

GAMMA BAND OSCILLATIONS REFLECT STRATEGY CHOICE IN A MULTIPLE OBJECT-TRACKING TASK

Christian Merkel[1], Jens-Max Hopf[1,2], Mircea Ariel Schoenfeld[1,2,3]; [1]Otto-von-Guericke University, Magdeburg, [2]Leibniz Institute for Neurobiology, Magdeburg, [3]Schmieder Clinic, Allensbach — It is possible to keep track of multiple simultaneously moving identical items. Previous models that postulate increasing attentional resources with rising tracking demands fail to account for interactions between the tracked items. Recent neurophysiological evidence indicated that at least some of the subjects enhance their tracking abilities by building a geometrical figure based on the spatial positions of the tracked items. These subjects show different behavioral and electrophysiological responses to luminance probes on all tracked items relative to subsets of target and distractor items. The current study focuses on oscillatory signals during target-assignment and tracking, for two afore mentioned different performance groups who were also different in their time-frequency profiles. Subjects who tracked the items by

building a figure showed strong transient gamma-bursts during target-assignment. The transient-gamma amplitude was correlated with the subsequent correct responses on the tracking task. In addition these subjects also showed strong desynchronization in the beta-frequency range during tracking. Subjects who did not form a figure during tracking do not exhibit transient gamma-activity during target assignment but a sustained gamma-response during motion. The results provide strong support for two fundamentally different multiple-objects-tracking strategies. Subjects who track the shape of the items appear to encode a shape template representation prior to the tracking phase. The other subjects group rather appears to use spatial visual short-term-memory to maintain each single item location during tracking.

D15

CANCELLATION TASKS, NUMBERS AND TABLET PCS: THE PERFECT LINK FOR CLINICAL AND EXPERIMENTAL PURPOSES.

Di Luca Samuel[1], Girelli Luisa[2], Vallar Giuseppe[2], Pesenti Mauro[3], Blini Elvio[4], Schuller Anne-Marie[1,5], Schiltz Christine[1]; [1]University of Luxembourg, [2]Università Milano-Bicocca, Italy, [3]Université Catholique de Louvain, Belgium, [4]Università di Padova, Italy, [5]Rehazenter Clinic, Luxembourg. — Cancellation tasks are typically used in the clinical assessment of patients' ability to explore extra-personal space. They require programming and executing on-line and step-by-step exploration of a display, with serial cancellations of specific targets displayed between distracters. One of their major aims is to detect the presence of unilateral spatial neglect, but when they are numerically adapted, they also allow measuring the subjective visuo-spatial displacements induced by number's magnitude. In our experiments we implemented cancellation tasks on a tablet PC and computed analyses based on the average x,y-coordinates of the participants' cancellation marks. Using a numerically adapted star cancellation task, we have firstly confirmed that numbers can induce attentional shifts according to their magnitude (small towards left and large towards right), even when participants are freely exploring the peripersonal space ($F(1,28)=12.713;p<.001$). This effect is purely due to the numbers. In fact by reorienting either the visual frame reference or the digits used as distracters 90° (counter-)clockwise, we found a vertical bias only when digits where tilted ($F(1,37)=2.845;p<0.05$). Moreover, by numerically adapting the OTA test, we induced "objet-based" biases in which participants produced false positive errors as a function of magnitude of distracter-digits, small vs. large ($F(1,30)=3.010;p=.05$). Finally but importantly, we were able to use numbers as a clinical tool for the rehabilitation of left neglect patients, who showed a stronger recuperation of their visual rightwards bias when presented with small digits to be marked ($F(2,33)=4.834;p<.014$). These studies establish the clinical and experimental interest of digitally administered cancellation tasks.

EMOTION & SOCIAL: Emotion-cognition interactions

D16

PERCEPTUAL REVERSALS OF NEGATIVE VS. NEUTRAL STIMULI DURING BINOCULAR RIVALRY ARE MARKED BY HIGHER CURRENT SOURCE DENSITY AND INCREASED BETA POWER OVER BILATERAL SCALP

Navdeep Ahuja[1], Nalin Mehta[2], Ratna Sharma[3]; [1]All India Institute of Medical Sciences, New Delhi, [2]All India Institute of Medical Sciences, New Delhi, [3]All India Institute of Medical Sciences, New Delhi — Binocular rivalry is a phenomenon of alternating percepts when two different stimuli are presented simultaneously to different eyes. Emotional stimuli have known to be perceived for longer durations during their binocular rivalry with neutral stimuli. Present study aimed to examine perceptual reversals in rivalry of negative and neutral stimuli. International Affective Picture System (IAPS) pictures classified according to their valence ratings were presented according to intermittent paradigm of binocular rivalry and their perceptual rivalry was achieved with the help of a mirror stereoscope in consenting healthy male subjects of age between 20-35 years. Quantitative EEG with 128 channels (EGI, USA) was simultaneously recorded. Source analysis was done using sLORETA(standardised low resolution brain electromagnetic tomography) and wavelet analysis was done with continuous wavelet transform. Dominance durations of negative stimuli were found to be more than that of neutral stimuli. A significantly higher beta power over bilateral areas of scalp was found during perceptual reversals compared to stable perception in time intervals of 100 ms before the stimulus onset as well as during 600 ms after stimulus presentation. Statistically significant higher current source density of 36 cortical gyri was obtained 100 ms before and in 46 gyri, 100 ms after the stimulus presentation. Pre-stimulus activation of source areas may reflect their influence on conflict resolution during binocular rivalry which is associated with higher beta power over bilateral scalp areas.

D17

DEFAULT MODE NETWORK INTERACTIONS IN THE CONTEXT OF SELF-REFLECTIVE PROCESSING

Ryan Phillips[1], Cameron Carter[1]; [1]University of California, Davis — Resting state data suggest that default mode and task positive networks (DMN/TPN) are often anti correlated. However the relationship between default mode network activation and external task performance remains poorly understood and is an area of active investigation. We sought to shed light on this issue using a novel task in order to examine the impact of personal relevance on DMN activity and task performance and administered it to 16 subjects. This task combined self-reflective processing with the AX Continuous Performance Task (AXCPT). Following the task, subjects rated self-reflective stimuli on the basis of personal relevance. In a preliminary analysis neuroimaging data was then analyzed across two levels of relevance and two levels of cognitive control demands. We found a main effect of personal relevance resulting in greater DMN activation, a main effect of cognitive control demands resulting in greater TPN activation, and an interaction involving the ACC. Behavioral results indicated an increase in attention lapses following high-relevance stimuli. We interpret these results as indicating that the ACC increases in activity under conditions of elevated competition for attention. That is, under conditions in which the subject is drawn to internal and external stimuli simultaneously. It appears that personal significance does alter how DMN activity influences external task processing, and that as previously has been suggested the ACC may be an important region for switching between internal and external focus of attention. Additional data in a larger sample of subjects will be presented.

D18

EXPECTATION AND INDIVIDUAL DIFFERENCES IN EMOTION REGULATION MODULATE NEURAL RESPONSES TO AFFECTIVE STIMULI

Emily G. Brudner[1], Martin Paczynski[2], Allen Osman[1], Amishi P. Jha[1]; [1]University of Miami, [2]George Mason University — We examined the influence of valence expectation and individual differences in emotion-regulation strategies on the Late Positive Potential (LPP), an event-related potential (ERP) component to negative and neutral visual images from the International Affective Picture System (IAPS). During ERP recording, participants (N=29) were asked to perform a simple category-judgment task in which they indicated by button press if briefly presented IAPS pictures were right-side up or upside down. Expectations regarding image valence were manipulated by the presentation of abstract visual cues (red or blue shapes) indicating the likely valence of the upcoming images. Cues were valid 75% and invalid 25% of the time. The LPP in response to the images was investigated to determine if there were significant amplitude differences as a function of the cue and image valence. The Emotion Regulation Questionnaire (ERQ) was used to measure individual differences in emotion regulation strategies involving cognitive-reappraisal and suppression. LPP amplitude was greater for negative than neutral images. Cue valence produced a similar pattern, with negative cues resulting in a larger LPP regardless of image valence. The electrophysiological effects of cue but not image valence were associated with ERQ reappraisal but not suppression scores. Low reappraisers evinced larger effects of cue valance than high reappraisers. This would be expected if the tendency to reappraise promoted successful emotion regulation in response to negatively-cued images. These findings provide further insight into how the neural activity associated with emotional reactions depends on the interplay between expectation, affective content, and individual differences in emotion regulation.

D19

EEG MU-SUPPRESSION SHOWS SELF-OTHER DIFFERENCES IN RESPONSE TO MOVING, BUT NOT STILL, EMOTIONAL FACES

Dylan Barbera[1], Grossman Taylar[1], C. Chad Woodruff[1]; [1]Northern Arizona University — Previous investigation into Electroencephalographic (EEG) mu-rhythm suppression (8-13 Hz) during action-observation vs. execution tasks has indicated that self-other differences in mu suppression are related to measures of perspective taking. Further study has shown that simply observing self- vs. other- related stimuli elicits this relationship as well. In the current study, we sought to investigate the necessity of motion perception in mu suppression and its discrimination between self and other. In separate blocks, participants were presented with both videos and pictures of either themselves or others expressing 1 of 4 emotional faces: happy, sad, angry or neutral. Participants then completed a self-report measure of empathy (Interpersonal Reactivity Index). Results revealed significant mu suppression in response to video stimuli while no significant mu suppression was elicited by still photographs. Additionally, a significant self-other difference was seen in mu suppression data of the motion condition. Mu suppression values in the motion condition showed significant correlations with empathy questionnaire's while static condition mu-suppression failed to elicit significant correlations. These data replicate previous mu suppression findings and further elucidate the relationship between mu suppression and self-reported empathy.

D20

THE EFFECT OF UNEXPECTED NEGATIVE EVENTS ON ENCODING

Brittany Corbett[1], Lisa Weinberg[1], Audrey Duarte[1]; [1]Georgia Institute of Technology — Previous research has found that episodic memory is better for negatively arousing events versus neutral events. What is unclear is how being prepared for a negative event changes the way it is encoded. In an fMRI paradigm, participants viewed negative and neutral pictures preceded by cues that were either reliable predictors of the valence of the image (valid) or cues that were unreliable predictors of the valence (invalid). Participants were asked to rate the emotional intensity of these pictures during encoding and to complete a recognition task immediately after the fMRI scanning. Our results show that regardless of valence, pictures preceded by an invalid cue were rated more intense than pictures preceded by a valid cue. Participants were slower to respond for intensity ratings during pictures preceded by an invalid cue than pictures preceded by a valid cue. Recognition memory accuracy was better for pictures preceded by an invalid cue than pictures preceded by a valid cue. Activity in the anterior cingulate predicted greater accuracy for negative events preceded by invalid cues compared to valid cues. Collectively the behavioral results suggest that when participants are unprepared to encode a negative event they are more likely to rate the pictures as more intense and they are more likely to remember those events. The imaging results suggest that unexpected negative events lead participants to engage in emotional regulation, which in turn supports subsequent memory performance.

D21

FOLLOW THE EYES - INFLUENCE OF EMOTIONAL EXPRESSION ON VISUOSPATIAL ATTENTION

Bastian Soehnchen[1], Anna K Kastner[1], Elena LR Flohr[1], Abby Looi[2], Matthias J Wieser[1], Paul Pauli[1]; [1]University of Wuerzburg, [2]University of California, Los Angeles — Perceived gaze direction has been shown to introduce shifts in visuospatial attention. The influence of emotional facial expression on this effect seems to be small under normal circumstances. However, evidence suggests that the context in which an emotional face is viewed is important. The present study investigated whether a threatening context mediates the effect of emotional expression on shifts in visuospatial attention. Participants conducted a probe detection task in two contexts. The contexts differed in level of threat, induced by context conditioning. The presentation of probes was preceded by facial cues, differing in cue-target congruency and facial expression, being neutral, angry or fearful faces. Behavioral results show a difference in reaction time (RT) between congruency and emotional expression. While fearful faces induce the typical congruency effect (faster RTs in congruent trials) in both contexts, the opposite effect is shown for angry expressions. However, this only occurs in the threatening context, and not in the non-threatening context. Moreover, RTs of neutral faces were not affected. Electrophysiological results show that the N170 component, time-locked to cue onset, was larger in emotional compared to neutral expressions. Furthermore, the N2pc component, an ERP associated with spatial shifts in attention, was significantly mediated by emotional expression and gaze-target congruency. For neutral faces N2pc difference scores are higher in incongruent, than in congruent trials; the opposite was found for trials with angry faces. To conclude, emotional expression influences shifts in visuospatial attention. However, the effect differs between expressions and is in some cases, context dependent.

D22

PRIOR EXPOSURE TO EXTREME PAIN ALTERS THE PERCEPTUAL PROCESSING OF OTHERS' PAIN; THE EFFECT OF OXYTOCIN

Moranne Eidelman-Rothman[1], Abraham Goldstein[1], Omri Weisman[1], Inna Schneiderman[1], Orna Zagoory-Sharon[1], Jean Decety[2], Ruth Feldman[1]; [1]Bar-Ilan University, [2]The University of Chicago — Extensive research examined brain mechanisms implicated in pain perception and theorized that the overlapping response to pain of self and other marks the human capacity for empathy. Here we investigated how prior exposure to extreme pain affects pain perception by assessing the spatio-temporal dynamics of pain processing in veterans previously exposed to severe injury. Additionally, we examined the effect of the neuropeptide oxytocin on pain perception. Using a double-blind, placebo-controlled, within-subject design, 43 participants(28 pain-exposed and 15 controls) underwent whole-head magnetoencephalography(MEG) twice following oxytocin/placebo administration while performing a pain-perception task, including the presentation and evaluation of photographs depicting limbs in painful and non-painful conditions. In line with previous research, we found increased brain activation in response to painful vs. non-painful stimuli among controls, indicated by enhanced suppression in the alpha frequency band(8-12 Hz) in the pain condition. This "pain-effect" was evident in two distinct time windows: an early effect at 0-220 ms following stimulus onset, which was located to the posterior cingulate(PCC) and sensorimotor cortices, and a later effect(760-900 ms), located to the PCC, superior temporal gyrus(STG)/insula, and fusiform gyrus. Importantly, no similar effect was found among pain-exposed individuals, who showed normative response to pain but no pain-to-no-pain differentiation. Oxytocin administration attenuated overall activity in the STG/insula and under oxytocin no pain-effect was found. Results demonstrate alterations in pain perception following extreme pain exposure, chart the sequence from early(automatic) to later(evaluative) pain processing and emphasize the importance of considering past experiences in studying the neural response to others' state.

D23

TIME PERCEPTION, EMOTION, & COGNITION: AN ERP INVESTIGATION

Luke R. Pezanko[1], Aminda J. O'Hare[1]; [1]University of Massachusetts Dartmouth — People often subjectively report time slowing down during negative events. Prior research on the effects of emotion on time perception has found negative emotional images to alter time perception in time reproduction tasks. Interestingly, when the type of negative emotion was controlled for, only disgust images were found to correspond to over-reproductions of time, while fear images were found to correspond to under-reproductions of time. Externally- versus internally-focused attention may account for these different effects, however, a better understanding of the effects of different types of negative emotion on time perception is needed. The contingent negative variance (CNV), an event-related potential (ERP), has been found to fluctuate with over- and under-reproductions of time. In the current study, participants (n = 36) completed a time reproduction task that presented high and low arousing angry, disgust, and fear faces, as well as neutral faces at different durations. High-density, 64-channel EEG was recorded during the task to test CNV effects. A significant main effect for emotion was found such that fearful faces elicited larger CNV amplitudes compared to angry and disgust faces ($p<.05$). A significant main effect of presentation duration was found, such that shorter (400ms) intervals elicited larger CNV amplitudes than 600ms and 800ms intervals ($p's<.05$). These data support previous research that has found different negative emotions to have different effects on time perception; however, the direction of the effect conflicts previous findings. Possible theoretical accounts for these findings will be discussed.

D24

NEURONAL BASIS OF EMOTION AND COGNITIVE PROCESSING IN YOUNG ADULTS AND ADOLESCENTS

Lynn V. Fehlbaum[1], Nora M. Raschle[1], Willeke M. Menks[1], Felix Euler[1], Christina Stadler[1]; [1]Psychiatric University Clinics Basel, Basel, Switzerland — Neuroimaging during tasks combining emotional and cognitive stimuli has suggested that negative cues can interfere with task performance. However, the neuronal networks involved in emotion-cognition interaction and the processing of cognitive load remain debated both in the typical population and in patients with impaired emotion regulation such as in conduct disorder (CD). Therefore, our goal is the investigation of the neuronal basis of emotion-cognition interaction in healthy young adults and adolescents with/without CD. We employed whole brain functional magnetic resonance imaging using an emotional priming task first in 30 gender-, age- and IQ-matched healthy young adults and, secondly, in 34 adolescents with CD and 19 age-matched controls. Each trial consisted of a number Stroop task (congruent/incongruent/neutral) preceded by an aversive or neutral prime. Preliminary analysis in young adults behaviorally revealed Stroop effects for aversive vs. neutral trials and incongruent vs. congruent trials. Neuronally, activity in cognitive (left inferior frontal junction and parietal lobe) and emotion (amygdala, insula, medial prefrontal cortex, anterior cingulate) areas of the brain were increased during emotional priming. More specifically, emotion-cognition interaction led to increases in emotion and cognition related activation when task load was low. As task load increased, interaction effects revealed a relative decrease in activation within similar brain regions. Cognitive load is, thus, a moderating factor in emotion-cognition interaction. This analysis lays the foundation for data presented in younger adolescents with and without CD. Here, we expect the neuronal interplay between emotion and cognition to be impaired according to symptom severity and personality characteristics.

D25

NEURAL CORRELATES OF MOTIVATION-EMOTION INTERACTION DURING PERCEPTION

Srikanth Padmala[1], Mihai Sirbu[1], Luiz Pessoa[1]; [1]University of Maryland, College Park — We have recently reported that during a challenging perceptual task, the impact of potent negative emotional distractors was reduced in the presence of performance-based monetary rewards (Padmala & Pessoa, 2014). In the current functional MRI (fMRI) study, we investigated neural correlates of this behavior. On each trial, participants (N=57) were asked to discriminate the orientation of peripheral bars while ignoring a centrally presented neutral or negative picture. The angular difference between the peripheral bars was calibrated for each participant such that participants produced approximately 80% correct responses. Motivation was manipulated by presenting a reward ("$$") or no-reward ("##") cue at the start of each trial. After a variable delay (2-6 s), the bars-plus-picture display was shown. Participants were instructed that they could earn 25 cents for fast and accurate performance during the reward condition. Behavioral RT results replicated our previous finding of a motivation and emotion interaction, such that the emotional distractor effect was significantly reduced during the reward compared to no-reward condition. fMRI responses during the cue phase revealed stronger reward (vs. no-reward) activation in ventral striatum and midbrain. Paralleling the behavioral data, fMRI responses during the task phase exhibited a significant interaction between motivation and emotion in anterior insula, anterior cingulate cortex, and intraparietal sulcus. Furthermore, reward cue-related activation in ventral striatum was correlated with the behavioral motivation x emotion interaction. Taken together, our fMRI findings add to our understanding of appetitive-aversive interactions in the brain during task performance.

D26

FEASIBILITY AND INITIAL EFFICACY OF A NOVEL MOOD ASSESSMENT AND INTERVENTION APPLICATION IN PARKINSON'S DISEASE

Alit Stark-Inbar[1,2], Ronnie Wanetick[3], Michael Merzenich[1], Thomas Van Vleet[1], Mor Nahum[1]; [1]Posit Science Corporation, [2]University of California, Berkeley, [3]Parkinson's Disease Foundation — Prevalent mood disorders such as depression and anxiety are among the most troublesome non-motor symptoms in patients with Parkinson's disease (PD). However, mood disruption is often poorly addressed. Thus, we have developed a multimodal iPad-based application that facilitates continuous mood monitoring and deployment of validated interventions in nearly any environment. The game-like interface is comprised of 3 components: (1) a suite of mood measures including validated questionnaires, behavioral tasks that capture implicit mood related biases, and voice analyses; (2) cognitive-emotional training exercises shown to improve mood states in several clinical populations; and (3) continuous connection with a cloud-based portal that provides performance feedback to users and remote clinical monitoring. Here we report initial feasibility testing in 6 patients with mild to moderate PD. Participants were asked to use the app at least twice per day for a period of two weeks. Participants engaged with the app at both ON/OFF medication states and provided usage feedback. Overall, participants completed 96±18% of the required sessions, enjoyed using the app, and were willing to recommend it to their peers. Data from the cognitive-emotion regulation intervention showed evidence of improvement in the training exercises, in that participants increased their working memory span and reduced their level of distraction. In addition, following this short period, participants showed trend-level improvements in several mood-related metrics. The information collected from this initial field-study showed that remote, app-based mood tracking and treatment is feasible in PD. A larger, well-controlled follow-up study is underway to further examine app efficacy.

D27

EFFECTS OF EMOTIONAL CONTENT IN WRITTEN AND SPOKEN WORD PROCESSING: EVIDENCE FROM EVENT-RELATED BRAIN POTENTIALS

Annika Grass[1], Wiebke Hammerschmidt[1], Mareike Bayer[1], Annekathrin Schacht[1]; [1]University of Goettingen, Germany — Spoken language plays a major important role in human communication in our everyday lives. Nevertheless, the investigation of effects of emotional meaning on spoken word processing was neglected, relative to written words. In the present study, the processing of emotional words in two modalities was compared by means of event-related brain potentials (ERPs). Spoken words were produced by a computer-voice (Experiment 1, N=25) and a human speaker (Experiment 2, N=22) and compared to the same written words. In both experiments, emotion effects for written words were evident roughly between 230-400 ms in the early posterior negativity (EPN), which has been suggested to reflect attention allocation to emotional content. Interestingly, spoken words elicited a highly similar component between 460 and 510 ms, when considering the scalp distribution of the ERP differences between emotional and neutral words. Source localization revealed comparable activations in occipital areas and the fusiform area for both visual and auditory EPN activation, spreading to the frontal lobe for auditory words only. Our finding indicate strong similarities in the processing of emotional content across modalities that – at least partly – rely on the same neural system leading to a comparable scalp distribution of emotion-related ERP effects.

EMOTION & SOCIAL: Other

D28

HEARING AN EMOTION ALTERS HOW WE SEE EMOTION IN A FACE AND THE CORRESPONDING PHYSIOLOGICAL STRESS RESPONSE

Vivian M. Ciaramitaro[1], Anh Phan[1], Daniel A. Harris[1], Hannah E. Lapp[1], Richard G. Hunter[1]; [1]University of Massachusetts Boston — Faces convey a variety of important information such as gender, identity or emotional state. Given that perception of emotional state is imperative for social interactions, we examined how an emotion we hear might influence how we see emotion in a face. We used an adaptation paradigm to quantify the shift in an individual's neutral point when seen and heard emotions were congruent (angry face and angry voices or happy faces and happy voices) versus incongruent (angry faces and happy voices or happy faces and angry voices). We hypothesized that adapting to congruent visual and auditory emotions would yield stronger perceptual shifts in the neutral point compared to incongruent emotions. To date, we have recruited 38 participants from the University of Massachusetts Boston (ages, 18-27 years). We quantified each participant's neutral point by fitting behavioral data with a cumulative normal to determine where faces are equally likely to be judged happy as angry, before and after adaptation. We also quantified each subject's physiological stress response by measuring salivary cortisol before and after adaptation. Preliminary behavioral results suggest

stronger adaptation for the congruent (mean shift of 15%) versus incongruent (mean shift of 3%) condition within each emotional category, with a trend for stronger effects after adaptation to happy versus angry faces. Preliminary physiological results suggest complementary changes in the cortisol stress response, with a trend for stronger effects, greater decreases in cortisol, after adaptation to happy versus angry faces, and with physiological trends mirroring behavioral trends for congruent versus incongruent conditions.

D29

TRANSCRANIAL DIRECT CURRENT STIMULATION AFFECTS INTENTION PROCESSING IN MORAL JUDGMENT

Tian Gan[1,2], Xiaping Lu[2], Honghong Tang[2], Chao Liu[2], Yue-jia Luo[3]; [1]Department of Psychology, Zhejiang Sci-Tech University, Hangzhou, 310018, China, [2]State Key Laboratory of Cognitive Neurosciences and Learning, Beijing Normal University, Beijing 100875, China, [3]Institute of Affective and Social Neuroscience,Shenzhen University, Shenzhen, 518060, China — When we evaluate the moral status of an action, we consider not only its outcomes but also the intentions of the actor. Previous studies showed that the right temporo-parietal junction (RTPJ) is the critical brain region for understanding intention. The present study aims to investigate the anodal excitation effect of transcranial direct current sitmulation (tDCS) on intention processing in moral judgment. 18 healthy subjects underwent two tDCS sessions (anodal and sham tDCS) on 2 separate days with 1 week interval between both stimulations. After stimulation, subjects read stories in a 2 (intention: negative vs. neutral) × 2 (outcome: negative vs. neutral) design and were asked to make moral judgment about how much blame the actor deserves. Results showed significant interaction between intention and outcome for the moral evaluation score. For the reaction time, judgments of attempted and accidental harm were slower than the other two conditions. Most importantly, the moral judgment was slower under anodal than sham tDCS stimulation, especially under the attempted harm and accidental harm conditions. These results implied that using anodal tDCS to excite the neural activity of RTPJ enhanced the capacity of mentalizing in moral judgment, especially in the cases of attempted harm and accidental harm. Key words: moral judgment; intention; RTPJ; tDCS This work was supported by NSFC (31400878), MOE Project of Humanities and Social Sciences (14YJC190005), the Project of Zhejiang Federation of Humanities and Social Sciences Circles (2014N145) and Science Foundation of ZSTU under Grant No.13062172-Y.

D30

ARE CHANGES IN CHOICE PAYOFFS REFLECTED IN NEURAL SYNCHRONY DURING THE PRISONER'S DILEMMA? AN EEG ANALYSIS

Bradley Robinson[1], Nicholas JA Wan[1], Kerry E Jordan[1]; [1]Utah State University — Previous research has explored behavior in social dilemmas. Less is known about neural differences in the decision to cooperate or defect. Research also has not explored whether differences in payoff quantities during the Prisoner's Dilemma (PD) affect neural activation. Here, we begin to explore possible neural differences when receiving a large reward when compared to a smaller reward after choosing to defect or cooperate. We examined activation in frontal and parietal regions using electroencephalography (EEG) while participants played the Prisoner's Dilemma, varying the payoff matrix between participants. Utilizing channel-wise comparisons to examine alpha desynchrony in cooperation and defection, we find greater alpha desynchrony in the cooperate condition ($p = .035$, $F = 5.785$), irrespective of payoff quantity. In addition, we examined whether there were differences in high (10-12 Hz) and low (8-10) alpha ranges. In high-alpha desynchrony, choice comparisons revealed activation patterns consistent with alpha desynchrony ($p = .003$), though with a greater effect size ($F=13.713$). In low-alpha desynchrony, however, this difference was not seen ($p=.28$), indicating that the desynchrony seen in the alpha band during choice conditions is found more specifically in high-alpha ranges. We did not see a significant difference when comparing payoff conditions - irrespective of point matrices differences - to synchrony in any of the frequency bands examined. This suggests differences in quantity during social dilemmas do not significantly alter activation in the regions of interest and frequency bands explored here.

D31

NOVEL TECHNIQUES FOR ELUCIDATING NEUROPHYSIOLOGICAL MECHANISMS OF SELECTIVE MUTISM

Erica J. Ho[1], Lindsay M. Alexander[1], Nicolas Langer[1,2], Maki S. Koyama[1], Michael P. Milham[1], Simon P. Kelly[3,2]; [1]Child Mind Institute, [2]City College of New York, [3]University College Dublin — Selective Mutism (SM) is an understudied anxiety disorder that inhibits an individual's ability to speak in specific social settings. While existing research has focused on behavioral characterizations, the present study used novel techniques to elucidate the neurocognitive mechanisms underlying SM. Ten SM-diagnosed children ages 5-10 participated. EEG and eye-tracking were recorded while participants completed: 1) an emotional face processing task, displaying faces from the Todorov database (seven faces each, along the trustworthiness and dominance dimensions); and 2) a response task, measuring motor vs. verbal responses to indicate color decisions, with and without a stranger present. Participants then completed tests of IQ, motor coordination, and processing speed. Parents also submitted questionnaires about the children's physical and mental well-being. Consistent with prior work studying the same face database using fMRI, the present work revealed orthogonal neurophysiological patterns for responses to Dominance vs. Trustworthiness using EEG. Specifically, at PO8, decreased P100 activity was associated with increased Dominance but not Trustworthiness, while the P300 showed increased amplitude with higher degrees of Trustworthiness but not Dominance. The classic, face-sensitive N170 component did not discriminate between the two dimensions. In the Response task, consistent with a priori predictions, the stranger's presence significantly increased response latencies and also decreased speaking volumes. Response-locked frontal activity patterns significantly differed between the motor vs. verbal modalities. Upcoming work will increase sample size and include a typically developing comparison group. This study demonstrates the potential to develop a cognitive neuroscience-based framework for indexing abnormalities in SM.

D32

THE SIGNIFICANCE OF HIGH OR LOW INTERNALIZING BEHAVIOR IN PRODUCING EVERYDAY ANTISOCIAL BEHAVIOR.

Natasha Hamilton[1], Connie Shears , Ph.D.[1]; [1]Chapman University — Research suggesting a genetic or neuroanatomical correlation to antisocial behaviour is growing. For example, the decreased fractional anisotropy in areas of dense white matter tracts, which connect the frontal and temporal lobes, correlates with the proximity of DNA methylation and the oxytocin receptor gene (Haney, Caprihan, & Stevens 2014; Cecil et al., 2014). Antisocial behaviours are challenging to investigate using empirical methodologies and currently nearly all research is limited to relational observations. This experiment tests whether the change in physiology and propensity to repeatedly commit antisocial behavior, specifically lying about stealing, increases for participants watching a moral perspective video relative to a control video. We hypothesize that individuals who exhibit antisocial behavior, even on a minor scale, and those who do not, can be evaluated based on pre-existing levels of internalizing behavior and measured by changes in physiological measures. Preliminary results show that participants who stole and had pre-existing high internalizing scores exhibit greater increases in physiological measures than participants who also stole but had pre-existing low internalizing scores and this was only after watching the moral video, not the control video. With more empirical research focused on non-clinical antisocial behaviors, psychologists may better understand causes of antisocial behavior from both a behavioural and biological level.

D33

MENTALIZING AND THE UNCANNY VALLEY

Abdulaziz Abubshait[1], George A. Buzzell[1], Paul J. Beatty[1], Eva Wiese[1]; [1]George Mason University — The uncanny valley hypothesis refers to the notion that computer-generated avatars or humanoid robots can elicit feelings of unease when such agents appear too similar to humans. Specifically, as visual human likeness increases, positive ratings of humanoid robots generally increase, with the exception of a sharp drop in positive ratings as robots come to more closely resemble humans. Here, we investigated the relationship between mentalizing and the uncanny valley, using a combination of subjective reports and a social attention paradigm. While being scanned with fMRI, participants rated different agents (appearance varied on a spectrum from 0%-100%

human), in terms of whether the agents "had a mind". Participants then interacted with each of the agents in a social attention task, where the degree of gaze-following is used as an index of the social relevance of the observed behavior. Subjective ratings suggested a linear increase in mind attribution as agents became more humanlike in appearance, with no indication of an uncanny valley effect. In contrast, the gaze-following task revealed a clear uncanny valley effect, with a sharp drop in gaze-following for the 60%-80% human-like agents. Interestingly, preliminary fMRI analyses suggest that two brain regions of the theory-of-mind (ToM) network, the posterior Superior Temporal Gyrus and the Medial Frontal Cortex, were parametrically modulated in a manner similar to the uncanny valley. This suggests that although conscious reports of ToM do not conform to the uncanny valley, brain regions involved in mentalizing do, and that neural data can predict actual behavioral interactions with agents.

D34

"MOO" SUPPRESSION- MU SUPPRESSION IN VEGANS AND VEGETARIANS IS HIGHER COMPARED TO OMNIVORES WHEN VIEWING A FOOD ANIMAL VIDEO

Joseph Aruguete[1], Nicholas James[1], Katherine Illecki[1], Karlie Krause[1], Chad Woodruff[1]; [1]Northern Arizona University — Vegans and vegetarians have been shown in fMRI studies to have structural neurophysical differences as compared to omnivores. Previous research indicates that vegans and vegetarians have higher empathy for food animals as compared to omnivores. Mu suppression, an 8-13Hz wave believed to originate over the C3, Cz, and C4 electrodes, has been found to negatively correlated with empathic perspective taking. This study wanted to observe whether or not omnivores would display less observed mu suppression when looking at food animals when compared to vegetarians. Using a 32 electrode EEG cap and Mitsar equipment, the study had participants watch 80 second blocks of farm, pet, human, and white noise videos. After the video was over, researchers gave participants (n=31) the Interpersonal Reactivity Index (IRI) to measure empathy in the individuals. 3x3 ANOVAs (condition x electrode), within subjects of condition and electrode, and 2x3x3 ANOVAs (diet x electrode x condition) with a between subject of diet and a two within subjects of electrode and condition were performed, as well as correlational analyses between IRI scores and mu suppression. Findings indicate that while there was no difference found between the 3x3 ANOVAs, there was significance found in the 2x3x3 ANOVAs ($p<.05$), with omnivores showing greater suppression towards pets and humans compared to food animals. Correlational analyses found pet condition bands had a positive correlation with Personal Distress scale subtype and negative correlation between food animals and Perspective Taking. Our findings indicate omnivores empathize differently compared to vegetarians when looking at food animals.

D35

THE EFFECTS OF TRANSCRANIAL DIRECT CURRENT STIMULATION ON THE EVALUATION OF EVERYDAY MORAL DILEMMAS

Christopher H. Ramey[1], Alex Fennell[1], Erin M. Calhoun[1]; [1]University of Kansas — Human beings are social creatures who constantly judge each other. The judgment of the morality of an everyday action (e.g., not returning a dropped wallet) plays a major role in evaluating human conduct. Previous research has revealed that the right temporoparietal junction (RTPJ) features in the understanding of another's intentions and allows one to project oneself mentally into another's perspective. In this study we used tDCS to affect the neural activity in the RTPJ during the evaluation of everyday moral dilemmas. Participants were healthy adult volunteers from the undergraduate psychology research pool who read 40 normed vignettes describing everyday moral dilemmas (Knutson et al., 2010), 20 very negative and 20 very positive dilemmas. After each vignette, participants responded to five questions on the perceived emotional intensity, amount of harm inflicted, level of premeditation, number of individuals involved, and overall moral appropriateness of the action. Participants were randomly assigned to one of three conditions, one receiving inhibition to the RTPJ, one receiving inhibition to the left temporoparietal junction (LTPJ), and one sham. In both active tDCS conditions we applied 1500mA cathodal stimulation for 20 minutes. Results indicate that for negative moral dilemmas, inhibiting LTPJ instead of RTPJ resulted in greater perceived emotional intensity; inhibiting RTPJ led to longer reaction times. Inhibition of RTPJ relative to LTPJ led to longer reaction times to judge the premeditation of an action. Overall, results support the involvement of RTPJ in the evaluation of everyday moral dilemmas and the possibility of modulating moral judgments with tDCS.

D36

AVATARS AS A SUPPORT FOR FEEDBACK-BASED LEARNING

Ali Momen[1,2], Marc Sebrechts[2], Mowafak Allaham[1]; [1]George Mason University, [2]The Catholic University of America — An avatar is a computer-based graphical character that typically shows similarity to a human figure, without the detail in visual characteristics or abilities. Previous work by Mumm and Mutlu (2011) has shown that feedback delivered by an avatar results in higher levels of motivation than when no avatar is present. These results fit with a number of arguments that an avatar can enhance task performance through a sense of "social presence." Although computer-based feedback studies have shown evidence for heightened learner perceptions, those studies did not measure actual learning. So, there is minimal evidence for this outcome. This experiment explored whether the inclusion of an avatar displaying verbal and non-verbal affective cues in a feedback task would enhance social presence and motivation as well as facilitate learning on a Chinese symbol retention task. The main task was a feedback-based learning of the translation of Chinese symbols into English. Learning occurred with four different computer-based agents: a computer generated figure, a human figure, a non-humanoid image and a non-image verbal condition. In each condition subjective measures of social presence and motivation were collected. Analysis compared feedback conditions and related them to social presence and motivation. The results showed no significant differences between groups on learning, although means showed best performance in the non-image verbal condition. Additionally, results showed that participants perceived less social presence with the non-humanoid image compared to feedback from the human figure.

EMOTION & SOCIAL: Person perception

D37

LET'S CHAT: DEVELOPMENTAL NEURAL BASES OF SOCIAL MOTIVATION DURING REAL-TIME PEER INTERACTION

Katherine Rice[1], Eleonora Sadikova[1], Elizabeth Redcay[1]; [1]University of Maryland — People are strongly motivated to interact with others, but neuroimaging studies of social motivation have predominately employed non-interactive contexts (e.g., photographs of faces). Understanding the brain bases of real-world social motivation is especially important in middle childhood (ages 8-12), when social relationships become more complex and social-cognitive networks are specializing. The current fMRI study employed a novel, interactive task in which 19 children (8 males, mean age=10.5y) believed they were communicating in real-time with a peer. We had two events of interest: (1) Initiation, in which children answered a self-relevant prompt, believing their answer was shared either with the peer or just the computer; and (2) Reply, in which the peer agreed with the child's answer (i.e., Peer Engagement) or was away (i.e., Peer Non-engagement). For computer trials, children were told their answer matched a randomly generated answer (i.e., Computer Engagement) or that the computer was offline (i.e., Computer Non-engagement). During Initiation, ventral striatum (VS) was more active for Peer than Computer. During Reply, VS, OFC, and dMPFC were more active for Peer Engagement than for either Peer Non-engagement or Computer Engagement. Post-test ratings indicated that the difference in self-reported reward value between Peer Engagement and Non-engagement was larger than the corresponding difference on Computer trials. These findings demonstrate a developmental role for the reward network in supporting on-going peer interaction using a naturalistic interactive task. The use of interactive paradigms has implications for disorders such as autism and social anxiety, where social motivation is more affected in real-world contexts.

D38

EXTRAPOLATION OF SOCIAL INFORMATION TO PHYSICALLY SIMILAR INDIVIDUALS CONTRIBUTES TO STEREOTYPING

Brandon Levy[1], Chris I. Baker[1]; [1]National Institute of Mental Health — Previous evidence demonstrates that social evaluations of a face will transfer to morphed versions of the same face even when the transformed face is perceived as a

new identity (Todorov et al., 2010). The current study investigated whether this similarity-driven generalization of social information might underlie social stereotyping. We created three groups of faces with high degrees of within-group similarity. A subset of individuals from each group appeared in an investment game in which they returned or kept money invested with them by the participant at different frequencies. Participants then replayed the game during a test phase, this time choosing whether to invest with novel individuals from each group without feedback. In Experiment 1, we found that the behavior of the individuals seen in the first investment game influenced both investment frequency and perceived trustworthiness of physically similar individuals at test. In Experiment 2, removing the social aspect of the initial investment game while maintaining the pattern of reward eliminated these effects, suggesting that participants are not simply learning a reward association. In Experiment 3, using a priming task to minimize explicit comparisons of facial structure, preliminary results also show a bias towards investing with faces preceded by face primes that are physically similar to the more trustworthy individuals from the initial investment game. Collectively, these results suggest that information about a subset of individuals is readily utilized to create group-level stereotypes that bias evaluations of perceptually similar individuals.

D39

A CAUSAL ROLE OF THE RIGHT SUPERIOR TEMPORAL SULCUS IN EMOTION RECOGNITION FROM BIOLOGICAL MOTION

Rochelle Basil[1], Margaret Westwater[1,2], Martin Wiener[1], James Thompson[1]; [1]George Mason University, Fairfax. VA, [2]University of Cambridge — Successful social interactions often depend upon our ability to detect and interpret the bodily kinematics of others. One important facet of social interactions is the recognizing the emotions of another person from nonverbal gestures and body movements. Observers can recognize emotions even from sparse point light displays (PLDs) of body movements, although this recognition can be impaired in schizophrenia and autism spectrum disorders. The right superior temporal sulcus (rSTS) is thought to be central to the perception of biological motion; here, we used repetitive transcranial magnetic stimulation (rTMS) to examine if rSTS plays a causal role in the recognition of emotion from biological motion. Participants (N=23; 13 females) received continuous theta-burst stimulation for 41 seconds in two separate sessions: (1) rSTS, functionally localized in each participant using fMRI and a comparison of intact vs scrambled biological motion and (2) over the vertex. Accuracy and reaction time on emotion from biological motion and on a non-biological, global motion control task were assessed before and after rTMS. Repeated measures ANOVA revealed an interaction between rTMS site and stimulus type ($p < 0.05$), with a reduction in accuracy of emotion from biological motion following rSTS stimulation, but not following vertex stimulation, and no effect on accuracy from either site for the global motion control. Effects of rTMS on reaction time were not significant ($p>0.1$). These data provide evidence for the causal role of the rSTS in decoding information about other's emotional state from their body movements and gestures.

D40

EFFECTS OF SELF-TRANSCENDENCE ON THE EMBODIED UNDERSTANDING OF OTHERS' EMOTIONAL STATES

Cosimo Urgesi[1], Giulia D'Argenio[1], Dusana Dorjee[1], Paul E. Downing[1]; [1]School of Psychology, Bangor University, Wales, UK — Mental representation of ourselves and of others is strongly linked to mapping our bodily states (embodiment). At the same time, the ability to assume an external perspective on actual body perceptions and actions (self-transcendence) is inherently linked to human spirituality. Here, we tested the effects of activating self-transcendent/spiritual representations on the ability to recognize emotions in others' faces. In two experiments, participants were presented with faces depicting positive (happy) or negative (fearful) expressions and were asked to either recognize the emotional valence (i.e., positive vs. negative) or the gender of the faces. Before each picture a prime word was presented that could be associated with spiritual or non-spiritual concepts. The prime was forward and backward masked by a string of Xs beside a central fixation point and was task irrelevant. In experiment 1, participants responded by means of speeded manual key presses and accuracy and responses times were collected and analysed. Results revealed that the presentation of spiritual prime words reduced emotion recognition performance as compared to non-spiritual prime words, while gender recognition remained unaffected. In experiment 2, we used the same trial procedure but rather than requiring an explicit motor responses we recorded motor evoked potentials from arms and forearm muscles. Results showed that presentation of spiritual words reduced motor facilitation during emotion perception, suggesting that priming spiritual representations alters the mapping of others' emotions on the observer's motor system. Overall, these findings point to the role of sensorimotor embodiment in social perception.

D41

REDUCED REPETITION SUPPRESSION TO FACES AND REDUCED FACE MEMORY IN ADULTS WITH AUTISM SPECTRUM CONDITIONS

Michael Ewbank[1], Philip Pell[1], Thomas Powell[1], Elisabeth von dem Hagen[2], Simon Baron-Cohen[3], Andrew Calder[1]; [1]Cognition and Brain Sciences Unit, Cambridge, UK, [2]Cardiff University, Cardiff, UK, [3]University of Cambridge, Cambridge, UK — Autism spectrum conditions (ASC) are associated with difficulties in memory for facial identity, however the neural mechanisms underlying this impairment are unclear. Functional magnetic resonance imaging (fMRI) studies in neurotypical participants reveal that repeated viewing of the same face leads to repetition suppression (RS) (i.e. a reduction in neural activity) in a region of occipitotemporal cortex known as the fusiform face area (FFA). As yet, no studies have investigated RS to faces in individuals with ASC, or investigated the relationship between RS and face memory. Using fMRI, we measured RS to faces and geometric shapes in the occipitotemporal cortex of individuals with ASC and in age and IQ matched controls. Both groups also completed standardized tests of face and object memory. Imaging data revealed that ASC participants showed significantly reduced RS to faces in bilateral FFA relative to controls. By contrast, RS to shapes in object-selective regions did not differ between groups. ASC participants also performed significantly worse than controls on a test of face memory but not on a test of object memory. A whole brain analysis revealed that individual variation in face memory performance (covarying out object memory scores) was positively correlated with RS in regions of parietal and prefrontal cortex commonly activated during short-term/working memory tasks. These findings suggest face memory deficits in ASC may be a consequence of differences in the maintenance and/or processing of face representations within a network of regions extending across occipitotemporal, parietal and prefrontal cortex.

EXECUTIVE PROCESSES: Development & aging

D42

WHITE MATTER MICROSTRUCTURAL DEGRADATION IS ASSOCIATED WITH DECREASED FINANCIAL ABILITY IN PATIENTS WITH MCI AND ALZHEIMER'S DEMENTIA

David A. Hoagey[1], Kristen M. Kennedy[1], Taylor Bartel[2], Deborah Kerr[2], Kristina Visscher[2], Adam Gerstenecker[2], Daniel C. Marson[2]; [1]Center for Vital Longevity, School of Behavioral and Brain Sciences, The University of Texas at Dallas, [2]Department of Neurology and Alzheimer's Disease Center, University of Alabama at Birmingham — Previous neuroimaging research using the Financial Capacity Instrument (FCI) has shown that decreased volumetric grey matter in areas linked to the default mode network (DMN) (angular gyri, precuneus, prefrontal cortex) coincide with reduced financial abilities in patients with mild cognitive impairment (MCI) and mild Alzheimer's dementia (AD). We hypothesized that similar structural declines would occur in corresponding white matter pathways in these groups. We analyzed diffusion tensor imaging (DTI) scans for MCI (n=31), AD (n=39), and older controls (NC)(n=60) using a voxelwise analysis technique, Tract Based Spatial Statistics (TBSS), and subsequent general linear models to estimate differences in white matter diffusivity across the three groups and in relation to FCI performance. Group results showed (1) better fractional anisotropy (FA) for NC and MCI compared to AD; (2) poorer mean diffusivity (MD) and radial diffusivity (RD) for AD than in NC and MCI; (3) poorer axial diffusivity ($\lambda 1$) for AD than MCI. Regarding financial performance, in the MCI group FCI score positively correlated with FA in the corpus callosum, bilateral uncinate fasciculus (UF) and cingulum, and left posterior portions of the superior longitudinal fasciculus (SLF), inferior longitudinal fasciculus, and inferior fronto-oc-

cipital fasciculus (IFOF). In the Alzheimer's group, FCI score negatively correlated with λ1 and MD in corpus callosum, cingulum, right UF, and bilateral anterior IFOF and SLF. These white matter regions cluster in DMN areas that receive neuronal projections from angular gyri, precuneus, and prefrontal grey matter cortices, lending support to prior volumetric studies of financial capacity. NIH support: AG-021927, AG-036818

D43

INCREASED DOPAMINE SYNTHESIS CAPACITY IS ASSOCIATED WITH A LOWER RATE OF LEARNING IN OLDER ADULTS

Vyoma D Shah[1], Anne S Berry[1], Suzanne L Baker[1], Taylor J Mellinger[2], Kaitlin N Swinnerton[2], Jacob W Vogel[2], William J Jagust[1]; [1]Lawrence Berkeley National Laboratory, [2]University of California Berkeley — Ventral striatal (VST) dopamine influences learning, and age-related disruption of the dopamine system may mediate changes in learning across the lifespan. The present cross-sectional study measured learning in young (n = 21, mean age = 23.8) and older adults (n = 16, mean age = 77.6) using the Logical Memory Test (Wechsler Memory Scale, 3rd Edition) and the Probabilistic Selection Task (Frank et al., 2004). Dopamine synthesis capacity was measured using 6[18F]fluoro-L-m-tyrosine (FMT) PET. Consistent with previous reports in dorsal striatum (Braskie et al., 2008), we found elevated dopamine synthesis capacity in VST for older adults ($t(35) = 3.79$, $p < .001$; partial volume corrected (Rousset et al., 1998): $t(35) = 2.02$, $p = .052$). Though upregulation of dopamine synthesis may reflect compensation for age-related deficits elsewhere in the system, our analyses suggest a negative impact of elevated synthesis capacity on learning in older adults. For the Logical Memory Test, there was a significant age x FMT Ki x learning interaction ($F(1,30) = 9.60$, $p < .005$) such that high synthesis capacity was associated with low rates of learning in older adults, but high rates of learning in young adults. A subset of participants completed the Probabilistic Selection Task. Preliminary analyses mirror these findings such that high synthesis capacity in older adults was associated with decreased learning from reward ($r = -.48$). These results are in line with previous findings suggesting intermediate levels of dopamine synthesis capacity, across age group, are associated with optimal cognitive function.

D44

SOCIOECONOMIC STATUS, WHITE MATTER DEVELOPMENT, AND EXECUTIVE FUNCTION

Alexandra Ursache[1], Kimberly Noble[2]; [1]Columbia University, [2]Teachers College, Columbia University — A growing body of evidence links socioeconomic status (SES) to children's brain structure. Few studies, however, have specifically investigated relations of SES to white matter structure. Further, although several studies have demonstrated that family SES is related to development of brain areas that support executive functions (EF), less is known about the role that white matter structure plays in the relation of SES to EF. One possibility is that white matter differences may partially explain SES disparities in EF (i.e., a mediating relationship). Alternatively, SES may differentially shape brain-behavior relations such that the relation of white matter structure to EF may differ as a function of SES (i.e., a moderating relationship). In a diverse sample of 1082 children and adolescents from the PING Data Resource, we examine socioeconomic disparities in white matter macrostructure and microstructure. We further investigate relations between family SES, children's white matter volume and integrity in tracts supporting EF, and performance on EF tasks. Results indicate that SES is associated with fractional anisotropy (FA) and volume in multiple white matter tracts. Moreover, FA in the inferior longitudinal fasciculus partially mediates the relation between parental education and inhibitory control. Additionally, we find that SES moderates the relation between white matter structure and cognitive flexibility. Specifically, across multiple tracts of interest, lower FA or lower volume is associated with reduced cognitive flexibility among children from lower income families. In contrast, children from higher income families show preserved cognitive flexibility in the face of low white matter FA or volume.

D45

SOCIOECONOMIC STATUS IS ASSOCIATED WITH HAIR CORTISOL AND EXECUTIVE FUNCTION IN 5- TO 7-YEAR-OLD CHILDREN

Emily Merz[1], Alexandra Ursache[1], Jerrold Meyer[2], Samantha Melvin[1], Kimberly Noble[1]; [1]Columbia University, [2]University of Massachusetts Amherst — Socioeconomic disparities in executive function (EF) development have been well-documented (Noble, Norman, & Farah, 2005). However, less is known about the associations between socioeconomic status (SES) and hair cortisol, an index of cumulative stress exposure, or the extent to which hair cortisol might mediate associations between SES and EF. As such, we examined SES, hair cortisol, and executive function in a sample of 5- to 7-year-old children (N = 40; mean age = 6.32 years; 16 males; 20 Hispanic/Latino; 10 African American). Parents reported on their income and education; parental and child hair samples were collected; and children completed the flanker, list sorting working memory, and dimensional change card sort (DCCS) tasks from the NIH Toolbox Cognition Battery (Akshoomoff et al., 2014). Adjusting for child age, gender, and race/ethnicity, we found that parental education (but not income-to-needs ratio) was significantly negatively associated with children's hair cortisol (Cohen's f2 = .24). Further, parental education was significantly positively associated with children's performance on the flanker (Cohen's f2 = .16) and working memory tasks (Cohen's f2 = .11). However, children's hair cortisol was not significantly associated with their performance on the EF tasks, and thus hair cortisol did not mediate the links between family SES and children's EF. These results converge with recent findings (Vaghri et al., 2013) in showing a link between socioeconomic disadvantage and higher hair cortisol levels in children, and suggest that hair cortisol should be further investigated as a marker of chronic stress among disadvantaged children.

D46

A VALIDATION STUDY OF THE RELATIONSHIPS BETWEEN COGNITIVE RESERVE CAPACITY, MEMORY AND COGNITIVE PERFORMANCE IN HEALTHY MIDLIFE TO SENIOR ADULTS

Lisa McGarrigle[1], Lorraine Boran[1], Kate Irving[1], Martin van Boxtel[2], Sebastian Kohler[2], Frans Verhey[2]; [1]Dublin City University, [2]Maastricht University — The objective of this research is to investigate the validity of a structural model of cognitive reserve (CR) capacity and cognitive decline. Active models of CR highlight the brain's ability to use pre-existing cognitive processes or enlist compensatory processes (Stern, 2002), in the face of mental challenge. The proposed CR model is comprised of Executive Function/Processing Resources (EF/PR) and Cognitive Activity (CA). The aim of the present study was to test this model of predictive relationships between baseline CR and global cognition/memory outcomes in two longitudinal cohorts, Dutch and Irish, at 6-year and 2-year follow-up, respectively. Analysis was conducted on the Maastricht Ageing Study (n=1587), and the Irish Longitudinal Study on Ageing (n=4512). Structural equation modelling (WLSMV estimation) investigated relationships between CR capacity, memory and cognitive performance in two age groups: 50-64 years and 65-82 years. Results indicate that overall the structural model fits the data at just reasonable level for the Dutch dataset and very well for the Irish dataset (Dutch 50-64/65-82 age-groups, respectively: RMSEA=.071[.059-.083]/.075[.063-.087]; CFI=.923/.888. Irish 50-64/65-82 age-groups, respectively: RMSEA=.044[.039-.049]/.041[.036-.047]; CFI=.964/.968). Parameter estimates across both datasets indicate a strong relationship between the two CR factors in both age groups (covariance range: 0.59 - 0.82). In all models EF/PR was a predictor of MMSE (standardized regression coefficient range: .325 - .386, $p < .01$). Investigating structure and fit of the CR model in both Dutch and Irish contexts has provided evidence for the validity of the two-factor CR capacity model and its predictive relationship with cognitive outcomes.

D47

AN INVESTIGATION OF SELF AND ERROR AWARENESS IN OLDER ADULTS

Eric A. Lacey[1], Mahnaz Arvaneh[2], Paul M. Dockree[1], Ian H Robertson[1]; [1]Trinity College Dublin, [2]The University of Sheffield — Whether engaged in highly demanding cognitive tasks or basic activities of daily living our capacity to monitor and adapt our behavior in an efficient 'online' manner has the potential to bestow enormous benefits upon us. This, coupled with the ability to take corrective action following an erroneous response, is highly dependent on a proficient level of self-awareness (SA). Recently our laboratory has demonstrated that healthy older adults (65 years +) display diminished awareness of errors, when compared to younger individuals, not only in everyday functioning but also when engaged in laboratory-based tasks. The current research sought to further elucidate on these findings by comparing a group of 30 younger and 30 older adults who,

in addition to undergoing a multifaceted psychometric battery completed the Error Awareness Dot Task (EADT), a Go/No-Go task which requires participants to signal errors of commission via a motor response. Throughout testing electrophysiological measures; namely electroencephalography (EEG) and electrodermal activity (EDA) were recorded. Whilst older adults displayed higher levels of accuracy on the EADT than their younger counterparts, the older population were significantly less aware of their erroneous responses, this despite the task being modified in order to eliminate task difficulty as a confounding variable. We also report that there is a marked difference between older and younger individuals in both the amplitude and time course of error positivity (Pe) and error related negativity (ERN), two reliable neural signatures of erroneous behavior. A potential clinical application of our EADT is briefly discussed.

D48

AGE-RELATED AND INDIVIDUAL DIFFERENCES IN THE NEURAL CORRELATES OF SPATIAL AND TEMPORAL INFORMATION IN WORKING MEMORY

Ya-Ping Chen[1,2], Ya-Wen Fang[1,3], Ching-Po Lin[4], Ovid Jyh-Lang Tzeng[1,2,3,4], Hsu-Wen Huang[1,3], Chih-Mao Huang[1,3]; [1]Academia Sinica, Taipei, Taiwan, [2]Taipei Medical University, Taipei, Taiwan, [3]National Chiao-Tung University, Hsinchu, Taiwan, [4]National Yang-Ming University, Taipei, Taiwan — Working memory (WM), the executive processes responsible for online manipulation of various domains of information to guide goal-directed behavior, declines with age. In the present study, we employed event-related functional MRI to investigate age-related and individual differences in the neural correlates of spatial and temporal WM. Participants were instructed to remember a sequence (for temporal WM) or spatial location (for spatial WM) of the abstract shapes with three level of working memory load. Behavioral results demonstrated that both young and older groups showed increased reaction times with increasing task demands, whereas only older adults showed reduced accuracy with increasing task demands. A whole brain analysis revealed common fronto-parietal activations during maintenance of temporal and spatial information in working memory across age groups, including DLPFC, middle PFC, and bilateral posterior parietal cortices (PPC). The young participants exhibited strongly left-lateralized fronto-parietal activation during temporal WM and strongly right-lateralized fronto-parietal activation during spatial WM, whereas older participants showed bilateral fronto-parietal activation across two tasks. Moreover, age-related patterns of neural recruitment in response to load effects were observed: whereas young participants showed reliably increased activity with increasing task demands, older participants showed a pattern with a sharp increase at the lower level of WM load but a flattening at higher level of WM load in inferior and superior PPC. These findings suggest that posterior parietal regions may play a functional role in modulation of working memory capacity for both temporal and spatial information and provide converging evidence for hemispheric asymmetry reduction in older adults.

EXECUTIVE PROCESSES: Goal maintenance & switching

D49

MOTIVATIONAL EFFECTS ON THE PROCESSING OF DELAYED INTENTIONS IN THE ANTERIOR PREFRONTAL CORTEX

Christine Stelzel[1,2,3], Jovita Bruening[1,2,4], Vera U. Ludwig[1,2], Lena M. Paschke[1,2], Henrik Walter[1,3]; [1]Charité Universitätsmedizin Berlin, [2]Humboldt University Berlin, [3]Berlin Center for Advanced Neuroimaging, [4]Technische Universität Berlin — Delaying intentions bears the risk of interference from distracting activities during the delay interval. Motivation can increase intention retrieval success but little is known about the underlying brain mechanisms. Here, we investigated whether increased motivation modulates the processing of delayed intentions in the anterior prefrontal cortex (aPFC), known to be crucial for intention processing. 22 participants performed an ongoing n-back working memory task and task phases with an additional intention (i.e. to respond with a different response button when a certain word is presented) were embedded into this n-back task. In a mixed blocked and event-related functional Magnetic Resonance Imaging design, we specifically tested whether motivation affects intention processing in a transient, phase-specific or in a sustained manner. We found a generalized effect of motivation on both correct intention retrieval and ongoing task performance. Within the intention-related network, sustained activity increases in rewarded compared to non-rewarded blocks were present in fronto-parietal regions including left lateral aPFC (Brodmann area 10). Importantly, higher activity in the sustained network was directly associated with greater reward-related behavioral improvements. Additionally, individual differences in reward-related performance benefits were related to the degree of transient signal increases in right lateral aPFC specifically during intention encoding. This suggests that the ability to mobilize control processes during the encoding of future intentions is crucial for successful intention retrieval in addition to general increases in processing effort. Bilateral aPFC is central to these motivation-cognition interactions.

D50

ACTIVITY IN THE ANTERIOR CINGULATE CORTEX IS ASSOCIATED WITH A MORE EFFICIENT TASK-SWITCHING NETWORK AT THE INDIVIDUAL LEVEL

Kelly Steele[1], John Butler[2], John Foxe[1,3]; [1]Albert Einstein College of Medicine, Bronx, NY, [2]Trinity College Dublin, Dublin, Ireland, [3]University of Rochester School of Medicine and Dentistry, Rochester, NY — Humans rely on the ability to easily and quickly switch between tasks, however there is a 'switch cost': a slowed response when switching between two tasks (e.g. ABABA) relative to repeating tasks (e.g.AAABB). Other sources of conflict increasing task-switching costs are "incongruency" (when the stimulus affords one response under Task A, different from Task B), and "motor-alternation" (whether the motor response on a given trial is different or the same as the previous trial). We explored individual differences in task-switching networks to determine which aspects of processing were associated with various sources of conflict. Adults performed a task-switching paradigm while 256-electrode EEG was recorded. Each trial started with a 700ms cue, indicating the task, followed by a letter-and-number stimulus for 1300ms, while they responded for the letter task if the letter was a vowel and for the number task if the number was even. Group analysis revealed the expected frontoparietal network activation. However, there was a range of individual behavioral phenotypes, associated with different networks. Reaction time and accuracy were negatively correlated ($r = -0.6494$, $p < 0.001$): the most accurate were the fastest. The anterior cingulate cortex detects conflicts and reallocates attention accordingly, and was more active for individuals with incongruency and motor-alternation costs than for those with switch costs; whereas the opposite was true for the middle frontal gyrus. The decreased ACC activity during switching resulted in delayed detection to changing tasks, and the MFG may have played a role in the executive functions necessary to change tasks.

D51

FLEXIBLE HUB UPDATES BETWEEN TASKS ASSOCIATED WITH GLOBAL INFORMATIONAL CONNECTIVITY CHANGES

Takuya Ito[1], Douglas H. Schultz[1], Levi I. Solomyak[1], Richard H. Chen[1], Ravi D. Mill[1], Michael W. Cole[1]; [1]Rutgers, The State University of New Jersey-Newark — We recently found that regions in the cognitive control network (CCN) demonstrate adaptive functional connectivity across task states, consistent with the flexible hub theory (Cole et al., 2013). A recently developed informational connectivity (IC) method utilizes multivariate activity patterns during tasks to elucidate the temporal relationship between multivariate information content between regions (Coutanche & Thompson-Schill, 2013). Using this novel approach, we hypothesized that information within CCN flexible hubs are associated with highly distributed task-related information throughout the brain. We analyzed a new fMRI task data set (N=32) during which subjects performed a modified version of the Permuted Rule Operation task (Cole et al., 2010). Four different rules were permuted across three different rule dimensions (logic, sensory, and motor), producing an experimental design with 12 unique task rules and 64 distinct tasks. To perform IC metrics on flexible hub regions, we computed multivariate informational time series using functionally defined brain regions, and computed IC estimates of each CCN region to the rest of the brain. We found that several CCN regions contained significantly distinct IC connections with a variety of brain systems across the three rule dimensions (logic, sensory, and motor). These findings suggest that domain-general changes in information content within CCN regions correspond with task-related information content

changes throughout the brain. Furthermore, we found that significant connectivity differences correspond to the recruitment of task-relevant regions, suggesting that CCN regions coordinate crucial informational representations across the brain during task states.

D52

TONIC NORADRENERGIC ACTIVITY PREDICTS FLEXIBLE ATTENTIONAL SET SHIFTING: INSIGHTS FROM PUPILLOMETRY AND EYE-TRACKING

Péter Pajkossy[1,2], Ágnes Szőllősi[2], Mihály Racsmány[1,2]; [1]Research Group on Frontostriatal Disorders, Hungarian Academy of Sciences, [2]Budapest University of Technology and Economics, Hungary — A constant task for every living organism is to decide whether to exploit rewards associated with current behaviour or to explore the environment for more rewarding options. Current empirical evidence indicates that exploitation is related to phasic whereas exploration to tonic firing mode of noradrenergic neurons in the locus coeruleus (Aston-Jones & Cohen, 2005; Bouret & Sara 2005). In humans, this exploration-exploitation trade-off is subserved by the ability to flexibly switch attention between task-related and task-irrelevant information. Here, we investigated whether this function, called attentional set-shifting, is related to exploration and tonic noradrenergic discharge. We measured pre-trial, baseline pupil dilation, proved to be strongly correlated with the activity of the locus coeruleus, while human participants took part in the Intradimensional-Extradimensional Set Shifting Task. This task requires participants to choose between two compound stimuli with distinct stimulus-dimensions based on feedback provided for their previous decisions. Both the reward contingencies and the stimuli change periodically, thus participants are repeatedly required to reassess which stimulus-features are task-relevant (i.e. they have to shift their attentional set). Our results showed that baseline pupil diameter increased after changes in reward contingency. Moreover, higher levels of baseline pupil diameter were related to better behavioural performance and also to eye-movement patterns indexing attention to irrelevant stimulus features. Thus, our results suggest that tonic firing mode of noradrenergic neurons in the locus coeruleus is implicated in attentional set shifting, as it biases attention toward currently task-irrelevant stimulus-dimensions. This work was supported by the KTIA NAP Grant (ID: 13-2-2014-0020).

D53

GOAL NEGLECT AND PROSPECTIVE MEMORY FAILURES: WHAT'S THE DIFFERENCE?

Francesca Biondo[1,2], Daniel J Mitchell[1], John Duncan[1,3]; [1]MRC Cognition and Brain Sciences Unit, [2]University of Cambridge, [3]University of Oxford — At a descriptive level, Goal Neglect (GN) and Prospective Memory failure (PMf) are analogous: both refer to a behavioural error whereby an intended future action fails to be completed. These errors may be thought of as dissociations between knowing and doing. We observed that the paradigms used to test these phenomena are similar enough to allow a close comparison, and thus further constrain our understanding of the underlying cognitive mechanisms. To test the similarities and differences of GN and PMf we ran a series of experiments involving both GN and PM tasks, in which we manipulated instructional load and the transparency of instructional cues, and observed the diagnostic effects on reaction time and accuracy. A novel finding was that decreasing the transparency of the instructional cue increased GN, similarly to published PM findings. In addition, our data suggested that cue transparency affected processes occurring at earlier stages than those typically highlighted in similar PM studies (e.g. Marsh et al., 2003; Meier & Zimmermann, 2015). A second result was that increasing instructional load increased GN, replicating previous studies (Duncan et al. 2008), however, interestingly, it did not affect PMf in a standard PM task. In addition, these errors appear to be associated with age and fluid intelligence in different ways. Our interpretation is that there may be several attentional mechanisms underlying performance on GN and PM tasks, and their relative dominance depends on the structural features of the tasks and individual differences.

D54

FEEDBACK PROCESSING IN PAIRED ASSOCIATE DECLARATIVE LEARNING OF LINGUISTIC AND NONLINGUISTIC PARADIGMS

James Borders[1], Yael Arbel[1], Sofia Vallila-Rohter[1], Lauryn Zipse[1]; [1]MGH Institute of Health Professions — The study evaluates feedback processing of declarative learning in healthy adults using event-related potentials (ERPs). Participants completed linguistic and nonlinguistic two-choice paired associate tasks in a block design. The linguistic task required participants to associate a non-word with a visually presented non-object. The nonlinguistic task required them to create associations between two visually presented non-objects. Behaviorally, participants had significantly better learning outcomes in the linguistic paradigm, as well as faster response times. Additionally, participants reported significantly higher ratings of confidence in their responses on the linguistic paradigm. These results suggest a learning advantage when one is able to utilize the linguistic system in the learning process. Temporal Principal Component Analysis (PCA) was utilized to examine two ERPs, the feedback related negativity (FRN) and the positivity that follows. Neurophysiologically, significant differences were found in these ERP components that were associated with learning outcomes in the linguistic and nonlinguistic paradigms. These findings provide neurophysiological evidence of differences in feedback processing in two tasks that differ in the ease of access to learning strategies. Clinical implications are discussed for populations with weak linguistic systems such as children with developmental language disorders and adults with Aphasia whose impaired ability to use linguistic strategies may affect the efficiency with which feedback is processed to facilitate learning.

D55

BILINGUAL AND MONOLINGUAL COGNITIVE FLEXIBILITY: THE ROLE OF THE DRD2 GENE

Brandin Munson[1], Kelly A Vaughn[1], Maya R Greene[1], Aurora I Ramos-Nuñez[1], Pilar Archilla-Suerte[1], Arturo E Hernandez[1]; [1]University of Houston — The present study explored individual differences in cognitive control abilities by examining the effects of genetic variability in a sample of English monolinguals (N = 10) and Spanish-English bilingual adults (N = 16). Specifically, the researchers explored the presence of a dopamine receptor-affecting genetic polymorphism that has been shown to affect cognitive flexibility, DRD2 / ANKK1-TaqIa. Previous studies found that carriers of the A1 DRD2 allele had less brain activity during a switching task than A1 non-carriers. The bilingual sample was divided into 2 groups: A1 carriers (n = 10) and A1 non-carriers (n = 6). All groups and subgroups were matched on English proficiency and SES. Participants were asked to perform a shape-color switching task during fMRI scanning. Monolinguals showed increased activity relative to bilinguals in brain regions found to be involved in control processes, including the MFG, the ACC, the IPL, and the putamen. Interestingly, monolinguals demonstrated similar patterns of increased activation in control regions relative to bilingual A1 allele non-carriers, but there were very few activation differences when compared with bilingual carriers of the A1 allele. Contrary to earlier findings, bilingual A1 allele carriers showed increased activity relative to bilingual A1 allele non-carriers, in regions including the MFG, the IPL and the caudate. The observed activation differences between monolinguals and bilinguals therefore appear to differ depending on the presence of the A1 DRD2 allele among bilinguals. Findings reveal the potential impact of genetic variability on the manifestation of cognitive control differences due to language background.

EXECUTIVE PROCESSES: Working memory

D56

THE ORIGIN OF THE VISUAL WORKING MEMORY CAPACITY LIMITATIONS

Emmanuel Delgado[1], Marjan Persuh[1]; [1]Borough of Manhattan Community College, City University of New York — Visual working memory has very strict capacity limitations; on average, people are able to hold in their memory only between 3 to 4 independent objects. Although most studies examined the maintenance of visual information over time, capacity limitations might originate at the earlier, encoding phase. In the current study, we tested this hypothesis directly; we modified the classical change detection paradigm by eliminating the maintenance phase. In change detection, two stimulus arrays are presented sequentially, with a temporal gap and observers are asked to report a change between two arrays. We have eliminated the temporal gap and presented two arrays simultaneously, side by side, creating a parallel change detection. In the first experiment, we compared detection of change in object orientation in both classical and

parallel change detection paradigms. Observers' performance dropped dramatically with increasing set size, even in parallel change detection task, in which two arrays were presented simultaneously. In the second experiment, we tested two visual features, orientation and size and their conjunction in parallel change detection task. We replicated results from the first experiment; furthermore, observers showed similar drop in performance with increasing set size for both, object size and conjunction of size and orientation. Our results suggest that visual working memory capacity limitations originate at the early, encoding phase of visual information processing and are therefore limitations of visual perception and not limitations of memory per se.

D57

DOPAMINE AND PARKINSON'S DISEASE DIFFERENTIALLY AFFECT WORKING MEMORY COMPONENTS

John Grogan[1], Elizabeth Coulthard[1,2]; [1]University of Bristol, UK, [2]North Bristol NHS Trust, UK — Parkinson's disease (PD) has been previously shown to impair certain aspects of working memory (WM), and dopamine has been heavily implicated in WM in animals and humans. Working memory can be fractionated into distinct sub-processes including phonological and visuospatial storage and information manipulation. Here we explore how PD and dopamine stimulation might differentially contribute to these distinct processes underpinning working memory. We tested 29 PD patients and 10 healthy controls (HC) on the digit span WM test, which has three components: forwards span which relies on phonological storage, backwards span involving visuospatial manipulation and sequence span which relies heavily on manipulation and visuospatial processing. PD patients were significantly impaired only on the sequence span (compared to HC). However, PD patients ON dopaminergic medication were significantly better than PD OFF medication for the forwards span only. This result was most marked in patients with the lowest spans OFF medication. Thus we have demonstrated that neurodegeneration in PD impairs sequence span which is dependent on visuo-spatial processing located in frontal cortex. In contrast, dopamine levels affect performance on the forward span, suggesting dopaminergic innervation of phonological loop. This result is unexpected as the site the phonological loop is generally thought to be inferior parietal lobe, with a sub-vocal rehearsal component in the frontotemporal language areas, which are not usually thought of as dopamine-related areas.

D58

WORKING MEMORY IMPAIRMENTS: CAUSES AND RESPONSES TO TRAINING ACROSS SPECIFIC LEARNING DIFFICULTIES

Erica Bottacin[1,2], Susan Gathercole[1], Joni Holmes[1]; [1]MRC Cognition & Brain Sciences Unit, [2]University of Cambridge — Deficits in working memory (WM) are common in specific learning difficulties, but it is not yet known whether these problems represent core cognitive difficulties. WM relies on efficient sensory inputs and is part of a network of higher-order cognitive control functions. Impairments in any of these related systems will impact on WM performance. The aims of this study were i) to identify the potential source of WM problems in children with specific difficulties in maths (MD), reading (RD) or in both maths and reading (MDRD), and ii) to investigate how their different baseline profiles modulate responsiveness to WM training. Children with MD, RD, or MDRD and a comparison group with normal reading and maths skills completed a battery of tasks designed to assess cognitive functions associated with WM before and after training. All three groups were characterised by impairments in phonological processing at baseline. The RD group had additional deficits in verbal short-term memory, while MDRD children were characterised by a broader profile of impairment that extended to visuo-spatial processing, and verbal and visuo-spatial WM tasks. Following training, improvements were observed in verbal processing and verbal and visuo-spatial short-term memory for MD children, and in verbal WM for the MDRD group. No training-related gains were observed for the RD group. These data suggest that WM difficulties may occur downstream of information processing problems in specific learning difficulties and that interventions targeting these specific problems may be more effective than WM-based interventions.

D59

EFFECTS OF A PROCESS-BASED COGNITIVE TRAINING INTERVENTION FOR PATIENTS WITH STRESS-RELATED EXHAUSTION: AN FMRI-STUDY

Hanna Malmberg Gavelin[1], Anna Stigsdotter Neely[2], Therese Stenlund[1], Lisbeth Slunga Järvholm[1], Carl-Johan Boraxbekk[1]; [1]Umeå University, Sweden, [2]Karlstad University, Sweden — Long-term stress has been associated with cognitive impairments, mainly affecting executive function, attention and episodic memory. However, with regard to rehabilitation of patients with stress-related illness, little is known about the effects of treatment on cognitive performance and associated neural mechanisms. The purpose of this study was twofold. First we evaluated the effects of a process-based cognitive training intervention in a clinical population of patients diagnosed with stress-related exhaustion. Second we examined training related functional neural responses. The cognitive training group consisted of 27 patients, participating in a multimodal group stress-rehabilitation program with the addition of a 12-week computerized process-based cognitive training intervention. The control group consisted of 32 patients, participating in the multimodal group rehabilitation only. Cognitive functions were assessed before and after the intervention, using an extensive cognitive test battery assessing both near- and far transfer effects. functional Magnetic Resonance Imaging (fMRI) was performed on a subset of patients in the cognitive training group (n = 10) and the control group (n = 12). The n-back task served as the near transfer task in the scanner. Results showed pronounced training-related improvements on the criterion updating task, as well as evidence of near transfer effects to updating and episodic memory. fMRI-performance confirmed the transfer effect with associated changes in functional neural response. These results suggest that process-based cognitive training may be a viable method inducing functional neural changes affecting the cognitive impairments associated with long-term stress.

D60

LIMITED RESOURCES FOR ICONIC AND WORKING MEMORY

Youxi LI[1], Robert Melara[2], Marjan Persuh[1]; [1]Borough of Manhattan Community College, City University of New York, [2]City College, City University of New York — Working memory shows striking limits in capacity; it lasts on the order of seconds and it stores only a few items. Because of the importance of working memory for human cognition, it is crucial to understand its precursor, iconic memory, which has not been well characterized. In two experiments, we used the adjustment method to directly compare precision of iconic and working memory. In the first experiment, we tested memory for object orientation by displaying objects of different orientations. Participants reported the orientation of the cued object by clicking on a corresponding position on a circle. We varied the delay between object display and cue to tap into two memory systems, iconic (no delay) and working memory (delay). As expected, working memory precision declined with increasing set size, confirming previous observations. Interestingly, iconic memory showed similar pattern of results. Although precision for iconic memory was higher, data revealed continuous decline of precision with increasing set sizes, especially for set sizes four and higher. In the second experiment, we tested precision of iconic and working memory for motion. Iconic memory precision again declined with increasing set sizes, mimicking results for working memory. Our results demonstrate that iconic memory is limited in precision and that capacity limitations of working memory originate at the earliest stages of visual memory formation. In light of this evidence, we suggest that short-term memory systems are perhaps best conceived as a continuum rather than distinct memory stages.

D61

NEURAL CORRELATES OF MAINTAINING CONSTRUCTED OBJECTS IN VISUAL WORKING MEMORY

Julia A. Ewerdwalbesloh[1], Satu Palva[2], Patrick H. Khader[1]; [1]Ludwig-Maximilians-Universität München, [2]University of Helsinki — How are visual objects that have been constructed from object parts through mental imagery maintained as a coherent representation in working memory (WM)? Here we investigated this issue with electroencephalography (EEG) and compared two conditions of WM maintenance that only differed in how the WM contents had been created. Participants maintained objects that they either had to create out of single features or that were presented to them as complete objects. Object complexity

varied between two and four features. Inter-areal synchronization may underlie the integration of objects features into coherent object representations and we hypothesized that the maintenance of constructed objects would be associated with stronger inter-areal synchronization compared to the maintenance of complete objects. We analyzed phase synchrony from EEG data in a time interval immediately before the appearance of a probe stimulus, because here both groups maintained essentially the same objects. Increased synchrony was observed between (predominantly left) frontal and parietal-to-occipital cortical sources for constructed in comparison to non-constructed objects in the theta, alpha, and gamma frequency bands. A similar increase in synchrony was also found for increased WM load (2 vs. 4 features for non-constructed objects) between frontal and occipital sources. However, under increased construction load (2 vs. 4 features for constructed objects), the synchronization was restricted to fronto-parietal couplings, suggesting additional activation in the fronto-parietal attention network specific for maintaining mentally constructed objects. Hence, strengthened synchronization for constructed objects may reflect increased attentional processes to keep the object parts together as a coherent representation.

D62

THE EFFECT OF MOTIVATION FROM HIGH REWARD VALUE ON CATEGORY LEARNING

Vivian V. Valentin[1], Lauren E. Vucovich[1], F. Gregory Ashby[1]; [1]University of California, Santa Barbara — Category learning recruits procedural memory for information integration (II) tasks, and declarative memory for rule based (RB) tasks. Both learning systems make use of reward in terms of positive feedback, but the extent to which each system interacts with reward value learning and motivation has not been explored fully. The literature suggests that decreased motivation due to sleep deprivation affects RB, but not II learning. Our study examines whether enhanced motivation has differential effects on RB and II learning. Given that uncertainty (i.e. reward prediction at p(0.5)) has been shown to be greatest near the category bound for both II and RB tasks, we compared the effect of higher reward value given to stimuli near versus far from the bound. In an RB task, higher reward value given to stimuli near the bound resulted in better learning of both near and far from bound stimuli. In an II task this effect was small. The data did not support the notion that reward value influenced reward prediction error available to procedural learning, because there were no stimulus specific effects. The somewhat better learning with higher rewards to stimuli near the bound in II was characterized as a quicker switch to (or release of inhibition of) the procedural system. The mechanism of giving up on rules and allowing the procedural system to control responding is thought to involve executive function associated with declarative memory. These results suggest that reward value learning and motivation interacts more with declarative strategies than procedural learning.

D63

HOW VIDEO-GAMES SHAPE THE BRAIN STRUCTURE – A VOXEL-BASED MORPHOMETRIC STUDY

Natalia Kowalczyk[1], Aneta Brzezicka[1], Artur Marchewka[2], Paweł Dobrowolski[3], Maciek Skorko[3], Maksymilian Bielecki[1], Małgorzata Kossut[4]; [1]University of Social Sciences and Humanities, Warsaw, Poland, [2]Laboratory of Brain Imaging, Neurobiology Center, Nencki Institute of Experimental Biology of Polish Academy of Sciences, Warsaw, Poland, [3]Institute of Psychology, Polish Academy of Sciences, Warsaw, Poland, [4]Laboratory of Neuroplasticity, Nencki Institute of Experimental Biology of Polish Academy of Sciences, Warsaw, Poland — Introduction: It has been demonstrated that video game players (VGPs) differ from non-video game players (NVGPs) in a wide range of cognitive functions. However, very little is known about the relation between action video game experience and structural brain plasticity. Aims: The aim of this study was to investigate the grey matter volume (GMV) differences in VGPs and NVGPs. Here we explore data obtained from voxel-based morphometry (VBM) with behavioural measures of working memory. Methods: High-resolution T1-weighted (T1w) images were collected from intensive real-time strategy VGPs and age-and-sex-matched NVGPs in a 3T MRI scanner. Differences between players and non-players were calculated using whole brain voxel-based morphometry analyses of GMV. Values from all of the significant clusters were correlated with visuospatial N-back working memory task performance. Results and Discussion: VBM based contrasts comparing the VGPs and the NVGPs revealed a significant increase in GMV in the right putamen for VGPs. There were no significant differences in GMV for the reverse contrast (NVGPs > VGPs). Additionally, GMV increase in VGPs was correlated with behavioural performance (more GMV translated to smaller differences in RTs between low and high working memory conditions). We interpret this as evidence of brain plasticity changes as a result of video game play. These findings are in line with previous evidence that VGPs perform more complex tasks with less effort compared to NVGPs, and provide evidence for its neural substrate. Supported by the National Science Centre Grant 2013/11/N/HS6/01335.

D64

NEURAL REPRESENTATIONS OF SPATIAL LAYOUT ACROSS MENTAL TRANSFORMATION – A TACTILE FMRI STUDY

Lisa Alexandria Velenosi[1,2], Timo Torsten Schmidt[1,2], Felix Blankenburg[1,2]; [1]Freie Universität Berlin, Berlin, Germany, [2]Center for Cognitive Neuroscience Berlin, Berlin, Germany — Sensorimotor recruitment models (Pasternak & Greenlee, 2005; Postle, 2006) argue that pictorial working memory (WM) content requires the activation of stimulus-specific neural networks within sensory-cortices. The current study addresses this hypothesis within the tactile domain using fMRI by not only studying the spatially-distributed representations underlying the maintenance but also the manipulation of mental stimulus representations with a delayed match to sample design. Subjects were simultaneously presented two different patterned tactile stimuli to the two index fingers using two 4x4-pin Braille-like displays (QuaeroSys). Using a retro-cue design, subjects were instructed to encode one of the tactile stimuli and either maintain it as experienced or move the representation to the contralateral finger during a 6s retention period. 22 subjects were scanned on a 3T Siemens Trio and the data was analyzed according to a univariate General Linear Model (GLM) approach which provided evidence for the somatotopic recruitment of sensory regions. To explore whether these regions also carry information regarding the stimulus identity, an assumption free whole-brain multivariate searchlight classification was implemented. Stimulus-specific representations were identified within the primary somatosensory areas, posterior parietal cortices and the inferior frontal gyrus. Finally, cross-classification analyses indicate the same neural networks within posterior parietal cortices represent stimulus information during both the maintenance and manipulation of stimulus representations. The results provide support for the sensorimotor recruitment model of WM as well as convergent evidence with findings from the visual domain (Christophel et al., 2014) for the representation of modality independent spatial relationships within posterior parietal cortices.

LANGUAGE: Development & aging

D65

ELECTROPHYSIOLOGICAL AUDITORY RESPONSE TO ACOUSTICALLY MODIFIED SYLLABLES IN PRETERM AND FULL TERM INFANTS

María Elizabeth Monica Carlier[1], Thalía Harmony[1], Omar Mendoza-Montoya[2], Jose Luis Marroquin[3], Donna Jackson-Maldonado[4], Josefina Ricardo-Garcell[1]; [1]Unidad de Investigación en Neurodesarrollo "Augusto Fernández Guardiola," Departamento de Neurobiologia Conductual y Cognitiva, Instituto de Neurobiologia, Universidad Nacional Autónoma de México, Campus Juriquilla., [2]Freie Universität Berlin Department of Mathematics and Computer Science, [3]Centro de Investigación en Matemáticas (CIMAT), [4]Universidad Autónoma de Querétaro (UAQ) — This study explored the effect of extending the duration of the syllable formant transition on auditory habituation in full-term and preterm infants at 12 months, as measured by decreases in amplitude for syllable repetition using EEG time-frequency analyses. EEG recordings for four repetitions of the syllable (/ta/) under two different conditions (non-modified and modified) were collected for one group of 13 full-term and two groups of preterm infants differing in language production performance; 15 infants had high scores (HS), and 14 had low scores (LS). Full-term and HS preterm infants showed significant decreases in amplitude for syllable repetition in both conditions. LS preterm infants showed a decrease only in the modified syllable condition, suggesting a facilitation effect of modified syllables in the LS preterm group.

D66

EXAMINING COMPENSATORY MECHANISMS AND PROTECTIVE FACTORS IN TYPICAL READERS WITH A FAMILY HISTORY OF DYSLEXIA

Xi Yu[1,2], Talia Raney[1], Bryce Becker[1], Nadine Gaab[1,2,3]; [1]Laboratories of Cognitive Neuroscience, Division of Developmental Medicine, Department of Medicine, Children's Hospital Boston, MA, 02115, US, [2]Harvard Medical School, Boston, MA, 02115, US, [3]Harvard Graduate School of Education, Cambridge, MA, 02138, US — Although developmental dyslexia (DD) is a heritable learning disability, only half of children with a family history of DD (FHD+) will subsequently develop into typical readers. However, the underlying compensatory mechanism and/or protective factors that contribute or mediate typical reading development in FHD+ children are largely unknown. The current study approached this question retrospectively. Thirty-eight second-graders with typical reading abilities were selected from the Boston Longitudinal Dyslexia study. Nineteen are FHD+ and 19 were controls (FHD-). Their imaging data for a phonological task, collected during their prereading stage, was retrieved. Multivariate pattern analyses, combined with the searchlight technique, were applied, in order to detect neural regions that responded differently for phonological processing between these two groups. Results revealed that neural patterns in the right inferior frontal gyrus, left posterior tempoparietal and anterior temporal cortices reliably categorized typical readers into FHD+ and FHD- groups (accuracy > 68%, $p < 0.01$, $k > 40$). Subsequent univariate analyses conducted in the observed regions further demonstrated greater activation for FHD- children in the left temporal gyri, but more importantly, higher activation for FHD+ group in the right inferior frontal cortex. While lower activation in the temporal cortices for the FHD+ children implies an imperfect neural basis for phonological processing, higher reaction in the right frontal gyrus suggests a protective or compensatory mechanism which supports their typical reading development. Further studies in prereading children are warranted to investigate the exact function of the right frontal gyrus, which could inform the design of early intervention strategies.

D67

PHONOLOGICAL PATTERN LEARNING IN ADULTS AND CHILDREN

Margaret Ugolini[1], Miriam Muñoz[1], Rachel Yox[1], Joe Pater[1], Lisa D Sanders[1]; [1]University of Massachusetts - Amherst — Learning a language requires acquisition of the rules that govern how sounds can combine to make words (phonotactics) and how words can combine to make sentences (syntax). Decades of research have suggested fundamental differences in how adults and children acquire and use new language rules. However, previous research has shown that adults can rapidly learn new phonotactic patterns from an artificial language such that they respond differently to novel items that do and do not fit the learned pattern (Pater & Moreton, 2014). Behavioral results do not provide information about whether listeners rate novel items by applying abstract rules or by analogy with words stored in their lexicon. We exposed adults and 4- to 6-year-olds to a novel phonotactic pattern – the consonants in consonant-vowel-consonant-vowel words either always matched in voicing or never matched in voicing. Both groups were trained on a word-picture matching task with 16 words that fit the phonotactic pattern. Behavioral and event-related potential (ERP) measures showed that adults and children learned the trained words AND learned the phonotactic patterns. Novel items that violated the phonotactic pattern elicited a larger late positive component (LPC) than novel items that fit the pattern. These results indicate that adults retain the ability to learn and apply new abstract rules, well beyond the end of any proposed critical period for language acquisition. However, differences in the ERP effects evident in adults and children indicate that the process of learning new language rules is distinct in these populations.

D68

WORKING MEMORY IN LANGUAGE COMPREHENSION IN OLDER VS. YOUNGER ADULTS: AN EVENT RELATED POTENTIAL STUDY

Graciela Catalina Alatorre Cruz[1], Juan Silva-Pereyra[1], Thalia Fernandez Harmony[2], Sergio Manuel Sanchez Moguel[2], Susana Angelica Castro Chavira[2], Sonia Yanin Cardenas Sanchez[2], Mauricio Gonzalez Lopez[2]; [1]Facultad de Estudios Superiores Iztacala, Universidad Nacional Autonoma de Mexico, [2]Instituto de Neurobiologia, Universidad Nacional Autonoma de Mexico, Campus Juriquilla — Since Memory and language are affected by aging, older adults are less efficient than younger adults in cognitive tasks that involve these processes. On the other hand, working memory loads impact language comprehension. To determine how cognitive decline during aging impacts language comprehension, effects of working memory loads in syntactic processing were examined with event-related potential in sample including 17 older and 20 younger adults; 220 sentences were read by both groups, every sentence had two features: working memory load, the number of words between subject and adjective (high load, low load), and gender agreement (agreement, disagreement). Subjects had to determine if sentences were correct or incorrect. Both groups showed a negativity (N400, 300-500ms) sensitive to semantic relationships and a positivity (P600, 500-700 ms) related to syntactic processing. Younger adults showed N400 effect (i.e. amplitude differences between agreement and disagreement conditions) in low load sentences in bilateral posterior topographic localizations, older adults did not have this effect. P600 effect was found in older adults bilaterally. In high load condition N400 effect was exhibited by young adults in the right hemisphere while the elder show it bilaterally; P600 effect was observed only among younger in left and anterior localizations. Topographical differences between groups can be seen as a compensatory mechanism since no behavioral differences between groups were observed; however older adults use different processing modules to perform the task, older adults use syntactic processing while younger use semantic and syntactic processing. Acknowledges; Héctor Belmont, PAPIIT (IN225414 grant) and CONACYT (grant #290915).

D69

ACTIVATION DURING PHONOLOGICAL PROCESSING IS ASSOCIATED WITH WHITE MATTER MICROSTRUCTURE IN PRESCHOOLERS WITH AND WITHOUT A FAMILIAL RISK OF DEVELOPMENTAL DYSLEXIA

Michael Figuccio[1,2], Xi Yu[2,3], Yingying Wang[2,3], Nadine Gaab[2,3,4]; [1]Boston University, [2]Boston Children's Hospital, [3]Harvard Medical School, [4]Harvard Graduate School of Education — Developmental dyslexia (DD) is a specific learning disorder characterized by deficits in phonological processing and spelling. It has been shown that children and adults with DD display reduced activation during reading-related tasks in key regions of the reading network and that these hypoactivations can already be observed in pre-readers at familial risk of DD. Compared to controls, individuals with DD also display reduced fractional anisotropy (FA) within the left arcuate fasciculus (LAF), a neural tract connecting parieto-temporal and inferior frontal regions, and increased FA in posterior corpus callosum (PCC). However, the relationship between familial risk, white matter alterations, and hypoactivations during reading-related tasks remains unclear. Twenty-one children (mean age=69.29, males=10) with a familial risk of DD and twenty children (mean age=71.38, males=7) without a familial risk of DD were examined using a phonological processing (PP) fMRI task and DTI measures. Regions of interest previously shown to differ in preschoolers with and without a familial risk of DD during the PP task were extracted. LAF and PCC were segmented into 100 equidistant units with automated fiber-tract quantification. Children with a familial risk of DD displayed greater FA in the PCC compared to controls. Furthermore across groups, FA measures of the LAF and PCC were positively correlated with weighted parameter estimates in regions of interest during the phonological processing task. This suggests that, in children with a familial risk, hypoactivation of PP is associated with microstructural changes in white matter prior to reading onset.

D70

FUNCTIONAL NEAR INFRARED SPECTROSCOPY (FNIRS) INVESTIGATION OF EMERGING READING PATHWAYS IN CHILDREN WITH POOR PHONOLOGICAL AWARENESS

Airey Lau[1,2], Kaja Jasinska[1], Lan Shuai[1], Heather Bortfeld[1,3], Nicole Landi[1,3], Kenneth Pugh[1,3,4]; [1]Haskins Laboratories, [2]Columbia University, [3]University of Connecticut, [4]Yale University School of Medicine — Skilled reading involves a left-lateralized network of frontal, temporoparietal, and occipitotemporal regions. Children with reading disorders show reduced neural activation in the left hemisphere reading network and increased right hemispheric and prefrontal cortex activation when reading. Such right hemisphere and frontal activation may function as a compensatory pathway when the left hemisphere reading cir-

cuit is less activated. However, little is known about what factors influence the emergence of compensatory reading pathways in young children prior to learning to read. In this ongoing study, we examined neural activation in left hemisphere reading networks and compensatory pathways in children who are beginning to learn to read. Six children with poor phonological awareness (at-risk for reading difficulty) and 10 children with good phonological awareness (typically-developing) were identified (ages 5-6). Using functional Near Infrared Spectroscopy (fNIRS) neuroimaging, we measured children's neural activation during spoken and printed word processing. Typically-developing children showed significant activation in left superior temporal gyrus (STG; $p<0.05$) and inferior frontal gyrus (IFG; $p<0.05$) when processing spoken and printed words. In contrast, children with poor phonological awareness showed significant activation in the prefrontal cortex ($p<0.01$), right STG ($p<0.01$) and IFG ($p<0.01$) during the same task. Preliminary results suggest children with poor phonological awareness show compensatory recruitment of prefrontal and right hemisphere regions. These findings reveal new insights into the emergence of compensatory reading pathways during the earliest stages of reading development and suggest that compensatory pathways are not just linked with reading ability, but also with phonological awareness—an important predictor of reading.

D71

NEURAL CORRELATES OF PHONOLOGICAL PROCESSING: DISRUPTED IN CHILDREN WITH READING DISORDERS AND ENHANCED IN CHILDREN WITH MUSICAL TRAINING

Meaghan Mauer[1], Jennifer Zuk[1,2], Bryce Becker[1], Nora Raschle[1,3], Yingying Wang[1], Michelle Chang[1], Nadine Gaab[1,2,4]; [1]Boston Children's Hospital, [2]Harvard Medical School, [3]Psychiatric University Clinics Basel, [4]Harvard Graduate School of Education — Phonological processing (PP) is understood to be a key deficit of reading disorders (RD), and prior studies have shown hypoactivation in left-temporoparietal and occipitotemporal regions in children with RD. In contrast, musical training has been associated with enhanced PP abilities, but a potential specialization of neural mechanisms for PP in musicians has yet to be investigated. The present research examined neural correlates of PP in typically developing children with musical training (musicians, n=16) and without (nonmusicians, n=13), and children with RD (n=11) using functional magnetic resonance imaging (fMRI). A whole brain ANOVA examining group differences in functional activation in response to a PP task identified significant differences in activation in bilateral temporoparietal regions. A post-hoc region-of-interest (ROI) analysis indicated a typical pattern of left temporoparietal activation in nonmusicians, whereas hypoactivation in this region was found in children with RD, and hyperactivation was observed in musicians. Musicians also showed right-hemispheric temporoparietal hyperactivation. These differential activation patterns were further supported by differences in lateralization indices among the groups, such that musicians showed reduced left-lateralization relative to nonmusicians in temporoparietal regions. The present results replicate the previously described disruption in neural correlates of PP in children with RD, and highlight specialized recruitment of bilateral temporoparietal regions during PP in musicians. These results suggest possible implications for musical training to support PP development and to stimulate compensatory neural mechanisms, particularly in children with RD.

D72

ARTERIAL SPIN LABELING REVEALS BRAIN CORRELATES OF COGNITIVE RECOVERY IN LEFT STROKE PATIENTS.

Olga Boukrina[1], A.M. Barrett[1,3,4], William W. Graves[2]; [1]Kessler Foundation, [2]Rutgers, The State University of New Jersey, [3]Rutgers New Jersey Medical School, [4]Kessler Institute for Rehabilitation — Arterial Spin Labeling (ASL) scans provide a non-invasive absolute (ml/100g/min) measure of blood flow in the brain. After stroke, acute lesions may include an ischemic penumbra, where salvageable tissue is being affected by inadequate blood supply. This physiologic abnormality may be invisible on standard clinically-acquired brain scans. In this study, we examined ASL data in 5 left-hemisphere stroke patients within 5 weeks of stroke, and again > 6 months after stroke. Following our previous work on lesion-deficit mapping in these and other patients (N=14), we expected recovery of phonological processing to be associated with increased perfusion within our previously identified phonology regions: anterior superior temporal (aSTG), inferior occipitotemporal and parietal regions. In each session, patients completed reading assessments and underwent structural MRI at 3T. We examined individual recovery trajectory across 3 cognitive domains of reading: semantics, orthography, and phonology; and computed mean perfusion differences within our lesion-deficit mask. All patients improved in phonological processing at follow up. All, but one, also showed increased perfusion within a mask spanning all 3 phonology areas. In the one patient without perfusion changes, the lesion affected large portions of aSTG. However, this patient improved most in phonology (27% improvement), suggesting that mechanisms other than re-perfusion may be responsible for this recovery. Mean acute perfusion of the aSTG was positively correlated with acute accuracy on phonology tests and negatively correlated with phonological recovery (Spearman rho = .98; $p<.01$), suggesting that those with high acute perfusion in aSTG showed fewer deficits and lower margin of recovery.

LANGUAGE: Lexicon

D73

MEDIAL TEMPORAL LOBES REVISITED: STRUCTURAL CORRELATES OF LEXICAL ABILITIES IN HEALTHY AGING

JungMoon Hyun[1], Susan De Santi[2,3], James Babb[2], Loraine Obler[1]; [1]The Graduate Center of the City University of New York, [2]New York University School of Medicine, [3]Piramal Imaging — There is controversy over brain patterns associated with cognitive performance; are these associations task-specific or task-general in older adults? The present study investigated the relationship between regional brain volumes and lexical performance abilities on four lexical tasks; the modified Boston Naming Test (BNT), two verbal fluency tests (Semantic and Phonemic Fluency), and the WAIS vocabulary Test. Cognitively normal older adults (N=137, average age at the first visit =71.31 ± 5.27) underwent structural MRI (T1 weighted scans) and performed lexical tasks at least twice over 2-7 years. Regional brain volumes were extracted via FreeSurfer and mixed effects modelling was employed to examine the relationship between lexical performance and brain volumes. Results revealed the presence of both general and specific brain associations. Regional volumes in the medial temporal lobes (MTL) were related to performance on all four lexical tasks while other brain region volumes showed distinctive associations with individual tasks. Frontal pole volume was related to BNT performance; the volumes of temporal pole, supramarginal gyrus, and superior frontal lobe were related to WAIS vocabulary Test scores; the volumes of dorsolateral prefrontal and precuneus were related to Semantic Fluency score; the volumes of the fusiform gyrus, inferior frontal and superior parietal lobes were related to Phonemic Fluency score. We argue that beyond the classic language areas seen in patients with aphasia and other language disorders, the MTL should be considered an important lexical network region for people undergoing a gradual aging process without frank brain damage.

D74

ISOLATING VISUAL, ORTHOGRAPHIC, AND SEMANTIC PRE-ACTIVATION DURING LEXICAL PROCESSING

Trevor Brothers[1,2], Tamara Y. Swaab[1,2], Matthew J. Traxler[1,2]; [1]Univeristy of California, Davis, [2]Center for Mind and Brain, UCD — During language comprehension, the predictability of a particular word in context is an important predictor of both online processing difficulty and N400 amplitude. Recent evidence suggests that contextual anticipation can influence multiple stages of word processing via the pre-activation of distinct lexical features. In the current study, we used the event-related potential (ERP) recording in combination with the "prediction paradigm" (Brothers, Swaab & Traxler, 2015) to identify which stages of word processing are influenced by successful lexical pre-activation. Participants were presented with associated word pairs (above – BELOW, miner – COAL) with an average forward association strength of 0.5. Participants were asked to actively predict each upcoming target word, and to report the accuracy of their prediction after a delay. We assessed the magnitude of three lexical ERP effects (word length, orthographic neighborhood size, and concreteness) separately for correctly predicted and unpredicted target words. Consistent with previous findings, correctly predicted target words showed reductions in the size of the concreteness effect, suggesting pre-activation at the level of semantic features. We also observed significant

reductions in the size of the orthographic neighborhood effect for successfully predicted words, suggesting reduced activation of lexical competitors. Finally, while word length resulted in larger P1 amplitudes (80-140ms), this effect was only present for unpredicted words but not correctly predicted targets. These findings suggest that specific lexical predictions have clear processing consequences during lexical access, even at the level of early visual processing.

D75

AN FMRI INVESTIGATION OF THE EFFECTS OF ORTHOGRAPHY-BASED AND PHONOLOGY-BASED TYPING METHODS ON ORTHOGRAPHIC PROCESSING OF CHINESE CHARACTERS

Hsiang-Yu Chen[1], Erik Chang[1,2], Denise Wu[1,2]; [1]Institute of Cognitive Neuroscience, National Central University, Taiwan, [2]Research Center for Mind, Brain, & Learning, National Chengchi University, Taiwan — Previous literature has shown that typed spelling involved similar neural networks with reading and writing English words (Purcell, Napoliello, & Eden, 2011), which might not be surprising as all these activities access representations of alphabet sequences. However, whether common neural substrates would underpin typed spelling via an orthography-based (Cang-Jie) and a phonology-based (Zhu-Yin) typing method is an open question. Because Cang-Jie typists have extensive experience in accessing (output) orthographic knowledge to convert it to decomposed character parts for typing, we hypothesized that orthographic representations cast extraordinary impact when they write Chinese characters. On the other hand, because Zhu-Yin typists have extensive experience in accessing (output) phonological knowledge to map it to phonetic symbols for typing, we hypothesized that phonological representations and/or orthography-to-phonology conversion strongly influence their Chinese writing. To investigate these hypotheses, we contrasted fMRI recording of proficient Cang-Jie and Zhu-Yin typists when they performed a written picture naming task and a line drawing task. The results identified a typical neural network from the temporoparietal to frontal regions supporting writing behaviors in both groups. Critically, Cang-Jie typists demonstrated higher activations on the anterior part of right middle frontal gyrus (BA 10) than Zhu-Yin typists, while Zhu-Yin typists demonstrated higher activations on bilateral subcortical regions than Cang-Jie typists. These findings suggest that long-term experiences of retrieving orthographic knowledge in Cang-Jie typists is related to the reliance of memory-based processes in writing, which evidenced the specific effects of cultural artifacts on cognition.

D76

WORD CO-OCCURRENCE STATISTICS AND CONCEPTUAL TAXONOMIES PREDICT DISSOCIABLE FMRI INFORMATION PATTERNS IN THE BRAIN SEMANTIC SYSTEMS.

Francesca Carota[1], Hamed Nili[2], Friedemann Pulvermüller[3], Nikolaus Kriegeskorte[1]; [1]MRC - Cognition and Brain Sciences Unit, Cambridge, UK, [2]Experimental Psychology Department, University of Oxford, UK, [3]Freie Universität, Berlin, Germany — Language comprehension relies on distributed brain systems, supporting both general and category-specific lexical semantic processes. However, the nature of the underlying lexical semantic representations is still poorly understood. Here we investigated how conceptual (e.g. peach and plum) and context-based associative relationships (e.g. peach and knife or peach and to peel) between single words of different semantic types affect the representational content of the semantic systems. Using representational similarity analysis (RSA), we performed whole-brain searchlights to relate multivariate fMRI patterns elicited by single words to computational linguistic models of both conceptual taxonomies of different types of actions and objects (Framenet, Wordnet), and word co-occurrence distributions in context (LSA, COALS). Co-occurrence statistics for all words (irrespective of their semantic type) predicted similarity fMRI patterns in general semantic binding hubs, including pars orbitalis (BA 47) of inferior frontal gyrus bilaterally, left anterior temporal cortex, bilateral angular gyrus, and dorsolateral prefrontal cortex. On the other hand, conceptual and co-occurrence properties specific to action and object words were reflected, to different degrees, by dissociable similarity patterns in premotor cortex, middle temporal gyrus, postcentral, parietal and temporo-occipital regions. Within the sub-set of object-related words, the representations of tool and food words were better explained, respectively, by co-occurrence and category-specific information in separate fronto-temporal and premotor regions. Extending current distributed accounts, these results suggest that the mapping of different word types in language, sensorimotor and visual regions arises from representational gradients of qualitatively different, fine-grained semantic information about individual words and their conceptual and contextual relationships.

D77

THE ROLE OF ORTHOGRAPHIC BIAS INFORMATION DURING BILINGUAL WORD RECOGNITION

Liv J. Hoversten[1], Trevor Brothers[1], Tamara Y. Swaab[1], Matthew J. Traxler[1]; [1]University of California- Davis — To function in a single target language, bilinguals need to attend to the target language while ignoring or inhibiting potentially active nontarget language representations. Previous research has shown that language membership information is available early enough during lexico-semantic processing that it can serve to restrict the depth of processing in a nontarget language (Hoversten, Brothers, Swaab, & Traxler, 2015). It is unclear, however, how language membership information accumulates upon stimulus presentation. The present experiment aimed to investigate the role of sublexical form information in language membership identification. Bilinguals viewed Spanish and English words and pseudowords with an orthographic bias toward one language or the other during electroencephalogram recording. The probability of encountering words in each language was manipulated in an oddball paradigm in which participants only responded to real words in the rare language category. In half of the experiment, words had an orthographic bias consistent with language membership (Bias blocks), and in the other half of the experiment, words were not orthographically biased (Non-Bias blocks). Words in the rare language category elicited a typical oddball P3 in both Bias and Non-Bias blocks. Pseudowords resembling the rare language category also elicited a P3 in the Bias blocks only. Finally, lateralized readiness potentials for words in the rare language category began significantly earlier in Bias than Non-Bias blocks. These results suggest that the bilingual brain is sensitive to orthographic bias information even in the absence of lexical information and that orthographic bias aids in language membership identification during bilingual word recognition.

D78

INVESTIGATING THE ROLE OF HIGH AND LOW SPATIAL FREQUENCIES IN WRITTEN WORD RECOGNITION: EVIDENCE FROM ERP MASKED PRIMING

Kurt Winsler[1], Jonathan Grainger[2], Ben Eaton[1], Katherine Midgley[1], Phillip Holcomb[1]; [1]San Diego State University, [2]CNRS and University of Aix-Marseille — Previous studies have implicated different streams of spatial frequency information during the processing of complex visual stimuli. A number of these studies have suggested that low spatial frequencies play an important role in some aspect of written language comprehension (e.g., the global shape of the word). This study examined the role of different spatial frequencies in visual word recognition using ERP masked priming. EEG was recorded from 32 scalp sites in 28 English-speaking adults in a go/no-go semantic categorization task. Stimuli were white characters on a neutral grey background. Targets were unfiltered uppercase 5 letter words preceded by a 300 ms unfiltered forward-mask (#######) and a 50ms lowercase prime. Primes were either the same word (repeated) or a different word (un-repeated) than the subsequent target and either contained only high (> 7.0 Hz/letter), only low (< 1.7 Hz/letter), or full spatial frequency information. In the full spatial frequency condition, typical ERP masked priming effects were found with an attenuated N/P150 (feature), N250 (sub-lexical) and N400 (lexical-semantic) for repeated compared to un-repeated primes. For high spatial frequency primes there was a clear posterior N250 effect, but no evidence of the earlier N/P150 or later N400. Low spatial frequency primes did not produce any of the classic ERP priming effects. This pattern supports the view that while the low spatial frequency content of a word is not sufficient on its own to modulate priming, when combined with higher spatial frequencies they do make an important contribution to visual word recognition.

LANGUAGE: Other

D79

BRAIN ACTIVATIONS OF CATEGORICAL TONE PERCEPTION: WITHIN-CATEGORY AND ACROSS-CATEGORY VARIATIONS

Huei-Mei Liu[1], Ming-Hsien Tsai[1], WeiChin Hsu[2], Feng-Ming Tsao[3]; [1]Department of Special Education, National Taiwan Normal University, [2]Applied Science and Technology, National Taiwan University of Science and Technology, [3]Department of Psychology, National Taiwan University — Categorical perception allows us to efficiently categorize the acoustic continuum into a number of limited phonetic categories. For speakers of tonal languages, lexical tone perception is critical to language processing. Although the neural representation of speech sounds is categorically and mainly organized in the superior temporal gyrus (STG), the neural mechanism of categorical perception of lexical tones has not been well explored. The purpose of this study was to examine the brain activations of categorical perception of lexical tones in Mandarin-speaking adults using a block design fMRI protocol. Twenty neurologically healthy, college students participated in the experiment. The stimuli were a nine-point synthesized tone continuum ranging from Mandarin /ba2/-/ba4/ syllables (tone 2 and 4). In the behavioral experiments, the identification and discrimination tasks were conducted to locate the lexical tone category boundaries. A pivotal stimulus, a within-category and an across-category stimulus with equal acoustic distances were selected. In the fMRI experiment, the across-category, within-category and silence block were contrasted. The fMRI results revealed that left superior temporal gyrus (STG) was activated in both cross-category and within-category tone discrimination. In addition, left Middle Frontal Gyrus and Inferior Frontal Gyrus were activated during the across-category tone discrimination. The right Anterior Cingulate Caudate, right Fusiform Gyrus, and the right STG were activated during the within-category discrimination. The different brain activations shown for across-category and within-category perception suggest that the mechanisms of ''top-down'' phonological representations, the ''bottom-up'' acoustic analysis, and the cognitive processes (ie., attention, executive functions) are involved in the categorical tone perception.

D80

LATERALIZATION OF THE N170 FOR WORD AND FACE PROCESSING IN DEAF SIGNERS

Zed Sevcikova Sehyr[1], Karen Emmorey[1], Katherine Midgley[1], Phillip Holcomb[1]; [1]San Diego State University — Left-lateralization for words develops before right-lateralization for faces, and hemispheric specialization for faces may be contingent upon prior lateralization for words (Dundas, Plaut & Behrmann, 2014). We examined the relationship between word and face processing for deaf native users of American Sign Language who have distinct developmental experiences with both words and faces (e.g., the face conveys linguistic information). We investigated whether hemispheric organization of word and face recognition (indexed by lateralization of the N170) is uniquely shaped by sign language experience. Hearing non-signers and deaf signers made same-different judgments to pairs of words or faces (192 trials each), where the first stimulus was presented centrally and the second was presented to either the left (LH) or right hemisphere (RH). EEG was recorded to the centrally presented stimulus and referenced to the average of all 32 electrode sites. We observed a similar pattern of N170 laterality for deaf and hearing participants, but with a different scalp distribution. For both groups, the N170 to words was larger at LH occipital sites, but only hearing participants also showed a larger N170 at LH temporal sites. For faces, deaf signers showed a larger N170 response at RH temporal sites, with a weaker amplitude difference at occipital sites. Hearing participants showed a similar RH lateralized response over both temporal and occipital sites. Thus, lateralization for words and faces appears similar for deaf and hearing individuals, but differences in scalp distribution may reflect unique organization of visual pathways in the occipitotemporal cortex for deaf signers.

D81

NEURAL SUBSTRATES OF WORD LEARNING IN ADULTS: A META-ANALYSIS OF FMRI STUDIES

Oliver Morgan[1], Jie Yang[1,2]; [1]Macquarie University, Sydney, Australia, [2]ARC Centre of Excellence in Cognition and its Disorders, Macquarie University, Sydney, Australia — How people learn words is a fundamental issue in language acquisition and has been increasingly studied via functional magnetic resonance imaging (fMRI). Although a large body of research has investigated the related neural networks, these studies are varied in stimuli input and paradigms, and thus the conclusion is still unclear. To address this issue, we conducted an activation likelihood estimation meta-analysis on 13 fMRI studies while considering the impacts of input modality (auditory, visual, or visual auditory) and paradigm (word in isolation or in context). The results of auditory training showed significant effects in the left inferior frontal gyrus (IFG) and right superior temporal gyrus (STG), areas involved in semantic and phonological processing. For visual training, significant effects were found in the left posterior STG close to the occipital and parietal cortices, an area thought be involved in processing visual linguistic information. For visual-auditory training, significant effects were found in the right anterior cingulate gyrus and left precuneus, areas thought to process both word phonology and structural information. When words were learnt in isolation, significant effects were found in the left dorsal IFG and left precentral gyrus. When words were learnt in context, a strong effect was found in the left posterior middle temporal gyrus, an area thought to play an important role in lexical semantic processing. To conclude, the meta-analysis results demonstrate modality-specific effects across different studies, and suggest the role of sentential context in effective word learning.

D82

SIMILAR BRAIN RESPONSES TO LIP-READ, READ, AND LISTENED NARRATIVE SPEECH

Jussi Alho[1], Satu Saalasti[1], Juha Lahnakoski[2], Mareike Bacha-Trams[1], Uri Hasson[3], Iiro Jääskeläinen[1], Mikko Sams[1]; [1]Aalto University, [2]Max Planck Institute of Psychiatry, [3]Princeton University — Previous brain imaging studies have demonstrated that viewing silent visual speech (lip-reading) activates brain areas associated with both auditory speech perception as well as reading. However, previous studies have predominantly used simple linguistic units as stimuli that do not engage all the processes involved in real-life language processing. The current study took advantage of recent advances in neuroimaging data analysis to investigate the extent to which lip-reading a narrative engages similar neural processes as listening or reading the same narrative. Participants (N=29), with a wide variation in lip-reading ability, had their brain activity measured with 3-T functional magnetic resonance imaging (fMRI) while they 1) listened to an 8-min spoken narrative, 2) read a time-locked transcript of the narrative, 3) lip-read the narrative from a silent video showing the speaker's face. The data were analyzed by voxel-wise comparison of the blood-oxygenation-level-dependent (BOLD) signal time courses elicited by the lip-read, read, and listened narratives. This allowed us to identify the brain areas responding with similar temporal response profiles to different stimulation types. All stimuli elicited similar responses in the middle temporal gyrus, inferior frontal gyrus, premotor cortex, precuneus, and cerebellum. Furthermore, individual lip-reading ability correlated with the response similarity between lip-reading and listening in the left middle and anterior superior temporal gyrus. Our novel results demonstrate that many linguistic brain areas do not differentiate whether speech narrative is lip-read, read, or listened. In addition, a characteristic feature of skilled lip-reading appears to be the efficient use of peri-auditory language processing mechanisms.

D83

AUDITORY PERCEPTION AND EXECUTIVE FUNCTIONS IN SIMULTANEOUS INTERPRETERS: RE-EXAMINING THE MUSIC-LANGUAGE RELATIONSHIP

Vanessa Tsz Man Chan[1,2], Claude Alain[1,2]; [1]University of Toronto, [2]Rotman Research Institute, Baycrest Hospital — Music and language have been proposed to share processing resources in the brain; an extension of this proposition is that expertise in one of these two skills may enhance processing of the other. Although many studies have examined the effect of musicianship on linguistic processing, comparatively fewer studies have examined this relationship from the perspective of linguistic expertise, and what constitutes a suitable linguistic expert to compare to

musicianship is up for debate. This study aimed to use an experience-dependent linguistic expert – simultaneous interpreters (SIs) – to address whether linguistic expertise enhances auditory processing outside of the linguistic domain, particularly in measures where musical expertise has been shown to improve performance. SIs and non-interpreter controls were compared on several measures, spanning fine temporal and spectral discrimination, speech-in-noise perception, memory for pitch, visual working memory and cognitive flexibility. Tasks were selected to match those which musicians have been shown to perform better in compared to non-musicians, to further address whether this form of linguistic expertise may tap into the same set of cognitive resources as musicianship. No significant differences were found between SI and two control groups (non-SI bilinguals and English-speaking monolinguals) on any of the tested measures except in the speech-in-noise task. The current findings suggest a limitation in the extent of transferability in this form of linguistic expertise, as well as the bidirectionality of transfer between language and music.

D84

L3 ITALIAN AND L2 SPANISH TRANSFER AFFECTS GRAMMATICAL GENDER ACQUISITION: AN EVENT-RELATED POTENTIAL STUDY

Margarita Zeitlin[1], Judith L McLaughlin[1], Jerimiah Rice[1], Lee Osterhout[1]; [1]University of Washington — Research has shown that L2/L3 learners progress from a "lexical" stage (in which grammatical anomalies elicit N400 effects) to a "grammaticalized" stage (in which the same anomalies elicit P600 effects). The transition from one stage to the next is quantified by the response dominance index (RDI; Tanner et al., 2013), with larger values reflecting greater P600 dominance. We separately recorded ERP responses to Italian and Spanish grammatical gender anomalies in novice, intermediate, and advanced L1 English L3 Italian learners (most had previously studied L2 Spanish). Sentences contained nouns whose grammatical gender was either orthographically transparent (il occhio/el ojo) or opaque (la salute/la salud), and either congruent or incongruent across Italian and Spanish. Stimuli included well-formed sentences and sentences with article-noun gender agreement violations (*la occhio/*la ojo; *il salute/*el salud). Learners were also given tests of Italian and Spanish proficiency. In the Italian sentence-reading task, greater Italian proficiency was correlated with larger RDI values for the anomalous opaque and incongruent stimuli, but only for learners with L2 Spanish. Gender agreement anomalies in Italian sentences elicited a P600 in advanced Italian learners in the transparent condition, but not in novice and intermediate learners. Anomalies in the transparent condition in Spanish sentences elicited a P600 in advanced Italian learners with prior Spanish instruction, and an N400 effect in Italian learners who had not studied Spanish. Our results show that L2-L3 typological similarity enhances L3 acquisition and L2 retention, and that aspects of an L3 can transfer to an unstudied but typologically related language.

D85

COMPARING STATISTICAL LEARNING OF SYLLABLES AND PURE TONES USING NIRS

Sandrine Girard[1], Ted Huppert[2], Jeff Barker[2], Erik Thiessen[1]; [1]Carnegie Mellon University, [2]University of Pittsburgh — Successful language acquisition requires learners to segment units embedded within larger structures; for example, words within phrases. Infants and adults employ a learning mechanism, statistical learning (SL), that facilitates the segmentation process by tracking the statistical regularities that define the linguistic input (e.g., syllables within a word are more likely to co-occur than syllables across word boundaries). While behavioral studies indicate that learners are sensitive to statistical structure, the neural correlates of SL remain undefined. We utilized near-infrared spectroscopy to measure changes in blood oxygenation in Broca's area and its right hemisphere counterpart while undergraduates completed a tone and syllable SL task. Two versions of each task were created to assess the effect of pre-training. In the pre-training version, participants were familiarized with the words from an artificial language before being presented with 30-second blocks of continuous sound (alternating between statistically structured and unstructured stimuli) interspersed with 30 seconds of silence. In the version without pre-training, participants experienced the same stimuli and procedure, except without pre-familiarization with the words in the language. We predicted an increase in blood oxygenation for structured syllables and tones in the left hemisphere. As predicted, participants showed increased blood oxygenation when listening to blocks of structured syllables. Surprisingly, participants showed decreased blood oxygenation during blocks of unstructured tones, rather than an increase during structured input. These results suggest that activation in Broca's area that is associated with recognition is sensitive to statistical structure, and that this sensitivity manifests differently for linguistic and non-linguistic stimuli.

D86

UNITS FIRST OR TENS FIRST: DOES LANGUAGE MATTER WHEN PROCESSING VISUALLY PRESENTED TWO-DIGIT NUMBERS?

Alexandre Poncin[1], Amandine Van Rinsveld[1], Christine Schiltz[1]; [1]Université du Luxembourg — The German number word system inverts units and tens compared to the Arabic notation. This is not the case in French, which is more transparent with respect to the Arabic number code. The linguistic structure of number words can facilitate or impede numerical development and performances in number transcoding tasks. We used an original transcoding paradigm with French-speaking (N=28) and German-speaking (N=19) 4th grade children who listened to two-digit numbers and had to identify the heard number amongst four visually presented Arabic numbers. The novelty of our paradigm consisted in manipulating the order of appearance of the units and tens of the Arabic numbers, leading to three conditions: Units-first, Tens-first and Simultaneous appearance. While German-speakers were globally slower than French-speakers, ($F(1,45)=3.95$; $p=.053$) we also observed an interaction between language group and transcoding condition, ($F(2,90)=13.26$; $p<.001$) as the largest group difference was observed for the Tens-first condition, ($t(45)=-3.729$; $p=.00$). Moreover, when the order of appearance was congruent with the number word system, (i.e. Units-first in German and Tens-first in French) transcoding was faster in both groups. For German-speaking children both Units-first and Tens-first conditions were faster than the Simultaneous condition, while for the French-speaking children the Tens-first condition was faster than both other conditions. In other words, our results suggest that children are influenced by the verbal structure of numbers of their respective language when processing visually presented Arabic numbers. Taken together, they provide new insights on how language structure qualitatively impacts basic numerical processing in children.

D87

READING AN ARTIFICIAL ORTHOGRAPHY RESULTS IN LEFT VISUAL WORD FORM AREA ACTIVATION

Lea Martin[1,2], Corrine Durisko[1,3], Michelle Moore[4], Julie Fiez[1,2,3]; [1]University of Pittsburgh, [2]Center for the Neural Basis of Cognition, Pittsburgh, PA, [3]Learning Research and Development Center, Pittsburgh, PA, [4]West Virginia University — The visual word form area (VWFA) is a left-lateralized region in visual association cortex. It responds preferentially to orthographic as compared to non-orthographic stimuli (Cohen & Dehaene, 2004). There is some debate as to whether the VWFA responds to the perceptual features of written language (visuo-spatial account) or if it is positioned to connect visual input with aspects of spoken language (linguistic bridge account). The current study pitted these accounts against each other, by training subjects to read an artificial "HouseFont" alphabet. In HouseFont, house images serve as letters that represent spoken English, with each image mapped to a specific phoneme. Twelve participants underwent a two-week training protocol to establish basic HouseFont reading proficiency. Functional neuroimaging data were collected while subjects viewed printed HouseFont words and control stimuli. The primary analyses focused on three regions identified by a localizer protocol prior to HouseFont training: the VWFA and the left and right parahippocampal place area (PPA). Significant pre- versus post-training increases in the response to HouseFont was observed in the VWFA, while no effect of training was observed in the left and right PPA. These results are consistent with behavioral and neuroimaging findings from our previous work which focused on the role of the VWFA in reading an artificial, alphabetic orthography comprised of faces, "FaceFont" (Moore, et al, 2014). Together, the body of findings supports the linguistic bridge account of VWFA specialization while also suggesting that the VWFA is not restricted to using traditional orthographic forms as graphemes.

D88

SENSITIVITY TO REGULARITY OF COMBINATORIAL VISUAL STIMULI CORRELATES WITH CHINESE CHARACTER RECOGNITION

Anya Yu[1], Henry Brice[2], Ram Frost[2,3,4], Denise H. Wu[1]; [1]Institute of Cognitive Neuroscience, National Central University, Taiwan, [2]Department of Psychology, The Hebrew University, Israel, [3]Haskins Laboratory, Yale University, USA, [4]Basque Center on Cognition, Brain, and Language, Spain — Recent research has shown that the abilities of statistical learning in the visual modality (VSL) have consistently correlated with literacy acquisition of alphabetic (Hebrew) and non-alphabetic (Chinese) languages alike. However, whether there are different aspects of VSL and whether these aspects contribute to literacy acquisition equally remain to be clarified. To explore these issues, the sensitivities to transitional probability in the spatial layout, sequential ordering, and feature combination of visual stimuli in Taiwan college students, as well as their IQ, working memory, and performance of lexical decision on Chinese characters, were measured. Because the majority of modern Chinese characters are phonograms, which are typically composed of a semantic and a phonetic radical on the left and right side of a character, respectively, we hypothesized that the VSL of combinatorial regularities (CVSL) would exhibit a stronger correlation with the literacy index than the VSL of spatial and sequential VSL. Consistent with this hypothesis, the results demonstrated that the reaction times of lexical decision correlated with CVSL but not with sequential or spatial VSL. In addition, sequential VSL correlated with IQ as measured in the block design task, while spatial VSL correlated with working memory as measured in forward digit span, suggesting that VSL encompasses sensitivity to different kinds of regularity. Based on these results, brain activations in the regions sensitive to radical processing in Chinese character recognition, such as the left inferior parietal cortex for orthography-phonology conversion, are predicted to correlate with the ability of CVSL.

LONG-TERM MEMORY: Episodic

D89

PRIORITIZATION BENEFITS ON ADOLESCENTS' MEMORY FOR PROSE PASSAGES ARE ENHANCED OVER TIME AND SLEEP

Kelly Bennion[1], June Lo[2], Michael Chee[2]; [1]Boston College, [2]Duke-National University of Singapore Graduate Medical School — As chronic sleep restriction is a widespread problem among adolescents, the present study investigated the effects of a one-week sleep restriction (SR) versus control period on the consolidation of long-term memory for prose passages. We also determined whether the benefit of prioritization on memory is modulated by adequate sleep occurring during consolidation. Fifty-six healthy adolescents (25 male, ages 15-19) were instructed to remember a prose passage in which half of the content was highlighted (prioritized), and were told they would receive an additional bonus for remembering highlighted content. Following an initial free recall test, participants underwent a 7-night period in which they received either a 5-hour (SR) or 9-hour (control) nightly sleep opportunity, monitored by polysomnography on selected nights. Free recall was tested at the end of the sleep manipulation period (one week after encoding), and again six weeks after encoding. Recall of highlighted content was superior to that of non-highlighted content at all three time points (initial, one week, six weeks). This beneficial effect of prioritization on memory was stronger one week relative to a few minutes after encoding for the control, but not SR group. N3 was similar in the control and SR groups. Overall, results show that the benefits of prioritization on memory are enhanced over time, requiring time and sleep to fully unfold. Partial sleep deprivation may attenuate such benefits, but this may be offset by preservation of stage N3 sleep -- suggesting that adolescents are relatively resilient to cognitive consequences of sleep restriction on consolidation.

D90

PLACE MEMORY SUB-REGIONS IN THE HUMAN HIPPOCAMPUS

Brittany M. Jeye[1], Jessica M. Karanian[1], Scott D. Slotnick[1]; [1]Boston College — Research in animals indicates that the hippocampus is associated with specific spatial processing, as illustrated by place cells. A separate line of research in humans indicates that the hippocampus is associated with general context processing. In the present fMRI study, we determined whether the human hippocampus was associated with specific spatial processing by evaluating whether distinct sub-regions were differentially associated with spatial memory for items presented in different quadrants of the visual field. During encoding, participants maintained fixation and viewed abstract shapes presented in the upper-right quadrant, the lower-right quadrant, the upper-left quadrant, or the lower-left quadrant. During retrieval, old shapes were presented at fixation and participants classified each shape as previously in the "upper-right", "lower-right", "upper-left", or "lower-left". Data were acquired at 3T with a 32 channel head coil, and a random-effect general linear model was conducted. Preliminary analyses revealed that accurate spatial memory for shapes in each quadrant of the visual field was associated with distinct hippocampal sub-regions (identified by contrasting hits > misses for each quadrant). For instance, accurate spatial memory for shapes in the upper-right quadrant was associated with activity in hippocampal sub-regions that were distinct from the hippocampal sub-regions associated with accurate spatial memory for shapes in the lower-right, upper-left, and lower-left quadrants. The present results indicate that the human hippocampus consists of sub-regions spanning many millimeters that are associated with memory for specific places in the visual field. These findings suggest that the hippocampus in humans, like animals, is associated with specific spatial processing.

D91

NEUROMODULATION OF UNINTENTIONAL FORGETTING: A TDCS STUDY

Davide Francesco Stramaccia[1], Barbara Penolazzi[2], Federica L'Abbate[1], Giovanni Galfano[1]; [1]University of Padua (Italy), [2]University of Trieste (Italy) — Background. Unintentional forgetting in episodic memory is mainly investigated with the retrieval-practice paradigm (RPP). Here, participants selectively retrieve part of previously studied material, which leads to forgetting of that part of the remaining material which is strongly associated to the former: a phenomenon known as retrieval-induced forgetting (RIF). The present work aimed to extend a previous study, where transcranial Direct Current Stimulation (tDCS) over the right dorsolateral prefrontal cortex successfully modulated RIF, by testing the involvement of another cortical area (the right Inferior Frontal Gyrus, rIFG), which has been shown to be involved in episodic forgetting as revealed by neuroimaging studies. Methods. 72 healthy volunteers performed a standard RPP. During the practice phase, participants received either sham, anodal, or cathodal tDCS (1.5mA, 20 min, 16cm2 electrodes, contralateral supraorbital reference) to the rIFG. Results. Retrieval-induced facilitation of studied material was significant in all groups. Conversely, although group differences (sham vs anodal tDCS, sham vs cathodal tDCS) were not reliable overall, RIF was significant ($p<0.05$) in the sham tDCS group only. Conclusions. Although further replication attempts are needed to corroborate between-group differences, these findings seem to support previous studies, where tDCS significantly affected inhibitory performance in the RPP, and help refining the overall picture by addressing the role of rIFG in unintentional forgetting.

D92

ANATOMICAL CORRELATES OF INDIVIDUAL DIFFERENCES IN SPATIAL ASPECTS OF AUTOBIOGRAPHICAL MEMORY

Melissa Hebscher[1,2], Alita Fernandez[1,2], Brian Levine[1,2], Asaf Gilboa[1,2]; [1]Rotman Research Institute, Baycrest, [2]University of Toronto — A distributed network of brain regions supports autobiographical memory (AM). A small number of studies have suggested that the hippocampus reinstates allocentric (world-centred) spatial representations early during AM recall. These are then translated to egocentric (body-centred) representations for mental imagery and re-experiencing by parietal regions. The current study investigated these proposed processes and how they contribute to individual differences in AM. We cued participants with personalized stimuli consisting of location and non-location cues and assessed (1) the time taken to recall AMs, (2) the first thing that came to mind when recalling the event, and (3) subjective memory quality. The likelihood of selecting location (versus non-location) as the first thing that came to mind was associated with faster recall and decreased re-experiencing of memories. Hippocampal volume predicted faster reaction times while superior parietal and precuneus volume/thickness predicted slower reactions times and a lower likelihood of selecting location as the first thing that came to mind. Additionally, the tendency to recall memories from an egocentric perspective was associated with increased precuneus and superior parietal volume/thickness, while the

tendency to recall memories allocentrically was associated with increased parrahippocampal thickness. These findings suggest that allocentric spatial information plays an early role in memory retrieval, likely supported by the hippocampus and parrahippocampus. Conversely, parietal regions may be later involved in slower, egocentric-focused recall promoting re-experiencing of memories. Individual differences in these regions may lead to variability in the subjective experience of remembering.

D93

MODULATION OF MNEMONIC PROCESSING BASED ON TASK RELEVANCE

Lynn Lohnas[1], Katherine Duncan[2], Thomas Thesen[1], Orrin Devinsky[1], Lila Davachi[1]; [1]New York University, [2]University of Toronto — Encoding and retrieval of episodic memories depend not only on the information being processed, but also on how that information relates to previously formed memories and task demands. In a continuous recognition paradigm, memory processing requires switching between encoding novel representations and retrieving prior representations. We examined the neural correlates of such switches in processing using a continuous recognition paradigm, while recording electrocorticography (ECoG) activity (n=5). Specifically, participants performed two versions of the paradigm in a blocked design. In the 'fine-grained' task, participants indicated whether they had seen this exact image before ('old'), whether they had seen a similar but not identical version of this image ('similar') or whether the item was entirely new ('new'). In the 'coarse-grained' task, participants only distinguished between 'old' and 'new' items; a 'similar' item was considered 'old' inasmuch as it shared a majority of features with a previously presented item. We first examined local -frequency activity (HFA, 45-115) in the hippocampus, a region proposed to switch dynamically between encoding and retrieval. In the fine-grained task, hippocampal HFA distinguished between correct responses across stimulus types as well as successful vs. unsuccessful memory for similar items. Surprisingly, hippocampal HFA didn't exhibit significant differences between stimulus or response types in the coarse-grained task. HFA in upstream lateral ventral temporal cortex and downstream dorsolateral prefrontal cortex exhibited the same differences between stimulus types irrespective of task demands, underscoring the role of the hippocampus in filtering information relevant to memory processing.

D94

SPATIAL RECONSTRUCTION AND PATTERN SEPARATION TASKS ARE DIFFERENTIALLY SENSITIVE TO THE RELATIONSHIP BETWEEN HEALTH BEHAVIORS AND HIPPOCAMPAL FUNCTION

Kelsey M. Hassevoort[1], Sarah E. Zola[1], Charles H. Hillman[1], Neal J. Cohen[1]; [1]The University of Illinois at Urbana-Champaign — Researchers have taken a number of different approaches in their exploration of hippocampal function. One approach probes the memory representations that the hippocampus supports. Another approach focuses on the hippocampus's role in the processes of pattern separation and pattern completion. Each of these approaches to understanding hippocampal function utilizes a distinct set of specialized tasks, and both of these task sets have been shown to be sensitive to changes in hippocampal function with age and disease status. But are the tasks utilized in these two approaches tapping into the same aspects of hippocampal function? The current study addressed this issue by employing sensitive tasks from both approaches in preadolescent children (N=45; mean age = 9.0 years) who underwent aerobic fitness and nutritional assessments as part of a larger randomized controlled trial. Participants completed both a relational memory task involving spatial reconstruction (Watson et al., 2013) and a pattern separation task (the MST or BPS-O task, Stark et al., 2013). Pattern separation performance was significantly related to spatial reconstruction performance, with pattern separation performance negatively associated with the rate of "swap errors", a type of relational memory error in spatial reconstruction (Watson et al., 2013). But only spatial reconstruction performance, and not pattern separation, was significantly associated with aerobic fitness. These results suggest that, while pattern separation and spatial reconstruction tasks both tap into hippocampal function, relational memory, at least as assessed via spatial reconstruction, may be particularly sensitive to lifestyle factors known to affect the hippocampus.

D95

NEURAL CORRELATES OF MENTAL AND PHYSICAL CONTEXT REINSTATEMENT SUPPORTING EPISODIC MEMORY RETRIEVAL

Inês Bramão[1], Anna Karlsson[1], Mikael Johansson[1]; [1]Lund University, Sweden — Human episodic memory is highly dependent on spatiotemporal context. This is corroborated by previous work showing superior memory performance when encoding and retrieval conditions overlap. In the present study, we investigated if mental reinstatement of an encoding context during retrieval yields a similar beneficial effect on episodic memory accessibility. We designed a paradigm where the overlap between encoding and retrieval context and the nature of context reinstatement (physical versus mental) were manipulated in a cued-recall task. During encoding, participants were asked to memorize word-pairs (cue – target) superimposed on visual background scenes. At retrieval, the cue word was presented in either an overlapping or a non-overlapping background context and participants were asked to retrieve the associated target word. Retrieval was preceded either by the active mental reinstatement of the context or by its visual presentation (physical context reinstatement). Behavioral data show that memory performance indeed improved when the encoding and retrieval context overlapped, and, notably, in a comparable way for mental and physical context reinstatements. The electrophysiological data, however, reveal different ERP correlates for the mental and physical reinstatement of the context, where mental reinstatement was characterized by later and more sustained ERP effects. Taken together, the present results suggest that the access to episodic memories can be facilitated also by mentally reinstating the encoding context, and furthermore that such benefits may be supported by processes differently engaged than when the encoding context is physically re-presented at the time of retrieval.

D96

MNEMONIC DISCRIMINATION OF OBJECT AND SPATIAL INFORMATION AS EARLY INDICES OF AGE-RELATED NEUROCOGNITIVE DECLINE

Zachariah Reagh[1], Huy Ho[1], Jessica Noche[1], Amanda Chun[1], Stephanie Leal[1,2], Elizabeth Murray[1], Michael Yassa[1]; [1]Department of Neurobiology and Behavior; UC Institute for Memory Impairments and Neurological Disorders; Center for the Neurobiology of Learning and Memory; University of California, Irvine, [2]Department of Psychological and Brain Sciences, Johns Hopkins University — Cross-species research has repeatedly shown episodic memory loss with aging. Episodic memory is reliant upon the medial temporal lobes (MTL), and different subregions of the MTL are thought to perform distinct but complementary functions. In addition to the hippocampus and its subfields, perirhinal and lateral entorhinal cortices (PRC/LEC) are thought to support memory for objects/items, whereas parahippocampal and medial entorhinal cortices (PHC/MEC) are thought to support memory for space/contexts. Recent work in animal models suggests that PRC/LEC may be selectively vulnerable to early age-related neuropathology. We designed a task taxing mnemonic discrimination (MD) of object and spatial information in samples of healthy young adults and aged adults with and without subclinical memory impairment ("impaired" and "unimpaired" groups). We find that all aged adults are outperformed by young adults on object MD (including the relatively "unimpaired" aged group), whereas only "impaired" aged adults struggle with both object and spatial MD. Importantly, unlike MD, simple recognition memory did not differ from young adults in either aged group. These findings suggest greater and more general age-related decline of object memory compared to spatial memory, consistent with animal models showing selective vulnerability in PRC/LEC. Furthermore, we find spatial memory deficits in the relatively "impaired" aged group, suggesting dysfunction of PHC/MEC in these individuals. In light of these behavioral data and related neuroimaging findings, we propose a framework of healthy vs. pathological aging trajectories based on the functional and structural integrity of MTL cortices.

D97

EFFECT OF POSTERIOR PARIETAL STIMULATION ON EPISODIC RETRIEVAL

Marty Fiati[1], Peter Bright[1]; [1]Anglia Ruskin University — Increasingly findings from the memory literature have implicated the posterior parietal cortex (PPC) in the memory operations which occur at the time of episodic retrieval. Involvement of the PPC has been found to support

fine multi-sensory recollection of features within episodic memories, and has also been suggested to reflect binding of such contextual information within an episode. In the current study, participants performed a multisensory episodic retrieval task in which they first identified previously studied (Old) faces, and subsequently made context-based source judgements denoting the spatial location (left/right), voice (male/female), and study task (pleasantness rating/celebrity judgement) that they had associated with each face at study. Recorded ERPs associated accuracy of source recollection with a late positivity (450ms-800ms) maximal over centro-parietal sites. In order to evaluate the causal relationship of this activity with retrieval transcranial direct current stimulation (tDCS), was employed. Participants underwent tDCS at the site of maximal peak activity in the left PPC (P3) before performing the retrieval task. The performance following excitatory anodal tDCS for 15 participants, and inhibitory cathodal tDCS for 15 participants, was compared to sham tDCS . Excitatory stimulation was not found to lead to greater retrieval of multimodal contexts than sham stimulation overall. Inhibitory stimulation however was found to decrease retrieval of multimodal episodic contexts compared to sham stimulation. The findings indicate that the binding of different sensory features of an episode at retrieval is decreased by reductions in activation of the PPC, and this region therefore may mediate the richness of episodic retrieval.

D98

IN WHAT WAY DOES PREPARATORY CUEING SUPPORT SOURCE MEMORY ENCODING?

Jonathan Strunk[1], Audrey Duarte[1]; [1]Georgia Institute of Technology — Previous evidence suggests that neural activity preceding stimulus onset predicts subsequent episodic memory performance. It is currently unclear, however, whether pre-stimulus preparation benefits episodic memory performance nor what kinds of processes underlie preparatory activity. In the current fMRI study, we manipulated the informative value of a pre-stimulus cue during the encoding phase of a source memory task. We assessed the effects of cue type on source memory accuracy and related neural activity both prior to and after stimulus onset. During encoding, participants were asked to assess the likelihood of an object and face (source) or object and scene (source) pairing. Prior to each encoding event, informative cues indicated whether the object would be paired with a face or a scene, while neutral cues provided no information. Reaction times during encoding were faster for informative than for neutral cued trials, and source memory accuracy was higher for informative than neutral cued trials. fMRI results indicated that both category-specific (face/scene) activity in visual association cortex and category-general activity in the medial temporal lobe underlie cue-locked preparatory activity. Stimulus-locked activity in the hippocampus predicted subsequent source memory accuracy to a greater extent for informative trials compared to neutral trials, across source category. These results suggest that preparatory cues may facilitate source memory performance through "priming" of activity in domain-specific visual cortex and domain-general MTL, as well as by recruiting domain-general hippocampal binding operations during encoding.

D99

THE HUMAN DENTATE GYRUS PLAYS A NECESSARY ROLE IN PATTERN SEPARATION

Stevenson Baker[1], Fuqiang Gao[2], Paula Vieweg[3], Thomas Wolbers[3,4], Sandra E. Black[2,5,6], Asaf Gilboa[6], R. Shayna Rosenbaum[1,6]; [1]York University, Toronto, Ontario, Canada, [2]LC Campbell Cognitive Neurology Research Unit, Canadian Partnership for Stroke Recovery (Sunnybrook site) and Brain Science Research Program, Sunnybrook Research Institute, University of Toronto, Ontario, Canada, [3]Aging and Cognition Research Group, German Center for Neurodegenerative Diseases (DZNE), Otto-von-Guericke University Magdeburg, Magdeburg, Germany, [4]Center for Behavioral Brain Sciences, Magdeburg, Germany, [5]Department of Medicine (Neurology), University of Toronto, Ontario, Canada, [6]Rotman Research Institute and Canadian Partnership for Stroke Recovery (Baycrest site), Baycrest, Toronto, Ontario, Canada — The ability to represent past experiences in episodic memory is believed to require at least two mechanisms: 1) pattern separation (PS), or the act of reducing interference among similar neural inputs by using non-overlapping representations; and, 2) pattern completion (PC), or the recollection of a past experience or event from a degraded or incomplete cue. Extant evidence that the two processes are dissociable within the hippocampus, with PS dependent on the dentate gyrus (DG) and PC dependent on the adjoining CA3 subfield, is indirect and correlational or based on patients with large hippocampal lesions that encompass multiple subfields. Here we report the rare case of B.L., a 54-year-old male who presents with bilateral hippocampal damage that is relatively restricted to the DG. PS and PC were examined in B.L. and age-matched controls using well-established tasks, the Mnemonic Similarity Task (MST) and Partial Scene Recognition task (PSR). Performance on the two tasks indicated that, relative to controls, B.L. had difficulty distinguishing between studied targets and unstudied lures that were similar in visual appearance and conceptual category, indicating a failure to pattern separate. B.L. also showed a heightened tendency to pattern complete when presented with degraded pictures of scenes. Taken together, the results provide the first definitive evidence in humans that PS and PC are indeed dissociable, with PS dependent on DG integrity.

D100

THE IMPORTANCE OF CONTEXT FOR POST-ENCODING STRESS EFFECTS ON MEMORY; AN ALTERNATIVE TO CONSOLIDATION THEORY

Matthew Sazma[1], Andrew McCullough[1], Andy Yonelinas[1]; [1]University of California - Davis — Acute stress immediately after learning has been shown to improve memory for the items learned prior to stress. This effect is believed to be a result of a consolidation process that acts to solidify recently encoded memories. However, an alternative account is that stress serves as a context shift that protects recently encoded memories from the effects of retroactive interference. The effect of context change on stress related memory effects has not yet been directly examined. In the current study, subjects encoded negative and neutral pictures, and then experienced stress (i.e., submerging their arm in ice water for 3 minutes) or a control condition (i.e., room temperature water). For half of the subjects, the stress/control manipulations occurred in the same room as the encoding phase, whereas the other half were moved to another room for the stress/control manipulations. Two days later, all participants returned to the initial encoding room and completed a recognition memory test. Preliminary results indicate that stress improved memory when it occurred in the same context as encoding, but not when the context had changed between study and stress. Importantly, simply changing context in the non-stressed groups also improved memory. The results suggest that post-encoding stress may act to reduce interference rather than to consolidate recently encoding memories.

D101

NEURAL OSCILLATIONS ASSOCIATED WITH LEARNING OF TEMPORAL SEQUENCES

Jordan Crivelli-Decker[1], Liang-Tien Hsieh[1], Charan Ranganath[1]; [1]Center for Neuroscience, UC Davis, USA — Episodic memories are conceptualized as sequences of events. Computational models suggest that neural oscillations play a role in the coding of temporal sequences, but the extent to which oscillations support sequence representation remains unclear. To address this question, we used electroencephalography (EEG) recordings to examine oscillatory activity over the course of repeated exposure to sequences of objects. EEG was recorded as participants made semantic decisions in response to a continuous stream of presented objects. For three of the sequences, the order of the objects was always fixed. Activity during these learned sequences was compared to a "Random" and a "Novel" sequence. Random sequences consisted of the same objects presented in a different order on each repetition, whereas Novel sequences consisted of trial-unique objects. Behavioral results showed that, over the course of learning, semantic judgments were faster for objects in learned sequences, as compared to objects in Random and Novel sequences. These findings indicate that, although participants were not required to recall sequence information during the semantic decision task, they used knowledge of learned sequences to optimize their decisions. Preliminary EEG analyses revealed increased oscillations in the beta (13-27Hz) band for objects in fixed sequences compared to objects in random sequences. This effect was most evident in late learning blocks, suggesting a role of beta oscillations in reinforcing structured order information over the course of sequence learning. Further analyses will evaluate how beta activity relates to behavioral measures of sequence learning and how it is modulated by serial position within sequences.

D102

GENETIC ASSOCIATIONS OF OBJECTIVE AND SUBJECTIVE MEASURES OF AUTOBIOGRAPHICAL MEMORY.

Derek Beaton[1], Daniela J. Palombo[2], Aggie Bacopulos[3], Rebecca M. Todd[4], Daniel J. Müller[5,6], Adam K. Anderson[7], Hervé Abdi[1], Brian Levine[3,6]; [1]The University of Texas at Dallas, [2]VA Boston Healthcare System, [3]Rotman Research Institute, [4]University of British Columbia, [5]Centre for Addiction and Mental Health, [6]University of Toronto, [7]Cornell University — To date, few genes have been associated with performance on laboratory measures of memory, whereas the genetic correlates of real-world (autobiographical) memory (AM) have been largely unaddressed. In the present study, we investigated genetic associations of AM with: (1) a "subjective" (self-report) measure: the Survey of Autobiographical Memory (SAM; Palombo et al., 2012), and (2) an "objective" (experimenter-rated) measure: the Autobiographical Interview (AI; Levine et al., 2002) in 268 healthy young adults. In accordance with the notion that memory is a polygenic trait, we focused on multiple genetic markers—ApoE, BDNF, ADRA2, SLC6A4, HTR2A, KIBRA, COMT, DRD2, DRD4, and DAT1—that are likely, or have previously been, associated with various aspects of memory. We used multiple correspondence analysis (a multivariate technique) to relate patterns of genetic markers to patterns of AM scores. The largest observable associations between genetics and AM were, generally, in relation to KIBRA and dopaminergic markers. For example, (1) DRD4 (Exon III LL repeats) are associated with generally low scores on both the SAM and the AI, (2) DRD2 (TT) is associated with relatively high scores on the SAM, with mid-to-low scores on the AI, and (3) KIBRA (TT) is associated with moderate-to-high scores on both the SAM and the AI. In conclusion, our results show that a number of genetic markers are associated with distinct (SAM or AI separately) or combined aspects of AM, and highlight the essential role of dopaminergic markers as stronger contributors to AM than other (typically observed) markers.

D103

EXPLORING THE VARIETY OF CONTEXTUAL FACTORS IN EPISODIC MEMORY: THE HIGH-RESOLUTION FMRI STUDY

Jonghyun Park[1], Yoonjin Nah[1], Na-Young Shin[2], Seung-Koo Lee[3], Sanghoon Han[1]; [1]Yonsei University, [2]Ewha Womans University School of Medicine, [3]Yonsei University, College of Medicine — Episodic memory consists of core event and the contexts around it. Although the role of hippocampus and neighboring regions in contextual representations during encoding has become increasingly evident, it remains unclear how the regions handle the various context-specific information other than spatiotemporal contexts. Using high-resolution functional MRI, we explored patterns of para-/hippocampal involvement during the encoding of various contextual information (i.e., journalism principle 5W1H); "Who did it?", "Why did it happen?", "How did it happen?", "What happened?", "When did it happen?", "Where did it happen?" Six different contextual questions were asked to participants while looking at the simple experimental events of two faces with one object in the screen. General linear model analyses revealed the robust medial temporal lobe (MTL) activation during encoding in all six conditions. However, unlike the spatiotemporal contextual (Where, When) processing, the cause-effect (Who, Why, How) contexts showed the activation of the distinct MTL subregions linked with prefrontal, amygdala, fusiform, and other regions relative to item-based (What) information encoding. To further investigate the relative functional involvement of hippocampal subfields sensitive to each condition, the multivariate pattern analysis with voxel-wise searchlight methods was conducted within bilateral MTL, using multiple single-trial as regressors to iteratively acquire beta estimate patterns. Results showed that anterior-to-posterior hippocampus and parahippocampal regions demonstrated differential engagement between spatiotemporal versus cause-effect contextual representations. In addition, the whole-brain functional connectivity was measured with each MTL subregion seed, which also allowed us to investigate the differential connectivity patterns within hippocampal regions across contextual conditions.

D104

PREFRONTAL THETA-BURST STIMULATION MODULATES EPISODIC MEMORY ORGANIZATION

Bianca-Maria Marin[1], Joel Voss[1], Donna Bridge[1]; [1]Northwestern University Feinberg School of Medicine — Although multiple elements comprise an episodic memory, some are "dominant" in that they are disproportionately bound with other elements and therefore serve as strong reminder cues for the entire episode. We have previously shown that active retrieval selectively increases dominance of specific episode elements. This dominance establishment was associated with activity of right dorsolateral prefrontal cortex (rDLPFC) and hippocampus, hypothesized to reflect active maintenance of dominant elements and binding of dominant elements with other elements, respectively. In the current study, we applied continuous theta-burst transcranial magnetic stimulation (TBS) to rDLPFC to test its causal role in dominance establishment. Anatomically-targeted TBS was applied prior to task performance in one rDLPFC TBS session and one sham TBS session following a counterbalanced within-subjects design (N=16). Subjects studied three objects at specific locations. One object was selected for an active or passive (control) manipulation. Active manipulation involved short-term memory retrieval of the selected object's location, whereas passive manipulation involved moving the selected object to a visually marked location. After the manipulation, subjects restudied the object-location associations. Memory was later tested for non-manipulated objects given either manipulated objects or other non-manipulated objects as reminder cues. Compared to sham, TBS enhanced the retrieval of object-locations when the actively retrieved object was used as a reminder cue relative to when non-manipulated objects were reminder cues. These findings suggest that rDLPFC causally contributes to dominance establishment and thereby the organization of episodic memory.

D105

NEURAL CORRELATES UNDERLYING THE EFFECT OF VALUE ON RECOGNITION MEMORY

Blake Elliott[1], Chris Blais[1], Gene Brewer[1]; [1]Arizona State University — In the present research we examined behavioral and neurophysiological correlates of value-directed recognition memory. Participants encoded words in multiple study phases that were assigned either high or low point values and were instructed that it was more important to remember the higher value words than the lower value words in order to increase their score on a subsequent word recognition test. Subjective states of recollection (i.e., "Remember") and familiarity (i.e., "Know") were assessed at retrieval. High value words were discriminated more effectively than low value words and this difference was primarily driven by increases in Remember responses with no difference in Know responses. A corresponding parietal old-new effect (500-800 ms post-stimulus) over posterior electrodes differentiated neurophysiological correlates of high and low value words. Overall, the behavioral and neurophysiological data add to previous evidence that two distinct processes support recognition memory decisions, and that value-directed encoding results in a greater effect on subjective states of recollection.

D106

USING EYE-TRACKING TO INVESTIGATE LONG-TERM MEMORY ENCODING AND RETRIEVAL IN ADULTS WITH AUTISM SPECTRUM CONDITIONS

Rose Cooper[1], Kate Plaisted-Grant[1], Simon Baron-Cohen[1], Jon Simons[1]; [1]University of Cambridge — Individuals with autism spectrum conditions (ASC) exhibit subtle deficits in recollection, as evidenced by reduced 'remember' responses, reduced source memory, and difficulty distinguishing old and similar lure items in memory. However, the encoding and retrieval processes underlying these deficits remain unclear. Using eye-tracking to explore encoding and retrieval processes provides benefits over explicit memory responses, having recently been used to investigate implicit memory, false recognition of similar lure items, and differences between recollection and familiarity during encoding and retrieval. In the current study, we used eye-tracking alongside a long-term memory paradigm, where participants were asked to distinguish between old and similar lure scenes and provide 'remember'/'familiar' responses, to investigate encoding and retrieval differences in adults with ASC. The ASC group were impaired in their ability to distinguish old and similar lure scenes in memory, accompanied by a reduction in remember but not familiar responses. In controls, subsequent lure false alarms and familiarity

responses were associated with fewer encoding fixations than lure correct rejections and recollection responses. In contrast, number of fixations did not predict subsequent memory in the ASC group. Recollection in the control group was associated with enhanced reinstatement of eye movements, which was not the case in the ASC group. The eye-tracking results suggest disruptions to recollection may predominantly occur after encoding in ASC and the experience of recollection may be less specific as well as less frequent in this population.

D107

DIFFERENCES IN FUNCTIONAL NETWORK ARCHITECTURE BETWEEN SUCCESSFUL SOURCE AND ITEM MEMORY

Zachary Monge[1], Matthew Stanley[1], Simon Davis[1], Roberto Cabeza[1]; [1]Duke University

— There is a fundamental distinction in memory research between source (SM; where, when, and how?) and item (IM; what?) memory. Available evidence suggests that SM relies more on executive processing in the prefrontal cortex (PFC), whereas IM relies more on memory processing in the medial temporal lobe (MTL). These brain regions do not operate independently from the rest of the brain, but rather they are embedded within a large scale, integrative network. We used graph theory to investigate the integrative properties of the PFC and MTL within the memory network. Healthy older participants (n=42) encoded words under a pleasantness or size judgment task. During retrieval they made SM decisions about the encoding task or IM recognition decisions (old/new). In order to identify brain regions important for successful SM and IM networks, graph theory measures of centrality and efficiency were calculated on a nodal level. For SM compared to IM trials there was higher degree centrality (more functional connections), PageRank centrality (more functional connections to highly connected nodes), and global efficiency (shorter functional connections) in the right lateral PFC. For IM compared to SM trials there was higher degree centrality, PageRank centrality, global efficiency, and local efficiency (shorter functional connections in neighboring nodes) in bilateral MTL and medial PFC. Here, we showed a double dissociation in integrative properties between the contributions of PFC to SM and MTL to IM. These results confirm and extend previous findings by showing the differential contributions of these regions within a general memory network.

D108

AGE-RELATED DEFICITS IN SELECTIVE ATTENTION DURING ENCODING INCREASE DEMANDS ON EPISODIC RECONSTRUCTION DURING SOURCE RETRIEVAL: AN ERP STUDY

Taylor James[1], Jonathan Strunk[1], Jason Arndt[2], Audrey Duarte[1]; [1]Georgia Institute of Technology, [2]Middlebury College

— Previous event-related potential (ERP) and neuroimaging evidence suggests that directing attention toward single item-source associations at encoding improves source memory performance and reduces demands on strategic retrieval operations in young and older adults. In everyday situations, however, there are multiple event features competing for our attention. It is not currently known how selectively attending to one source feature while attempting to ignore another influences source memory performance and the processes that support successful retrieval in the young and old. We investigated this issue in the current ERP study. Young and older participants studied pictures of objects in the presence of two source features: a color and a scene, and their attention was directed to the object's relationship with one of those sources. Participants made source memory decisions for both attended and unattended sources and rated their confidence in those decisions. Behavioral results showed that while both groups were generally successful in applying selective attention during source encoding, older adults were less confident in their source memory decisions for attended features and showed greater dependence in source memory accuracy for attended and unattended source features, i.e. 'hyper-binding'. ERP results were largely consistent between age groups but older adults showed a more pronounced late posterior negativity (LPN) implicated in episodic reconstruction processes. We conclude that age-related suppression deficits during encoding result in reduced selectivity in source memory, thereby increasing subsequent demands on episodic reconstruction processes when sought after details are not readily retrieved.

LONG-TERM MEMORY: Semantic

D109

INVESTIGATING THE TEMPORAL DYNAMICS OF RETRIEVING NEW "FOIL" SEMANTIC AND PHONOLOGICAL INFORMATION

David Amadeus Vogelsang[1], Matthias Gruber[2], Zara Bergstrom[3], Charan Ranganath[2], Jon Simons[1]; [1]Department of Psychology, University of Cambridge, UK, [2]Center for Neuroscience, University of California at Davis, CA, USA, [3]School of Psychology, Keynes College, University of Kent, UK

— Previous research has suggested that incidental encoding of new "foil" words during an old/new recognition test is better when participants search their memory for items that were encoded semantically compared to phonologically when previously studied. However, the temporal dynamics underlying this behavioural effect remain unresolved. In this EEG experiment, participants encoded information in both a deep semantic and shallow phonological task and were tested in a subsequent blocked memory test to examine how orienting retrieval towards these different types of information influences encoding of "foils". After this memory test, participants performed a further surprise old/new recognition test on foil items that were incidentally learned during the previous semantic and phonological testing blocks. Recognition memory during this foil test was significantly better for semantic foils than phonological foils, even though the only difference between the foils was the type of information that was oriented towards when they were first encountered. Time-frequency analysis on the EEG data during the initial study phase revealed that semantic compared to phonological processing was associated with alpha decreases in the left frontal electrode cluster. Results from the first test phase revealed that decreases in alpha and theta oscillatory activity in the left frontal electrode cluster differentially predicted successful memory for semantic and phonological foils on the final foil recognition test. These results suggest that attempting to retrieve semantic versus phonological information involves reinstating the distinct neurocognitive operations that were engaged during initial encoding.

D110

SHARP CATEGORY BOUNDARIES IN THE HUMAN BRAIN REVEALED THROUGH MULTIVARIATE ANALYSES OF FUNCTIONAL CONNECTIVITY AND STIMULUS PREFERENCES

Quanjing Chen[1], Frank Garcea[1], Jorge Almeida[2], Bradford.Z Mahon[1]; [1]University of Rochester, [2]University of Coimbra

— The ventral visual pathway supports object and scene identification and exhibits a macroscopic organization by semantic domain. Multivariate techniques have recently been increasingly used to show that category-selectivity in the ventral stream is not all or none, leading to the argument that there are 'graded' object representations in the ventral stream. Here we show that sharp categorical boundaries do in fact exist in the ventral stream when the same multivariate techniques are used to map distributed patterns of functional connectivity onto distributed patterns of stimulus preferences. We focus on a subregion of the ventral stream (medial fusiform gyrus, parahippocampal gyrus) that exhibits differential activity for places compared to tools, and differential activity for tools compared to animals and faces. The same region exhibits overall stronger functional connectivity to retrosplenial cortex compared to left parietal regions. Nonetheless, within that region, multivariate analyses indicate that tool preferences over voxels are selectively related to variability over voxels in functional connectivity to the inferior parietal lobule. In contrast, and over the same set of voxels, place preferences are selectively related to variability in functional connectivity to retrosplenial cortex. These findings indicate that the basic organizing principle of the ventral stream may be captured best by neither functional connectivity alone, nor stimulus preferences alone, but rather by the common code that relates stimulus preferences to functional connectivity.

D111

THE EFFECTS OF VISUOMOTOR ENGAGEMENT ON SEMANTIC RETRIEVAL FOR FLEXIBLE OBJECT USE

Hannah M. Morrow[1], Evangelia G. Chrysikou[1]; [1]University of Kansas

— Cognitive neuroscience research on the organization of semantic memory for objects has revealed that different object attributes (e.g., color vs. function), different stimuli (e.g. visual or verbal), and different tasks (e.g., naming vs. object use) can influence the

retrieval of semantic information about objects. For example, past work in healthy adults and patients with semantic dementia has shown that certain aspects of object knowledge (e.g., the object's function or mode of manipulation) can be accessed independently of more abstract properties of the object (e.g., its name) and faster when participants are presented with three-dimensional objects relative to stimuli in pictorial format. However, the majority of these studies have focused on the retrieval of canonical object attributes. Nevertheless, frequently in daily life, one is required to solve a problem or satisfy a goal under unexpected or emergency circumstances, when an object may have to be used in a manner different from its typical use. Here we examined whether visual and manual experience with three-dimensional objects, relative to two-dimensional pictures of these objects, would allow for differential access to semantic memory under conditions of impromptu goal achievement (i.e., when a participant has to come up with an unusual, relative to a typical, use for a common object). Our results showed that participants who engaged with three-dimensional object stimuli during the flexible object use task showed facilitated access to sensorimotor object properties, yielding better performance on this task. We discuss these implications of these results for theories of object knowledge retrieval.

D112

PUPIL DILATION REFLECTS INTERFERENCE DURING COMPETITIVE MEMORY RETRIEVAL

Roger Johansson[1], Amanda Bjernestedt[1], Philip Pärnamets[1,2], Mikael Johansson[1]; [1]Lund University, [2]Karolinska Institutet

— The present study investigated the relationship between pupil dilation and interference during competitive memory retrieval. Pupil diameter was recorded from 31 participants engaged in a memory task designed to cause proactive interference. Participants completed 12 blocks each consisting of 4 trials for two conditions which differed on the last trial. In each trial they encoded 3 words from the same semantic category, which subsequently were to be recalled in their original presentation order. In the proactive interference (PI) condition the target words came from the same semantic category for all 4 trials, leading to a progressive buildup of interference from previous words. In the release from proactive interference (RPI) condition the semantic category was switched for the 4th trial, leading to a release from interference. As expected, results showed that retrieval performance systematically declined for both conditions until the last trial, where it continued to decline for the PI condition, but improved for the RPI condition. Results for pupil size revealed a mirroring pattern, where pupil dilation systematically increased for both conditions over the first 3 trials of retrieval. Critically, the pupil was significantly more dilated in the PI condition than in the RPI condition during the last trial. To our knowledge, this is the first study to show that pupil dilation can be used as a reliable index of the cognitive effort needed to handle interference from competing memory traces during memory retrieval and thus demonstrates the possibility of using pupillometry to track interference independent of explicit responses.

D113

DIFFERENT RATES OF FORGETTING IN LONG-TERM MEMORY: THE ROLES OF ASSOCIATIVE BINDING, SEMANTIC RELATEDNESS, AND SLEEP

Samantha Audrain[1,2], Mary Pat McAndrews[1,2]; [1]University of Toronto, [2]Toronto Western Research Institute

— Many factors impact retention of information including the degree of associative binding required for memory, semantic relatedness of learned associations, and sleep-dependent consolidation processes. We sought to determine how these factors interact and influence rate of forgetting in the long-term, which has yet to be directly explored. Healthy participants studied semantically related and unrelated object-scene pairs and completed a forced-choice recognition task after 5 delays ranging from minutes to days. Half of the recognition trials could be solved using only familiarity or item memory (old/new object-scene pairs) whereas associative memory was required for the other half (intact/re-paired object-scene combinations). Semantically related and unrelated item and associative memory trials were compared over time. We found that participants recognized significantly less associative than item stimuli by 6 hours post-study. However, after a night of sleep there was no difference in retention between the two conditions due to a boost in memory for associative stimuli, which continued to decline significantly faster than item memory thereafter. This effect was particularly robust for associative pairs that were semantically unrelated, as semantic relatedness benefitted both types of memory with little decline over time. Our findings demonstrate that associative memory shows the greatest forgetting over time, benefits temporarily from a night of sleep, and shows a long-lasting benefit from existing cortical schemas for learned associations.

D114

QUANTIFYING NEURAL REPRESENTATIONS OF SEMANTIC SIMILARITY

Ellen L. Zippi[1], Neal W Morton[1], Alison R. Preston[1]; [1]The University of Texas at Austin

— While prior work has identified brain regions that respond preferentially to items from specific visual categories, less is known about how meaning is represented in the brain. To identify where meaning is represented, we first constructed a model to determine quantitative measures of latent semantic similarity. Articles from Wikipedia corresponding to each stimulus in a pool consisting of famous people and famous landmarks were used to build a text corpus. We used natural language processing tools and dimensionality reduction techniques to calculate vector representations of the articles. These vector representations were used to estimate the cosine similarity between each pair of items. Then, the model was trained to maximize the difference in similarity between within-category and across-category pairs. To measure the neural representations of these stimuli, participants were shown images of each stimulus during fMRI scanning. The trained model makes predictions about the similarity of meaning between different pairs of stimuli. We find a significant correlation between representational dissimilarity maps for observed activity patterns in the ventral temporal cortex and the model-based similarity predictions for different landmarks. This finding is consistent with the idea that ventral temporal cortex is representing the meaning of the stimuli. Moreover, our technique can be used to identify specific sub-regions of ventral temporal cortex involved in representation of meaning.

D115

ELECTROENCEPHALOGRAPHY THETA ACTIVITY ELICITED BY VISUALLY PRESENTED SEMANTIC CATEGORIES

Jihyeon Choi[1], Bambi L. DeLaRosa[1], Michael A. Motes[1], Ryan Tychinsky[1], Scott Shakal[1], John Hart Jr.[1,2]; [1]Center for BrainHealth, The University of Texas at Dallas, [2]Department of Neurology and Neurotherapeutics, The University of Texas Southwestern Medical Center

— Current models of semantic memory suggest that an object is represented in distributed neural systems, including sensory-motor cortices, with activation of object representations via temporally coordinated electrical activity. In this study, topographical theta band (4-8 Hz) was investigated in response to visually presented objects that varied on categorical membership. Electroencephalography (EEG) was measured from 64 electrodes in 74 healthy adults during a Go-NoGo paradigm (Object-Animal task) with a focus on categorical effects for the Go condition. Go stimuli consists of line drawings of six categories: body parts, cars, clothes, food, kitchen, and tools. Reaction times for each category in the Go condition were different from each other, with car category as the fastest and the human body parts category as the slowest. EEG results showed that over motor cortex (electrode FC3) the categories of cars and tools had greater theta power than the other categories of clothes, food, and kitchen. In occipital cortex (electrode OZ) the food category showed the most substantial theta power over cars, clothes, kitchen, and tools categories. The findings show topographical theta activity over brain regions corresponding to the features of the semantic categories.

D116

VIVIDLY REMEMBERED: NON-CLINICAL DELUSIONAL IDEATION AND FALSE MEMORIES

Ahmad Alsemari[1], Ferrinne Spector[1]; [1]Edgewood College

— On any given day, a person may have an average of six delusional thoughts (Peters et al., 2004) and any number of false recollections. While we know that false memories represent a risk factor for delusions in the clinical population, little is known about non-clinical delusions and false memories. Here we examine the relationship between delusional ideation and false memories in the non-clinical population. We measured participants' delusional ideation using an inventory designed to measure delusional thinking in the normal, healthy population (Peters et al., 2004). We assessed memory performance in 80 typical healthy participants across two exper-

iments. The first experiment was a list-learning paradigm modeled after Roedinger and McDermott (1995) in which participants viewed words that were highly associated with non-presented target words and later asked to recognize the words from within a list loaded with distracter/target words. In Experiment 2, participants viewed words followed by either an image of the object, or a blank rectangle. Participants were later instructed to identify only the words for which they had seen an image from a spoken word list. Participants who identified the target words in Experiment 1 and words for which they had not seen an image in Experiment 2 are exhibiting false memory. Results suggest a positive correlation between delusional ideation and false memories, with high delusional participants showing greater confidence for falsely remembered items. These results support the hypothesis that healthy participants who are high in delusional ideation do show an increased tendency to make false memory judgments.

D117

WHEN A MARSHMALLOW IS MORE LIKE A PILLOW THAN A GRAHAM CRACKER: PARSING PERCEPTUAL AND CONCEPTUAL PROCESSES OF THE MEDIAL TEMPORAL LOBE

Rachel Newsome[1,2], Danielle Douglas[1], Louisa Man[1], Morgan Barense[1,2]; [1]University of Toronto, [2]Rotman Research Institute — It is largely accepted that the anterior temporal lobes and perirhinal cortex (PRC) are important structures for representing conceptual information about objects. For example, recent findings show that the PRC is active when distinguishing semantically similar objects. However, in these studies, there is an inherent confound: semantically related objects are often also perceptually similar (i.e., lions and tigers are conceptually related – both are jungle cats, predators; they are also perceptually related – both have big claws, four legs). Evidence suggests that the PRC is also critical for aspects of object perception, particularly when a task requires discriminating highly overlapping visual features. In the present study, we created a novel paradigm that independently manipulated perceptual and conceptual overlap across items. We asked participants to make similarity judgments on objects based on either perceptual or conceptual relatedness. Critically, we equated the relatedness of the targets and foils, such that for every conceptual target there was a matched perceptual foil (and vice versa). We tested amnesic patients whose damage included or excluded the PRC and age-matched healthy controls. We found that PRC damage was associated with object discrimination impairments in both conditions, with greater deficits in the perceptual condition. In contrast, patients whose damage did not include the PRC were not impaired on perceptual or semantic judgments. Our findings provide evidence that the PRC may be required for discriminating both perceptual and semantic ambiguities. Furthermore, we provide a novel task to differentiate perceptual and conceptual commonality in real-world objects.

LONG-TERM MEMORY: Skill learning

D118

EFFECTS OF DOPAMINE ON THE CONSOLIDATION OF LEARNING AND MEMORY: IMPLICATIONS FOR PARKINSON'S DISEASE

Madeleine Sharp[1], Katherine Duncan[2], Karin Foerde[3], Rebecca Kahane[4], Daphna Shohamy[4]; [1]Department of Neurology, Columbia University Medical Center, [2]Department of Psychology, University of Toronto, [3]Department of Psychology, New York University, [4]Department of Psychology, Columbia University — Dopamine plays an important role in multiple aspects of learning, but its role in the consolidation of learning is not well understood. Here, we aimed to address this gap by examining the role of dopamine in the consolidation of different forms of learning and memory in humans. Specifically, we asked: First, does dopamine contribute to the consolidation of incremental learning? Second, does dopamine contribute to the consolidation of episodic memory? And third, are there differences in consolidation of learning from positive vs. negative outcomes? To address these questions, we used a task that measures both probabilistic incremental learning and episodic memory. To test the effect of dopamine on the persistence of incremental learning and episodic memory, we tested participants with Parkinson's disease, either ON or OFF their dopaminergic medications, at two time points across a two-day delay. Results show that initial learning was similar among Parkinson's patients and controls, but Parkinson's patients showed weaker consolidation than controls for both incremental learning and episodic memory. This pattern of results was also seen when comparing the consolidation of learning from positive or negative outcomes, suggesting a general difference in consolidation of learning between the groups. These findings suggest that dopamine plays a role in the consolidation of both incremental and episodic memory. Identifying the vulnerable stages of learning in Parkinson's patients has implications for effectively designing and delivering the learning based therapies so often used in Parkinson's disease.

D119

USING COMPUTATIONAL METHODS TO CHARACTERIZE IMPLICIT SEQUENCE LEARNING

Kelsey R Thompson[1], Paul J Reber[1]; [1]Northwestern University — Implicit learning involves extracting statistical variation from the environment in order to improve behavior. Because knowledge of environmental structure is acquired outside of awareness, it is challenging to determine the precise nature of the information that is obtained from experience. Here we report the development of a computational simulation model aimed at identifying the simplest possible mechanisms (e.g., the model with the minimum necessary free parameters that provides the closest prediction of participant behavior) that could underlie human implicit sequence learning. Typical paradigms covertly embed repeating sequences constructed to require learning of second-order conditional probabilities. As a result, although the repeating sequence could be 12 or 30 items long, it is only necessary to calculate statistics of trigram fragments to perfectly predict the next item in the sequence. However, a simulation model restricted to trigram statistics is unable to provide a fit to human learning data. An identically structured model that extracts higher-order statistics (fourth-order conditional probabilities) provides a more accurate fit, offering a hypothesis about the representational structure of the underlying human learning mechanism. In addition, detailed comparison of the computational predictions and fine-grained performance analysis illustrates the need for additional performance mechanisms (such as the effect of adaptive speed on performance) beyond simple power-law or exponential learning of the statistical frequency of sequential response co-occurrences. Based on the model structure, predictions are described for future experiments that might require the addition of more complex or abstract representations (e.g., non-adjacent dependencies, abstract patterns, hierarchical chunk structures) to the model.

D120

IS IMPLICIT LEARNING INTACT IN AUTISM? BEHAVIORAL AND ERP RESULTS FROM A STATISTICAL LEARNING TASK

Fenny Zwart[1], Roald Maes[1], Constance Vissers[1,2], Paul Eling[1], Jos Egger[1,3,4], Roy Kessels[1,5]; [1]Donders Institute for Brain, Cognition and Behaviour, Nijmegen, [2]Koninklijke Kentalis, Sint-Michielsgestel, [3]Vincent van Gogh Institute for Psychiatry, Venray, [4]Behavioural Science Institute, Nijmegen, [5]Radboud University Medical Centre, Nijmegen — Autism Spectrum Disorder (ASD) is characterized by deficits in social and communication skills as well as deficits in language and motor domains. It is precisely these skills that are thought to develop largely by implicit, or 'incidental', learning mechanisms. Hence, an influential theory in ASD research posits that ASD originates from a deficit in implicit learning capacities. However, the majority of implicit learning studies in ASD does not find support for this theory. The aim of the current project is to provide evidence that implicit learning capacities are intact in ASD and it is rather the propensity to use implicit learning strategies that differs from people without ASD; while people with ASD can learn implicitly, they prefer to use other, explicit strategies. In the current EEG-study, implicit and explicit learning are investigated in a group of adults with ASD (n=20) and a group of controls (n=23) by using an adapted version of the widely used Serial Reaction Time Task (SRTT). Behavioral results show evidence that implicit learning as well as explicit learning is similar for the ASD group compared to the control group. However, interestingly, EEG results suggest reduced evidence of implicit learning as represented by an enhancement of P300 to novel stimuli for the ASD group. Our lab is currently performing in-depth analyses on the EEG data which should elucidate further on the question whether electrophysiological mechanisms underlying implicit learning are altered in ASD.

D121

(DON'T) MIND THE EFFORT: EFFECTS OF CONTEXTUAL INTERFERENCE ON ERP INDICATORS OF MOTOR PREPARATION

Romy Frömer[1], Birgit Stürmer[2], Werner Sommer[1]; [1]Humboldt-Universität zu Berlin, [2]International Psychoanalytic University Berlin — Motor learning is associated with a decrease in frontal control-related brain activity and increase of central and parietal motor-related activity. Contextual interference (CI), manipulated typically by blocked versus randomized training schedules, affects motor learning, resulting in inferior performance during training but in superior retention and transfer. The CI effect is often explained by increased processing demands under high CI training. Consistently, in the motor preparatory phase the activity of control and attention related areas is higher under high CI. Here we investigated the effect of CI on learning-related changes in event related brain potentials during motor preparation. Participants learned throwing at virtual targets and were retested on the target condition one week later. Frontal P3 activity decreased in retention for both low and high CI training. In the low CI group, stimulus related initial CNV was unaffected, but late CNV amplitude, as a measure of abstract motor preparation, was increased in retention compared to training, consistent with previous literature. In contrast, in the high CI group, amplitudes of both, initial CNV as well as late CNV were lower in retention than training. High CI training furthermore resulted in significantly lower prefrontal and right lateral occipital activity in retention compared with training, reflecting the decrease in processing demands. We conclude that CI modulates the interplay of cognitive and motor processes in the preparatory phase of motor learning and that higher contribution of cognitive processes under high CI in training accounts for differential effects of CI on motor preparatory ERPs in retention.

D122

WHY REDUCING FEEDBACK FREQUENCY ENHANCES LEARNING: ELECTROENCEPHALOGRAPHIC EVIDENCE

Francisco Colino[1], Gordon Binsted[2], Olave Krigolson[1]; [1]University of Victoria, [2]University of British Columbia — Behavioural studies suggest that providing feedback to participants after every trial in learning tasks is not optimal. Indeed, overwhelming behavioural evidence suggests that a reduced feedback schedule (e.g., Wulf et al., 1993) results in greater learning. Here, we investigate the neural basis for the reduced feedback frequency effect. We hypothesized that a reduced feedback frequency schedule might result in greater learning related activity within a neural learning system in the human medial-frontal cortex. Specifically, we predicted that during a reduced feedback schedule the amplitude of the reward positivity – a component of the human event-related brain potential associated with reward processing – would be greater in a reduced feedback schedule. Two groups of participants completed a line drawing task while electroencephalographic data was recorded. In a key manipulation, each group received a different feedback schedule – one group of participants received feedback on every trial the other on only half of the experimental trials. Following completion of the acquisition phase of the experiment both groups of participants completed a retention test to gauge learning. An analysis of our behavioural data revealed learning effects in line with expectations. Interestingly, an analysis of the electroencephalographic data revealed that during learning the amplitude of the reward positivity was greater for participants on a reduced as opposed to a full feedback schedule. Our data suggest that during a reduced feedback schedule the "gain" of the medial-frontal learning system is increased – perhaps in an attempt to take advantage of sparse feedback – and as such greater learning occurs.

D123

DISSOCIATING THE IMPACT OF REWARD AND PUNISHMENT ON PERFORMANCE AND RETENTION OF SKILLED BEHAVIORS

Adam Steel[1,2], Edward Silson[1], Charlotte Stagg[2], Chris Baker[1]; [1]Laboratory of Brain and Cognition, NIMH, NIH, [2]FMRIB, University of Oxford — Feedback during skill learning improves immediate performance and aids long-term memory formation. However, neither the specific effects of reward (REW) and punishment (PUN) nor generalizability of those effects across skill domains is well understood. The present study investigated the influence of REW and PUN on learning two different tasks: a serial reaction time task (SRT) and a force-tracking task (FTT). 72 subjects were evenly distributed across the two tasks, and split into three feedback conditions: REW, PUN or control (CONT). Feedback was based on ongoing performance; in SRT, accuracy and reaction time determined feedback, which was given after each button press. In FTT, feedback was given whenever the subject was inside their previous error margin. In REW, subjects were told if their performance improved compared to their previous block. In PUN, subjects were told when their performance was worse than their previous block. In CONT, subjects received feedback unrelated to their performance. We examined performance during learning and tested retention at 1 hour, 24 hours, and 30 days after the learning finished. The effect of feedback on performance during learning differed between the tasks. For SRT, subjects in PUN condition responded faster than those in REW or CONT, with minimal impairment in accuracy, i.e. they performed better. In the FTT, REW had the least error, equating with better performance. There was little difference between the feedback conditions on retention on either task. These results suggest that feedback influences performance rather than long-term memory.

OTHER

D124

ARITHMETIC PROCESSING IN CHILDREN WITH SPECIFIC MATHEMATICS LEARNING DISORDER AND CHILDREN WITH NORMAL ACADEMIC PERFORMANCE. AN EVENT-RELATED POTENTIAL STUDY.

Sonia Yanin Cárdenas Sánchez[1], Thalía Fernández Harmony[1], Juan Silva Pereyra[2], Belén Prieto Corona[2], Ana Milene Roca Stappung[1], Benito Martínez Briones[1], Minerva Rojas Méndez[3], Graciela Catalina Alatorre Cruz[2]; [1]Department of Behavior and Cognitive Neurobiology, Neurobiology Institute, National Autonomous University of Mexico., [2]Faculty of Iztacala, National Autonomous University of Mexico., [3]National Pedagogic University of Mexico — Specific Mathematics Learning Disorder (SMLD) affects academic performance and daily life, so it is of interest study the brain's electrical activity underlying this disorder. Objective: To compare arithmetic processing between a group of 20 children with SMLD and a group of 18 children with Normal Academic Performance (NAP) using Event-Related Potential (ERP) during an arithmetic verification task. Each trial corresponds to one-digit sum followed by a correct or incorrect probe (experimental conditions). Children decided if their own result match or mismatch regarding the probe. ERP were obtained time-locked to onset of the probe. A non-parametric permutation multivariate analysis was applied to evaluate differences between conditions. In both groups there was a higher percentage of right answers for the incorrect-probe compared to correct-probe. In both conditions, the percentage of right answers was higher in NAP than SMLD group. NAP group showed an N400 effect (i.e., higher amplitudes to incorrect-probes than correct-probes) and a late positive shift effect with widespread distribution. In contrast, SMLD group displayed no significant N400 effect but a focal late positive shift effect. This suggests that SMLD group has significant problems from arithmetic and matching-probe processes, reflected by N400, to a deficient verification process manifested by the late positivity. Acknowledgments: Dr. María Elena Juárez, Ing. Héctor Belmont, Lic. Lucero Albarrán Cárdenas, CONACYT (218556) y PAPIIT (IN204613).

LONG-TERM MEMORY: Skill learning

D125

FAILURE OF OBSERVATIONAL LEARNING OF 2D, BUT NOT 1D CATEGORIES

Yi-Wen Wang[1], Vivian Valentin[1], F.Gregory Ashby[1]; [1]UC Santa Barbara — Humans can learn about categories by observing exemplars in each category, or by receiving feedback after making a categorization response. Previous research indicates that observational learning works better for the declarative rule-based (RB) task than the procedural information-integration (II) task, because participants tend to use suboptimal rules for the II task shown by the categorization transfer test following training. Two confounding factors challenge this interpretation. First, there are 2 relevant dimensions (2D) in the more difficult II task compared to 1-dimension (1D) in the RB task. Second, randomly intermixing stimuli from both categories might encourage participants to compare stimuli and generate rules. We avoided these confounding factors by adding difficult 1D and 2D

RB tasks, and by asking participants to memorize exemplars from blocks of 2 alternating categories. Recognition tests after each block and a transfer to categorization test after training were given. For participants with good recognition of the exemplars, transfer of category knowledge was severely affected in the 2D, but not the 1D categories. People tend to come up with suboptimal 1D rules in observational learning, even for category structures that require use of both dimensions (i.e. II and 2D RB). Our results show that feedback learning is a more efficient way than exemplar memorization for learning categories, and it is difficult for people to form proper category structures by merely exposing them to multiple exemplars in categories.

D126

ACQUISITION AND CONSOLIDATION OF MOTOR SEQUENCE LEARNING IN PARKINSON'S DISEASE

Lucy L W Owen[1], Madeleine E Sharp[2], Daphna Shohamy[1]; [1]Department of Psychology, Columbia University, [2]Department of Neurology, Columbia University Medical Center — The striatum lies at the interface of actions and outcomes. Disrupted striatal function, such as occurs in Parkinson's disease, impairs learning of action-outcome associations as well as learning of motor sequences. But patients with Parkinson's disease are also impaired at motor control itself, regardless of learning, and it remains unclear to what degree the motor learning deficits reflect learning deficits per se, deficits in motor performance, or deficits in the consolidation of learning. We aimed to address this gap. We used a sequence learning task which allowed a separate assessment of performance, acquisition and consolidation of learning. Parkinson's patients and matched control participants first performed a motor sequence task, then trained on the learning of the motor sequence, and finally were retested after two days to assess consolidation of learning. Not surprisingly, we found that overall performance of the motor task was worse in the Parkinson's patients, to begin with. But, taking this baseline difference into account, the degree of learning of the sequence was actually similar in the Parkinson's patients and the controls. Furthermore, patients and controls showed similar consolidation and retention of learning across the two-day delay, and similar vulnerability to interference as assessed with a competing motor sequence condition. These findings suggest that despite impaired performance of a motor sequence, Parkinson's patients have preserved motor sequence learning and preserved consolidation of motor learning.

D127

EVALUATING THE RELATIONSHIP BETWEEN WHITE MATTER INTEGRITY, COGNITION AND VARIETIES OF VIDEO GAME LEARNING: AGE-RELATED DIFFERENCES AND INDIVIDUAL DIFFERENCES

Nicholas Ray[1,2], Margaret O'Connell[1,2], Kaoru Nashiro[3], Evan Smith[1,2], Shuo Quin[1,2], Chandramallika Basak[1,2]; [1]University of Texas at Dallas, [2]Center for Vital Longevity, [3]University of Southern California — Videogames have been proposed as a possible intervention to age-related declines in cognition, by reducing degradation of anterior brain regions that decline rapidly with aging (Basak et al., 2008; 2011). This anterior-posterior gradient has been shown in white matter FA of the corpus callosum (Head et al., 2004; Salat et al., 2005). The current study of 55 participants (24 young and 31 old) was designed to a) assess the age-related declines in white matter integrity, b) evaluate the common as well as different white matter FA predictors of varieties of game learning – one action and one strategy, and c) evaluate the relationship between white matter integrity, cognitive abilities and types of game learning. Our results support previous research regarding age-related differences in integrity of corpus callosum; we observed a negative correlation between age and FA in the genu, but no correlation between age and FA in the splenium. We also found different predictors of the two types of game learning, with measures of cognitive control, FA in splenium and FA in left cingulum hippocampal correlated positively with the strategy game learning, but working memory capacity, FA in genu and FA in right cingulum hippocampal correlated positively with the action game learning. Multivariate analyses to evaluate the structure-cognition-game learning relationship are being conducted, which would help us devise better cognitive training interventions.

METHODS: Other

D128

HEMISPHERIC INTERACTION AND LATERALIZATION IN SIMPLE AND COMPLEX ADDITION PROCESSING: A NOVEL BEHAVIORAL TASK

Eric J Failes[1], Andrew J Hughes[2], Barbara J Rutherford[3]; [1]Washington University in St. Louis, [2]University of North Dakota School of Medicine and Health Sciences, [3]University of British Columbia Okanagan — Past studies of hemispheric interaction and lateralization of arithmetic processing fall primarily into two categories: behavioral studies using lateralized visual or auditory presentations, and physiological/neuroimaging studies. Lateralized presentations lack ecological validity, as arithmetic problems are not naturally solved using peripheral vision or single ear presentation; physiological/neuroimaging research is expensive. Prior studies support left hemisphere dominance for addition processing, but simple addition processing may involve greater hemispheric interaction. We replicated past findings using a novel behavioral task in which simple and complex addition problems were presented at fixation either alone or with a distractor in the left or right visual field. The distractor weights problem processing to the ipsilateral hemisphere by competing for the attention of the contralateral hemisphere. Comparison of distractor-present trials with distractor-absent trials measures relative costs or benefits of hemispheric interaction. Experiment 1 tested problems with single-digit addends involving two (simple) or three (complex) operands. Experiment 2 tested problems that either did not require carry-over from the ones to tens column (simple) or did (complex). Only problems with two single-digit addends in Experiment 1 showed benefits to response time and accuracy from hemispheric interaction (no distractor) compared to each distractor-present condition; other problems showed no benefit or a cost. Regardless of complexity, responses were faster to problems with a left versus right distractor. The findings support left hemisphere dominance for addition, and suggest that collaboration between the hemispheres shifts to conflict as problem complexity increases. Convergence with past studies supports the procedure as an alternative behavioral test.

D129

USING VIRTUAL REALITY ENVIRONMENTS TO ASSESS WITHIN AND ACROSS CONTEXT SEGMENTATION AND SPATIAL MEMORY PERFORMANCE

Kevin Horecka[1], Michael Dulas[1], Christopher Widdowson[1], Neal Cohen[1]; [1]Beckman Institute of Advanced Science and Technology, University of Illinois at Urbana-Champaign — Virtual Reality (VR) has been identified as a useful tool in neuropsychological evaluation thanks to its increased control and measurement capabilities over other methods (Schultheis et al, 2002). More recently, evidence shows that along many measures, VR provides similar ecological validity to real environments (Kuliga et al, 2014). One area of research which is particularly amenable to VR paradigms is learning and memory. Previous work has suggested that context-boundaries have a selective effect on sequential binding of information and, therefore, item relationships which span contexts should show segmentation effects when compared to within-context items (DuBrow & Davachi, 2013). In this study, a VR spatial navigation task with four contexts (colored rooms) was constructed to evaluate how judgments of item pair locations within a context different from pairs which cross contexts. During the task, subjects were instructed to explore their environment (beginning from pseudo-random positions and orientations) and study locations of all items before being tested. Measurements of subject position, orientation, and memory for item locations were assessed. The data show significant increases in performance (speed, efficiency of movement/orientation, and memory accuracy) across successive training/test trial as well as significant difference in distance between within-context and across-context item pairs (with across context pairs being placed further apart and within context pairs closer together despite the pairs being equidistant). These results show that virtual reality can be used successfully in exploring spatial memory segmentation phenomena as well as provide tantalizing new measures which increase spatio-temporal resolution on behavior beyond other existing methods.

D130

DESIGN OF A MICROCONTROLLED LED SYSTEM WITH VERY HIGH PRECISION TIMING PARAMETERS FOR USE IN EEG ENTRAINMENT EXPERIMENTS

Maria Ruiz-Blondet[1], Sarah Laszlo[1]; [1]Cognitive and Brain Sciences, State University of New York at Binghamton — EEG entrainment is a robust and increasingly prominent phenomenon by which neural oscillations can be synchronized to an exogenous frequency, by presenting a visual stimulus at that frequency-- usually a flickering computer monitor. It is well-established that, for entrainment to be successful, it is necessary to have high precision control over the frequency at which the stimulus is shown. Here, with the use of a photosensor, we formally compare two common methods of computer monitor flicker control (CPU control and refresh synchronization) with a new method based on a device we have constructed to control LED lights with the help of a microcontroller, the Raspberry Pi. Results indicate that while refresh synchronization can produce fairly high temporal precision flicker, the physical limitations of even high-end computer monitors (i.e., the finite refresh rate) result in occasional frame dropping and consequent loss of precision in the timing of the flicker stimulus. Our microcontrolled LED system, in contrast, is not subject to the same physical limitations as a computer monitor and is therefore shown to have better temporal precision for implementing flicker stimuli. We include in the poster details of how to build and implement the LED device.

D131

PERSISTENT INFLUENCE OF SPORT-RELATED CONCUSSION ON NEUROPSYCHOLOGICAL FUNCTION IN MALE AND FEMALE ATHLETES

Veronik Sicard[1,2], Robert Davis Moore[1,2], Dave Ellemberg[1,2]; [1]Université de Montréal, [2]Centre de Recherche en Neuropsychologie et Cognition — Despite the increasing participation of females in sport over the last decades, there is limited evidence that sex differences exist in outcomes of concussive injuries. Therefore, we sought to determine if there is a sex difference in the long-term cognitive outcome of athletes with a history of concussion (HOC). One hundred and ninety-six collegiate athletes (49 HOC women, HOC 49 men, 49 women matched controls, 49 men matched controls) completed the Cogstate test battery, to which a 2-back condition (N-back task) was added to increase our ability to detect persistent deficits in higher cognition. All participants were asymptomatic at time of testing and those with a HOC were 6+ months from injury (24.0 ± 15.8 months). No group difference was observed for target and non-target reaction time or accuracy (ps>0.05). However, HOC men exhibited a greater number of omission errors relative to HOC women ($p<0.01$) on the N-back task. Additionally, irrespective of sex, HOC athletes exhibited a greater number of errors on the 1-back and 2-back conditions (ps<0.01), relative to controls. HOC athletes also exhibited decreased accuracy on the 1-back and 2-back conditions (ps<0.01), relative to controls. Conversely, analysis failed to reveal any group differences on tasks measuring lower-level cognitive functions (ps>0.05). The current results suggest that beyond the acute phase of the injury, sex does not seem as a moderating variable of cognitive outcomes following concussion. Furthermore, the results reaffirm that concussive injuries can result in persistent deficits in aspects of higher cognition.

D132

REMOTE ACQUISITION OF NEUROPSYCHOLOGICAL DATA THROUGH THE USE OF A COLLABORATIVE VIDEOCONFERENCING SYSTEM

Ololade Adebiyi[1], Corrine Durisko[1], Michael McCue[1], Patrick J. Doyle[2], Michael W. Dickey[1], Julie A. Fiez[1]; [1]University of Pittsburgh, [2]VA Pittsburgh Healthcare System — Neuropsychology, or the "lesion method", is the study of behavioral changes that occur as a consequence of focal brain injury. For more than 100 years it has played a central role in research that seeks to understand the mind in terms of underlying neural structure and function. Standard neuropsychological methods rely upon face-to-face interactions between a patient and researcher. This creates geographic and logistical barriers that impede research progress. To overcome these barriers, we created a flexible and integrated system for the remote acquisition of neuropsychological data (RAND). The system we developed has a secure architecture that permits collaborative videoconferencing. The system supports shared audiovisual feeds that can provide continuous virtual interaction between a participant and researcher throughout a testing session. Shared presentation and computing controls can be used to deliver auditory and visual test items adapted from standard face-to-face materials or execute computer-based assessments. Spoken and manual responses can be acquired and the session can be recorded for offline data analysis. Using our RAND system, we administered a speech-language battery to stroke survivors with a variety of communication, sensory, and motor impairments. The sessions were initiated virtually without prior face-to-face instruction. Neuropsychological data were successfully acquired and participants indicated a high level of satisfaction with their testing experience. Because our RAND system architecture uses off-the-shelf technology and software it can be duplicated without specialized expertise or equipment. In sum, our RAND system offers a readily available and promising alternative to face-to-face neuropsychological assessment.

D133

ALPHA TACS DOWN-REGULATES OCCIPITAL BOLD SIGNALS IN A VISUAL DISCRIMINATION TASK

Johannes Vosskuhl[1], Sara da Ponte Martins Calado[1], Christoph S. Herrmann[1]; [1]University of Oldenburg, European Medical School, Oldenburg, Germany — Transcranial Alternating Current Stimulation (tACS) at the individual alpha frequency (IAF) has been shown to elevate EEG amplitudes at the IAF in a time period exceeding stimulation for at least 30 minutes. Whether this amplitude increase results in a change of brain activation, as measured by the Blood Oxygen Level Dependent (BOLD) signal, is only sparsely investigated so far. Previous studies suggest that task related BOLD-signals but not resting state activation react to tACS. In many studies, the occipital BOLD-signal correlates negatively with alpha (8-13 Hz) and positively with gamma (30-80 Hz) oscillations. Therefore, we conducted an experiment, in which tACS was delivered at IAF (N=7) and 40 Hz (N=8) between groups, to induce a double dissociation between BOLD-effects as measured throughout the experiment. We conducted three blocks (15 min each) of a visual discrimination task. Stimulation (1 mA current strength) was active only in the middle block. During stimulation, a reduced BOLD-reaction to visual stimuli in the IAF group relative to the 40 Hz group could be demonstrated. The same comparison after tACS-offset showed a return to pre-stimulation baseline BOLD-signal differences. Additional analyses indicated that the effect was mainly driven by the IAF group. These results replicated previous findings and thereby consolidated the notion of tACS being able to directly manipulate brain activation. The after-effect documented in previous EEG-studies, was not present in the BOLD-signal. Given the novelty of the combination of tACS with measures of the BOLD-signal, these results yield important insights into the functional mechanisms behind tACS.

D134

MODULATION OF CORTICAL ACTIVITY USING HIGH DENSITY TRANSCRANIAL DIRECT CURRENT STIMULATION

Devin Adair[1,2], Dennis Truong[1], Marom Bikson[1]; [1]The City College of New York, CUNY, New York, USA, [2]The Graduate Center of The City University of New York, New York, NY, USA — Background: Transcranial Direct Current Stimulation (tDCS) is a non-invasive neuromodulation technique that applies low currents across the scalp to alter brain excitability. tDCS is well tolerated and easily adjusted to stimulate different brain regions, resulting in its application to a number of clinical and research question within the field of cognitive neuroscience. In conventional tDCS (1x1) two large pad electrodes with opposing charges are used to modulate underlying cortical function. However, confrontational modeling studies of current flow produced by conventional tDCS indicate that regions between the electrodes and deep in the brain are also stimulated. We propose that the use of the 4x1 high-definition tDCS (HD-tDCS) montage can be used to produce neuromodulation that is largely unidirectional and restricted to one targeted cortical region of interest. Methods: Here we use high resolution cortical electrical field models to describe the basic features of designing a 4x1 HD-tDCS montage. Namely, altering location, polarity and radius of the center and surrounding electrodes. Results: The best fit solutions were arrived at using finite element method (FEM). The results indicate that increasing the ring diameter for a given current increased peak cortical current intensity and depth of penetration. The degree of unidirectionality was not significantly influenced by ring diameter. The 4x1 HD-tDCS approach also produces much more consistent cortical targeting across brain regions and across individuals.

D135

EXAMINING THE EVIDENTIAL VALUE OF TDCS STUDIES USING A P-CURVE ANALYSIS

Sam Cason[1], Jared Medina[1]; [1]University of Delaware

— Transcranial direct current stimulation (tDCS) is a non-invasive method of brain stimulation that has been shown to modulate neural excitability via electrical currents. A number of studies across cognitive domains have claimed that tDCS can influence behavior. However, recent meta-analyses (e.g. Horvath, Carter, and Forte, 2014) have found no effects of single-session tDCS on cognitive tasks. Due to the incentivization of novelty and pressures to publish throughout academia, selective analyses or samples that produce significant p-values can be favored over those that do not. This phenomenon – p-hacking – may artificially inflate the real strength of an effect. Given questions regarding whether p-hacking is prevalent in the tDCS literature, we applied a p-curve meta-analysis to a random selection of manuscripts that used tDCS to modulate performance on cognitive tasks in healthy adults. A p-curve analysis, developed by Simonsohn and colleagues (2014), analyzes the distribution of significant p-values (i.e. < .05) over a series of papers. If the selected studies have some evidential value, the distribution of p-values should be right-skewed (e.g. more .01s than .04s), while p-hacked distributions are either flat or left-skewed (more .04s than .01s). Our distribution of p-values was significantly more right-skewed than expected by chance, providing evidence that these studies contain some evidential value.

PERCEPTION & ACTION: Motor control

D136

MOTOR CORTEX INVOLVEMENT IN OFF-LINE EFFECTOR RECOGNITION

Katherine R Naish[1], Sukhvinder S Obhi[1]; [1]McMaster University

— Observing an action performed by another person modulates activity in the observer's motor system. Most research to date has focused on how this modulation contributes to action perception in real time, and there has been little work on what happens after an action is observed. In previous work, we showed that interfering with motor activity during action observation impairs recognition of the objects involved in the action. In the current study, we examined whether motor interference impairs effector recognition in a similar way. In two experiments, single-pulse transcranial magnetic stimulation (TMS) was delivered over the primary motor cortex (M1) to briefly disrupt motor activity as participants watched an on-screen hand action. After a visual mask, a second video clip or a still image of a hand was presented, and participants judged whether the hand was the same or different to that viewed previously. Our results showed an impairment of effector recognition on trials where TMS had been delivered over M1 during action observation, compared to trials on which TMS was not applied or was delivered over the vertex. Importantly, stimulation over M1 did not influence recognition of hands that were presented as static images, or recognition of dot configurations or a moving shape. This work suggests a role for motor cortex in offline recognition of elements of action, with the motor system retaining a representation of the acting effector beyond the action observation period. Such lasting representations could play a role in observational learning and delayed action imitation.

D137

CTBS DISRUPTION OF THE SUPPLEMENTARY MOTOR AREA STRENGTHENS THE INVOLVEMENT OF HIPPOCAMPUS IN SEQUENCE PROCESSING

Oleg Solopchuk[1], Andrea Alamia[1], Etienne Olivier[1], Alexandre Zénon[1]; [1]Université Catholique de Louvain, Brussels, Belgium

— Two neural circuits are thought to be involved in sequence processing. The dorsal system (parietal and supplementary motor areas, SMA) would be responsible for procedural sequence memory while the ventral system (medial temporal lobes) would be responsible for declarative sequence memory. Here, we wanted to investigate whether those neural systems run in parallel during sequence processing and what is their respective contribution to sequence performance. Twelve subjects were trained for 4 days to execute 3 different movement sequences. Then they underwent 2 sessions of continuous Theta Burst Stimulation (cTBS) immediately followed by a functional neuroimaging (fMRI) session during which they executed trained or novel sequences and single finger movements. In one of the sessions, cTBS targeted the SMA, a core node of the dorsal learning system network. In the control session, cTBS was delivered over a region of somatosensory cortex corresponding to the leg representation. Our preliminary results showed that in both sessions the cortical network responsible for sequence execution (mainly primary motor and premotor cortex) was less activated during performance of trained versus novel sequences, in accordance with the literature. SMA cTBS did not affect subjects' task performance in terms of reaction time but increased the involvement of bilateral hippocampus during the execution of the trained motor sequences. This suggests that the ventral (declarative) sequence processing system compensated the deficit induced by the disruption of the dorsal (procedural) system. We expect multivariate analyses to shed more light on the integration of the neural circuits involved in motor sequence learning.

D139

THE MAGNITUDE OF SUPPRESSION TO SELF-INITIATED SENSATIONS IS DEPENDENT ON THE INITIATING MOTOR-ACTION

Nathan Mifsud[1], Tom Beesley[1], Thomas Whitford[1]; [1]UNSW Australia

— Self-initiated auditory sensations elicit smaller N1 amplitudes in the auditory evoked potential compared to physically identical externally-initiated sensations. The magnitude of this effect, known as 'N1-suppression', is typically larger for sounds evoked by willed vocalizations compared to sounds evoked indirectly by motor actions (e.g., button-pressing for tones). While this effect may be due to a learning effect (i.e., auditory sensations are more likely to result from mouth movements than finger movements), it could be due to the different sensations elicited in the different conditions. The present study compared N1-suppression evoked by three different types of motor movements. We collected ERP data from healthy individuals who either blew into a microphone (Blow condition), pressed a button (Press condition), or moved their eyes (Saccade condition) to generate a simple auditory tone. N1-suppression was calculated for each of the three conditions by subtracting N1-amplitude for each condition from the External condition, in which the computer automatically generated stimuli. There were marked differences in N1-suppression between the three conditions. N1-suppression was largest in the Blow condition and smallest in the Saccade condition, with the Press condition showing intermediate levels of N1-suppression. These results indicate that when holding auditory stimulus constant, N1-suppression magnitude is dependent on the eliciting motor action; mouth movements are associated with higher levels of N1-suppression than eye movements, with finger movements in between. These results suggest that N1-suppression is influenced by prior 'learning' as to the likelihood that a given motor action will result in an auditory sensation.

D140

THE NEURAL CORRELATES OF MOVEMENT IMAGERY: MU RHYTHM REFLECTS IMAGERY SUCCESS AND ABILITY

Kathryn Lambert[1], Yvonne Chen[1,2], Christopher Madan[1,3], Anthony Singhal[1,2]; [1]University of Alberta, [2]Neuroscience & Mental Health Institute, [3]Boston College

— The mu rhythm (8-12 Hz) is a variant of the alpha band that is recorded over the motor regions of the brain. Research has indicated that the mu rhythm is related to sensorimotor processes as it is suppressed during both overt movement and action observation. However, the relationship between this rhythm and imagined movements is less clear. Here we were interested in examining brain rhythms in the context of movement imagery success and ability. We recorded continuous EEG while 61 participants performed the Test of Ability in Movement Imagery (TAMI; Madan & Singhal, 2013), an objective measure of movement imagery ability. We hypothesized that mu activity would be suppressed during successful movement imagery trials in addition to varying as a function of overall motor imagery ability. The results demonstrated that, as expected, the mu rhythm was significantly suppressed on successful movement imagery trials compared to unsuccessful ones. We also examined the data with an alternative scoring method for the TAMI (Madan & Singhal, 2014) that allowed us to compare the "good" imagers with the "poor" imagers. These analyses revealed that the good imagers had higher levels of mu activity on average compared to the poor imagers. Taken together, these results suggest that the mu rhythm reflects important processes related to movement imagery, which are likely closely related to the processes that underlie overt movements and action understanding.

D141

MUSICAL RHYTHM ACROSS SPECIES: DISENTANGLING MOTOR CONTROL LIMITS AND AESTHETIC PREFERENCES

Tina Roeske[1], Eathan Janney[2]; [1]Max Planck Institute for Empirical Aesthetics, Frankfurt, Germany, [2]Psychology Department, Hunter College, New York, NY, USA — In a skillful musical performance, motor actions will often be executed close to a motor-control limit. Sometimes this becomes apparent in the music itself (e.g. shriller voice close to its upper pitch limit, less expressive timing manipulations at high than at lower tempo). Here we present a way to directly compare a motor-control limit in human musicians and songbirds, by measuring how the timing of notes is manipulated at fast tempi. When human musicians swing (= produce long-short patterns instead of uniform note repetitions, e.g. in jazz), they are known to decrease the swing and approach a uniform rhythm as tempo increases3. This might be due to reaching a motor limit: the musicians are no longer able to independently manipulate adjacent timing intervals. Here we show a similar effect in thrush nightingales who frequently produce repetitive long-short patterns (swing). Their swing patterns fall into different groups revealing different kinds of motor constraints: 1) In the fastest swing patterns, the birds seem to have no control over the short time interval duration, consistent with a production mechanism where one gesture creates a double sound (like clicking your tongue). 2) At medium tempi, swing patterns form distinct, non-overlapping groups characterized by swing ratio (long-to-short time interval ratio). Each group's swing ratio decreases with increasing tempo, again suggesting motor limits on timing manipulations in faster sequences. However, the occurrence of such distinct groups with different swing strengths is unlikely to result from constraints, but might reflect aesthetic preference for distinct rhythmic patterns instead.

D142

PLACEBO AND NOCEBO EFFECTS: A TMS STUDY ON THE CONGRUENCY BETWEEN CONDITIONING AND VERBAL SUGGESTION

Nicole Corsi[1,2], Michele Tinazzi[1], Mehran Emadi-Andani[1,3], Mirta Fiorio[1]; [1]University of Verona - Italy, [2]University of Maryland Baltimore - USA, [3]University of Isfahan - Iran — Placebo and Nocebo refer respectively to a positive or a negative outcome induced by expectation about the effect of a treatment, actually inert. These effects can be induced by conditioning processes and verbal suggestion, that typically match (i.e., both positive or both negative). Until now, no study has examined what happens when these two variables do not go hand by hand. Our study included 50 participants tested in a motor task and assigned to four groups: two with congruent conditioning and verbal suggestion (both positive or negative) and two with incongruent ones (one positive and one negative). The protocol consisted of three sessions and after the second and third sessions an inert treatment was applied with verbal suggestion of improvement or worsening. During the conditioning procedure a visual feedback (surreptitiously manipulated) indicated the force level: in two groups the feedback manipulation was congruent with the verbal suggestion; while in other two groups it was incongruent. Results showed a strong decrease of force in the groups with negative verbal suggestion, independently of the conditioning. These groups also showed a lower perception of force and a higher sense of effort at the end of the procedure compared to the beginning. During the procedure, TMS was applied over the primary motor cortex to investigate the excitability of the corticospinal system. Results showed a general shortening of the cortical silent period in all the groups. These findings hint at a more prominent role of verbal suggestion compared to conditioning, especially during a nocebo procedure.

D143

PHASE LOCKING AS A NEUROPHYSIOLOGICAL MARKER OF MOVEMENT EXECUTION IN YOUNG AND ELDERLY SUBJECTS

Silvia Daun-Gruhn[1,2], Nils Rosjat[1,2], Svitlana Popovych[1,2], Liqing Liu[1,2], Azamat Yeldesbay[1,2], Bin Wang[2], Rouhollah Abdollahi[2], Shivakumar Viswanathan[2,3], Christian Grefkes[2,3], Gereon Fink[2,3]; [1]Heisenberg Research Group of Computational Biology, Department of Animal Physiology, Institute of Zoology, University of Cologne, Germany, [2]Cognitive Neuroscience, Institute of Neuroscience and Medicine (INM-3), Research Centre Jülich, Germany, [3]Department of Neurology, University of Cologne, Germany — Motor actions are generated by complex interactions of various brain regions. The same brain regions can build various functional networks depending on the action. Identifying the neural signals that encode an action's component (selection, preparation, execution) remains a difficult task. In the current study, EEG data were recorded continuously from 18 young (22-35 years) and 15 elderly (60-71 years) right-handed healthy subjects as they performed a simple motor task. The task required participants to execute a left or right index finger tapping triggered by a visual cue or by an uncued voluntary choice. We found that voluntary and visually triggered movements exhibit significant phase locking in the delta-theta frequency band (2-7 Hz) around movement onset both in young and old subjects. However, significant differences in movement and processing time between the two groups of subjects were observed as well. Moreover, there was a negative correlation between the movement time and the maximal value of the phase-locking index (PLI) in young subjects. This indicates that the aforementioned changes in behavioral performance result from a decrease of PLI in the respective motor regions. In summary, we suggest that this enhanced intra-regional synchrony, which seems to be impaired in the elderly, helps the simultaneously active pathways of distinct cortical networks that initiate voluntary and stimulus-triggered movements, converge to a common motor output and activate the appropriate muscles to perform the movement. This mechanism may thus be regarded as a prototype for organizing more complex motor activities.

D144

THE PRIMARY MOTOR CORTEX CONTRIBUTES TO MOTOR IMAGERY DURING MENTAL ROTATION OF HANDS: EVIDENCE FROM TRANSCRANIAL MAGNETIC STIMULATION.

Christian Hyde[1], Ian Fuelscher[1], Jarrad Lum[1], Peter Enticott[1]; [1]Cognitive Neuroscience Unit, School of Psychology, Deakin University — A strong body of evidence suggests that mental simulation of movement (viz motor imagery- MI) activates similar neural networks to actual movement. Presently, however, evidence on the contribution of the primary motor cortex to MI remains equivocal. We sought to clarify debate using single-pulse transcranial magnetic stimulation (TMS) to the left primary motor cortex of neurotypical young adults (18 to 35 years) during a novel yet highly controlled hand rotation task. Participants made laterality decisions about single hand stimuli presented at varying angular rotations. A TMS pulse was delivered to the left primary motor cortex during each trial (with varying latencies), and motor evoked potentials (MEP) were recorded from the right first dorsal interosseus (FDI). In order to maintain the reliability of performance measurements associated with manual responses yet control for associated motor effects, participants responded visually via saccades to fixation points either side of the stimulus, recorded using near infra-red eye -tracking. Consistent with the use of MI strategy, response time data suggested the influence of biomechanical constraints of real movement on hand rotation performance as indicated by slower response times for hands requiring lateral compared to medial rotation. Importantly, MEP amplitudes were significantly larger for biomechanically more difficult rotations (lateral) compared to easier rotations (medial) following TMS at 50ms and 400ms post stimulus presentation; no differences were observed with stimulation at 650ms latency. These results are consistent with the view that the left primary motor cortex contributes to MI performance and that MI complexity may moderate activation levels.

D145

INCREASED CORTICOSPINAL ACTIVATION DURING IMPLICIT MOTOR IMAGERY IS ASSOCIATED WITH IMPROVED MOTOR IMAGERY ABILITY

Ian Fuelscher[1], Christian Hyde[1], Jarrad Lum[1], Peter G. Enticott[1]; [1]Deakin University — Recent evidence suggests that increased corticospinal excitability during motor imagery (MI) may be associated with improved MI ability. However, no study to date has tested this assumption empirically by investigating the association between corticospinal excitability and implicit MI ability using concurrent metrics from the same task. This was the aim of the present study. Participants were healthy adults aged 18-35 years. MI ability was inferred from response efficiency on the hand rotation task, an implicit MI paradigm commonly used in developmental and clinical settings. To measure corticospinal excitability during the hand rotation task, single pulse transcranial magnetic stimulation (TMS) was delivered to the left primary motor cortex at latencies of either 50ms, 400ms

or 650ms following stimulus onset. The amplitude of motor evoked potentials (MEP) was recorded from the right first dorsal interosseus muscle as an index of corticospinal excitability. Regression analysis showed that, after controlling for MEP amplitude at baseline, increased MEP amplitudes during the hand rotation task were associated with improved MI performance when TMS was delivered either 50ms or 400ms following stimulus presentation. This is the first study to provide critical empirical evidence in support of the view that individual differences in corticospinal activation may underlie implicit MI ability. Implications of these findings for the involvement of the motor cortex during implicit MI are discussed.

D146

MODULATION OF SENSORY-MOTOR CORTICAL NETWORK USING TRANSCRANIAL DIRECT CURRENT STIMULATION

Pejman Sehatpour[1,2], Devin Adair[1,2,3], Stephanie Rohrig[1,2], Joanna DiCostanzo[1,2], Daniel Javitt[1,2,3]; [1]Columbia University, [2]Nathan Kline Institute, [3]The City College of New York of CUNY — Background: Transcranial direct current stimulation (tDCS) is a technique for modulating local brain function by applying constant low (<2 mA) direct currents to corresponding regions of the scalp. It is noninvasive and can be repeated over time within the same subject, therefore representing a practical new neurocognitive investigation and treatment tool. Our goal was to characterize the effects of tDCS on modulating the activity in a critical cortical network engaged during a motor sequence task (MST). Methods: Participants performed the MST (pressing four color-coded keys according to a prompted sequence) under four tDCS conditions: anodal, cathodal, sham and visual. Simultaneous EEG recordings were acquired over all four sessions administered on different days. We employed a combination of tDCS, behavioral measures, EEG and fMRI data. Analyses of variance were performed to assess the modulations in task-relevant EEG and fMRI signals. Results: Time-frequency decomposition of the EEG data revealed statistically significant effects of stimulation on task-relevant frequency bands within specific cortical nodes verified independently by fMRI. Conclusions: The present results indicate that tDCS brings about statistically significant modulations of the sensory-motor network involved in performance of MST. Characterization of spatio-temporal effects of tDCS on task-dependent cortical network activity greatly contributes to our understanding of neurocognitive mechanisms.

D147

TIME COURSE CEREBELLAR ACTIVITY TRACKS SACCADE ADAPTATION BEHAVIOR

Jason Fuller[1], Alain Guillaume[1], Clay Curtis[1]; [1]New York University — Sensorimotor adaptation is a learning process that serves to continuously calibrate movements to evolving environmental conditions. When the world around us and/or our effectors change states (e.g., fatigue), we tend to produce larger than usual motor errors. These errors gradually reduce over time as adaptation mechanisms learn to recalibrate our movements to the new conditions. Recent animal neurophysiological studies suggest that the cerebellum plays a critical role in sensorimotor adaptation by generating an exafferent teaching signal which varies with the size of motor errors over time. Analogous evidence of a similar process in the human brain is lacking. To address this, we investigated if cerebellar activity tracks the time course of adaptation behavior as measured through trial-by-trial changes in movement error. We performed an fMRI study of saccade adaptation in which we experimentally induced a discrepancy between predicted and actual sensory feedback by consistently perturbing a saccade target during mid-movement. Subjects initially made large errors to the perturbed target but then adapted their saccades over the course of 50-100 trials, reducing errors close to pre-perturbation magnitudes. Trial-by-trial estimates of BOLD activity in the cerebellum correlated with adaptive learning, reducing in amplitude as saccade errors decreased. This finding is consistent with the notion that the cerebellum contributes to sensorimotor adaptation by computing an exafferent teaching signal capable of adapting the motor system to ensure future movements remain in registry with new environmental conditions.

D148

IMITATIVE CONTROL OF ADOLESCENTS WITH DELINQUENT BEHAVIOR

Chia-Chi Chow[1], Pasco Fearon[1], James Sheffield[1], Peter Fonagy[1]; [1]University College London — Introduction: Previous research has suggested the functional-anatomical overlap between the capacity of imitation inhibition and empathy. Recently, two ERP components, temporal-parietal 450 (TP450) and the late frontal slow wave (LFSW) are indicated to reflect the shared neural processes and time course during imitative control and empathy. Numerous studies have linked the lack of empathy with delinquent actions toward others. However, little work has investigated the shared neural process of empathy and imitative control in adolescents with delinquent behavior. Method: 19 clinical referred adolescents (8 females, mean age =16.16±1.95) who reported a high occurrence of serious violence (≥ 13) in the past 6 months on the Self-Reported Delinquency Scale were recruited as participants. We used the imitation inhibition task and measured simultaneous high-density EEG. The interpersonal reactivity index was also given to measure their empathy. Results: Repeated measure ANOVA indicated that participants showed more activation at right temporal-parietal lobe for TP450 than at the left hemisphere. No main effect of congruency or interaction effect was found. Regarding the LFSW, there was a main effect of congruency. The mean amplitude of LFSW was larger in congruent condition than in incongruent condition. No site or interaction effect was found. Correlational analysis demonstrated that cognitive perspective ability was negatively correlated with mean amplitude of TP450 in the incongruent condition. Conclusion: Adolescents who were involved with severe violence showed a different pattern of neural process during imitative control. The implication will be discussed.

PERCEPTION & ACTION: Vision

D149

EMOTIONAL PERCEPTUAL TRAINING AS A TREATMENT FOR SOCIAL ANXIETY: BEHAVIORAL AND MEG EVIDENCE

Lucas Novak[1], Yuqi You[1], Colin Humphries[2], Wen Li[1]; [1]Florida State University, [2]Medical College of Wisconsin — A characteristic of social anxiety is hypersensitivity to social threat information, such that mildly negative or neutral facial expressions may be perceived as threatening and cause distress. Current psychotherapy for social anxiety focuses on modifying prefrontal processing of these cues via cognitive reappraisal or extinction learning; however, the possibility of revising sensory encoding of facial emotion, thereby reducing perceptual biases and ameliorating symptoms, has not been thoroughly explored. Therefore, we implemented an emotional perceptual training protocol where participants were trained to categorize faces with anger intensity 15% and 5% above or below detection threshold as angry or neutral faces, respectively. Reflecting improved distinction between meaningful and insignificant anger, performance on an anger-detection task (involving another set of face morphs) demonstrated reduced anger detection at low anger intensities and increased detection at high intensities (p's<.01). Importantly, two weeks after the training, social anxiety decreased among these participants [T(18)=4.19, p=.001] while remaining unchanged among a control group who performed gender judgments only (p=.98). A magnetoencephalogram (MEG) study on an independent group undergoing a similar training protocol replicated training-induced discrimination between meaningful and insignificant anger [T(16)=12.1, p<.001]. In parallel, we observed enhanced discrimination of faces with supra- and sub-threshold anger intensities in fusiform face area at ~122ms poststimulus (Z=2.65, p<.05 SVC) and anterior fusiform at ~178ms (Z=2.69, p<.005). In sum, our findings accentuate an emotional perceptual training protocol that expands the boundary between threat and safety signals by altering visual cortical encoding of these signals, thereby alleviating social anxiety.

D150

NATIVE READING DIRECTION AND DIFFERENCES IN LATERAL BIASES DURING ARTWORK LIGHTING AND SPATIAL LOCATION TASKS

Austen Smith[1], Kari Duerksen[1], Carl Gutwin[1], Lorin Elias[1]; [1]University of Saskatchewan — Most people demonstrate consistent leftward biases across a variety of visuospatial tasks. However, some research examining right-to-left (RtoL) readers has found an attenuation of the leftward bias. The current study examined both left-to-right (LtoR) and bilingual RtoL readers in two computerized free-viewing spatial tasks. First, in a spatial-location task participants viewed a centred rectangle that had a portion of a circle overlapping it. The rectangle was unchanged while circles varied in size and location between trials, only ever overlapping the rectangle from either the left or right. Participants were instructed to estimate the centre of the circle

with a single mouse click. Analysis of lateral and vertical errors between true and perceived centre revealed no significant differences between LtoR and RtoL readers. Both groups demonstrated greater errors in lateral dimensions than in vertical and when lateral errors were divided between left and right significantly smaller errors were made for circles on the left. For the second task, participants were presented with 20 images of abstract paintings, in both their original orientation and flipped upside down, and given a 'virtual flashlight' with the instructions to light the painting in a way that is most aesthetically pleasing. Whereas LtoR readers made significantly more leftward final light placements, RtoL readers made nearly equal placements. Additionally, LtoR participants' average light placement was significantly in the upper left quadrant. RtoL participants displayed no significant lateral or vertical final light placement biases. These results suggest leftward biases endure across spatial location but not aesthetic preference tasks.

D151

CATEGORY BOUNDARIES AND TYPICALITY WARP THE NEURAL REPRESENTATION SPACE OF REAL-WORLD OBJECT CATEGORIES

Marius Cătălin Iordan[1], Michelle R. Greene[1], Diane M. Beck[2], Li Fei-Fei[1]; [1]Stanford University, [2]University of Illinois at Urbana-Champaign — Categories create cognitively useful generalizations by leveraging the correlational structure of the world. Although previous work has shown that object categories possess both hierarchical structure (entry-level effects, Rosch et al., 1976) and typicality structure (Rosch, 1973), little is known about the neural underpinnings of these processes. In this study, we leverage representational similarity analysis to understand how cognitively useful category structure emerges in the human visual system. We performed a functional neuroimaging (fMRI) experiment in which participants were shown photographs of 15 subordinate-level categories from each of two basic-level categories (dogs and cars). Typicality for each subordinate within its basic category was also assessed behaviorally. We computed the neural correlation distance between all pairs of subordinates in early visual areas (V1, V2, V3v, hV4) and object-selective cortex (LOC). We found that as we move from low-level visual areas to object-selective regions, neural distances are compressed within categories and simultaneously expanded between categories. This effect arises gradually as we move up the ventral visual stream, with a marked increase between hV4 and LOC. Furthermore, within each basic category in LOC, typicality influences the organization of the neural distance space: highly typical items are brought closer together, while distance between atypical exemplars grows. Taken together, our results suggest that as we move up the ventral visual stream, distances between neural representations of real-world objects warp to facilitate categorical distinctions. Moreover, the nature of this warping may provide evidence for a prototype-based representation that clusters highly typical subordinates together in object-selective cortex.

D152

CHANGES IN EVENT-RELATED POTENTIALS INDUCED BY CATEGORY LEARNING

Fernanda Perez Gay Juarez[1,2,3], Daniel Rivas[3], Hisham Sabri[3], Nicolas Botero[4], Madeline Gregory[4], Riona Morgan[4], Stevan Harnad[1,2,3]; [1]Integrated Program in Neuroscience, McGill University, [2]Center for Research in Brain, Language and Music, [3]NeuroUQAM, Université du Québec à Montréal, [4]Psychology and Cognitive Science departments, McGill University — We study Categorical Perception (CP), a phenomenon in which our categories influence our perception, making members of the same category look more alike (compression) and members of different categories look more different (separation). Inborn CP effects (colors, phonemes) are well documented but because most of our categories are learned rather than inborn, acquired CP effects are of particular interest. To test for CP effects induced by learnings, we trained subjects by trial and error with corrective feedback to sort samples of unfamiliar stimuli into two categories. Before training they rated sample pairs of stimuli for similarity. Some were in the same category some in different categories, but the subjects had not yet learned the categories. Some succeeded in learning, some did not. After training, they again rated the sample pairs for similarity. We recorded EEG during the training. There were 4 levels of difficulty, 20 subjects per level. We compared early and late Event Related Potential (ERP) in successful learners and non-learners and their relation to their similarity ratings. The learners had significant differences in their late (450-600 ms) and early (160-200 ms) components, comparing the trials after learning to the trials before learning. These effects were absent in non-learners, comparing the first and second half of their training trials. The results provide evidence for the emergence of CP effects after learning a new category and thus support the existence of CP induced by learning.

D153

AN EFFECT OF PRIOR ON SUBJECTIVE VISIBILITY JUDGMENTS

Jean-Rémi King[1], Gabriela Meade[2], Stanislas Dehaene[3]; [1]New York University, USA, [2]San Diego State University & University of California, San Diego, USA, [3]College de France, France — A growing body of evidence suggests that human perceptual decision-making follows Bayesian principles. Indeed, subjects appear to combine i) the likelihood and ii) the prior of incoming sensory evidence to iii) generate their perceptual report posterior. However, the neural mechanisms underlying these three computational elements remain poorly understood. In the present study, we investigated each of these elements in a classic backward masking protocol using behavioral measures, computational modeling and a combination of electro- and magneto-encephalography (M/EEG). We parametrically manipulated i) the likelihood of the stimuli by varying the target-mask stimulus onset asynchrony (SOA) and ii) the prior of the stimuli by varying the visibility of the preceding trials, and iii) inferred subjects' posteriors by using a continuous visibility rating task. Behavioral results suggested that subjects' visibility responses varied as a function of both target likelihood and the visibility prior established by the preceding trials. MEG analyses further revealed that these effects of target likelihood and visibility prior were correlated with multiple processing stages of the stimulus. The effect of visibility of the preceding trial was observed as early as 150 ms and was strongest around 200-300 ms after target onset, importantly suggesting that priors can directly impact low-level sensory processes. Paralleling the behavioral visibility ratings, these effects of prior were strongest when likelihood was low (i.e., for shorter SOAs). By disentangling the dynamics of distinct computational elements of perceptual decisions, this study paves the way to understanding the canonical algorithm of perceptual inferences.

D154

TMS TO PRIMARY OCCIPITAL CORTEX DECREASES FEATURE-SPECIFIC NEURAL ACTIVITY FOR ORIENTATION TUNING

Annelinde Vandenbroucke[1], Dobromir Rahnev[2], Mark D'Esposito[1]; [1]University of California, Berkeley, California, [2]Georgia Institute of Technology, Atlanta, Georgia — Transcranial Magnetic Stimulation (TMS) is widely used as a tool to 'virtually lesion' a specific brain area. However, this interpretation is challenged by studies that found that even in simple visual acuity experiments, TMS to occipital cortex can both positively (Thompson et al., 2008; Waterston & Pack, 2010) and negatively (Antal et al., 2002; Kosslyn et al., 1999) affect behavior. It has been proposed that TMS either decreases signal strength (Harris et al., 2008; Rahnev et al., 2013) or adds neural noise to the system (Ruzzoli et al., 2010; Schwarzkopf et al., 2011). Here we set to examine the neural mechanism through which TMS affects visual stimulus processing. We used functional Magnetic Resonance Imaging (fMRI) to investigate the effect of continuous Theta Burst Stimulation (cTBS) on the tuning curves in primary occipital cortex. Participants participated in two sessions during which cTBS was delivered to V1 and a control site (vertex) in a counterbalanced order. Before and after cTBS application, participants performed a simple orientation discrimination task on oriented Gabor gratings during fMRI scanning. We found that – compared to control cTBS – occipital cTBS led to a decrease in orientation decoding in V1, and this effect diminished in extrastriate cortex. Decreased orientation decoding was associated with a decrease in tuning curve amplitude, whereas there was no overall loss in neural signal. These findings suggest that cTBS affects feature-specific neural activity, such that neural activity becomes less specifically tuned to a preferred orientation.

D155

BOUNDARY ENHANCEMENT EFFECTS IN FMR ADAPTATION: WARPING OF REPRESENTATIONAL SPACE OR HEIGHTENED ATTENTION?

Dmitrii Paniukov[1], Darrell Worthy[2], Tyler Davis[1]; [1]Texas Tech University, [2]Texas A&M University — Category learning results in increased

discriminability along stimulus dimensions that are relevant for distinguishing between categories. Such heightened discriminability is thought to reflect a stretching of category representations along relevant dimensions. FMR adaptation is a measure of neural representation thought to be sensitive to representational stretching and is based on the observation that BOLD signal adapts (decreases) for sequentially presented stimuli as a function of their similarity. Consistent with representational stretching theories, studies using FMR adaptation have found that sequentially presented items that cross a previously learned boundary between categories elicit reduced adaptation compared to equally spaced items along an irrelevant dimension. However, these results are not sufficient to establish a true stretching effect because item pairs that cross a boundary are also associated with heightened attention due to previously being associated with different behavioral responses. To compare accounts, we used a continuous carry-over design in which we could test for representational stretching of the distances between items that cross a category boundary while adjusting for the salience of different category labels. Consistent with previous findings, sequentially presented items from different categories exhibited a greater release from adaptation. However, when the categorical effect was controlled, activation in ventral visual stream was negatively correlated with distance between stimuli: the closer two stimuli in different categories were, the greater the release from adaptation. These results suggest release from adaptation for sequences of items crossing a boundary may be due to attentional salience and not representational stretching.

D156

EARLY VISUAL CORTEX RESPONSES TO VIOLATIONS OF EMOTION-LOCATION ASSOCIATIONS

Karsten Rauss[1], Laura Herde[1], Valentina Rossi[2], Gilles Pourtois[2]; [1]University of Tuebingen, Germany, [2]Ghent University, Belgium — Over the last years, evidence has accumulated for an active involvement of low-level sensory processing in higher cognitive functions. Some of the modulations of early visual processing in particular suggest that retinotopic visual cortex may be implementing active predictions of upcoming stimuli. In the present study, our aim was to test this idea at the earliest stages of visual processing that can be reliably detected using non-invasive recordings in humans. Healthy participants learned to associate centrally presented images of human faces expressing different emotions with peripherally presented line-elements known to produce strong responses in retinotopically organized brain areas. Different emotions predicted upcoming stimuli in either the upper or the lower visual field on frequent standard trials. On infrequent test trials, emotional faces were followed by combined stimulation of upper and lower visual fields. Subtracting ERPs elicited by standard trials from those elicited in test trials allowed us to compare visual cortex responses to the same physical stimulus elements under expected vs. unexpected conditions. We hypothesized increased early visual cortex responses elicited by unexpected stimuli compared to responses to expected ones, reflecting the mismatch between expectation and perception. Our results show no such difference between expected and unexpected stimuli at the level of the retinotopic C1 component. These findings indicate that the violation of emotion-location association is not detected at the level of early visual cortex. However, exploratory comparisons between initial and later phases of the experiment suggest an asymmetric adaptation of prediction-error signals, at least in the upper visual field.

THINKING: Decision making

D158

A FUNCTIONAL NETWORK UNDERLYING THE CONSTRUCTION OF SUBJECTIVE CONFIDENCE IN THE BAYESIAN BRAIN

Maxine Sherman[1,2], Anil Seth[1,3], Ryota Kanai[1,4]; [1]Sackler Centre for Consciousness Science, University of Sussex, UK, [2]School of Psychology, University of Sussex, UK, [3]Department of Informatics, University of Sussex, UK, [4]Department of Neuroinformatics, Araya Brain Imaging, Japan — When making visual perceptual decisions, conscious visual experience is typically accompanied by a sense of confidence. How subjective perceptual confidence arises at the neural level remains unclear. 'Predictive processing' accounts propose that perceptual content arises from inferring the causes of sensory signals, given prior expectations. Confidence corresponds to the posterior probability of the inferred sensory cause, itself a function of top-down prior beliefs and bottom-up prediction errors. Here we tested whether confidence can be functionally explained according to these principles. Participants performed a psychophysical perceptual detection task under fMRI in which prior predictions and attention were orthogonally manipulated and confidence ratings collected. We found that high prediction error in right VLPFC related to low subjective perceptual confidence. Additionally, the more prediction error discriminated between degrees of subjective confidence, the greater the V1 to right VLPFC effective connectivity and the less the right OFC to right VLPFC effective connectivity. Individual differences in the relative perceptual contributions of these components were reflected in individual differences in occipital lobe and OFC white matter density. In summary, results support the notion that subjective confidence, constructed in right VLPFC, is a combination of sensory prediction errors, originating in V1, and expected task performance, represented in OFC. The balance of top-down and bottom-up influences is instantiated in brain structure. Our results therefore reveal a functional brain network underlying the construction of subjective confidence during visual perceptual decision. These findings extend predictive accounts of perception to account for subjective aspects of perception and their neural underpinnings.

D159

NEURAL DYNAMICS OF CONTROLLED AND AUTOMATIC MEMORY ACTIVATION DURING MEMORY-BASED DECISION-MAKING

Patrick Khader[1], Thorsten Pachur[1], Lilian Weber[2], Kerstin Jost[3]; [1]Max Planck Institute for Human Development, Berlin, Germany, [2]University of Zurich and ETH Zurich, Switzerland, [3]University of the Federal Armed Forces, Hamburg, Germany — When making decisions based on information stored in memory, people often make use of strategies such as "take-the-best" (TTB), which processes attribute information sequentially and stops search as soon as a given attribute allows making a decision. In a functional neuroimaging study, we delineated the neural signatures of two fundamental aspects of memory retrieval during decision-making with TTB: (1) automatic activation of all attributes that had been associated with a decision option, and (2) controlled retrieval of individual task-relevant attributes. Participants decided, based on previously learned attribute information, which of two companies would be more successful. To disentangle the relative contributions of automatic and controlled retrieval processes, we manipulated the number of attributes associated with each object (one, two, or three) and the number of attributes that had to be retrieved according to TTB, respectively. The results showed that the retrieval of knowledge—whether automatic or controlled—affected decision performance and activated attribute-specific posterior brain areas. Moreover, the two facets of memory retrieval were associated with distinct activation patterns within the fronto-parietal network of memory control. Specifically, the dorsolateral prefrontal cortex reflected increasing retrieval effort during both automatic and controlled activation of attributes. In contrast, the superior parietal cortex only responded to controlled retrieval, arguably reflecting the sequential updating of attribute information in working memory. These findings demonstrate the usefulness of combining memory and decision-making research with neural measures to construct models of the retrieval dynamics involved in memory-based decision-making.

D160

DECISIONS ABOUT WHEN: TRADING OFF INFORMATION AGAINST REWARDS IN TIME IN A VISUO-MOTOR DECISION TASK

Poa-Kai Feng[1], Shih-Wei Wu[1,2]; [1]Institute of Neuroscience, National Yang-Ming University, Taipei, Taiwan, [2]Brain Research Center, National Yang-Ming University, Taipei, Taiwan — Information often comes at a cost: while more information is more desirable under a variety of situations, it takes time to collect information. How do humans trade off the benefit of time as a result of information gain against the cost of time? In a visuo-motor task, subjects had to point to a hidden target presented on a touch screen for a chance to receive monetary reward. Noisy visual information about target location was presented in the form of dots sampled from a bivariate Gaussian distribution around the target center. Critically, the number of dots presented increased as a function of time so that the longer the subjects waited, the larger the sample size and hence the higher the probability of hitting the hidden target. However, upon dots presentation, the amount of reward for a hit started to decrease, effectively acting as time cost. We found that subjects (n=16) traded off the

probability of hitting the target against the rewards for hitting it by changing their response time. However, compared with an ideal decision maker who optimally trades off information against time, subjects were optimal when the rewards decreased at slower rates, but were slower than optimal under faster decrease rates. This pattern was robust across trials where the amount of potential reward at the start differed. Together, our results indicated that while humans clearly recognize and attempt to trade off information against time, the efficiency of such tradeoff critically depends on the dynamics of cost structure in the environment.

D161

EVENT-RELATED POTENTIAL (ERP) SALIENCE AND VALUE REPRESENTATION OF PRIMARY REINFORCERS

Emily Hird[1], Deborah Talmi[1], Wael El-Deredy[1]; [1]University of Manchester — To learn, prediction error - the difference between expected and actual outcome - is signalled by midbrain dopamine neurons. Most human studies investigate reward prediction error, operationalised as the difference between unexpected omission and delivery of reward. We investigated neural response to reward prediction error and aversion prediction error, operationalised as the difference between unexpected omission and delivery of an aversive outcome. While most human studies use monetary reward, here we used primary reinforcers to bridge the animal and human literatures. Twenty participants received sweet and bitter tastes, signalled by a cue. Cues indicated likelihood of receiving a particular taste. We measured event-related potentials (ERPs) to information about upcoming unexpected rewarding and aversive taste. 290ms after participants received information on the upcoming taste ERPs were more positive to unexpected delivery compared to omission of both reward and aversion. This suggests within the time window that corresponds to the Feedback-Related Negativity (FRN) ERP neurons signal any unexpected salient event, regardless of whether it is rewarding or aversive. This is surprising as the established assumption is that the FRN signals valence to reinforce rewarding behaviour. At 350ms the P3 differentiated outcome valence, responding positively to any worse-than-expected outcome (omission of sweet and delivery of bitter taste). This suggests an attentional response to worse-than-expected outcomes due to loss aversion. These results challenge current perspectives on mechanisms of reinforcement learning. We show that the neural signalling of salience (outcome delivery) is followed by attention to outcome valence across the domains of reward and aversion.

D162

EXPECTATIONS ABOUT THE SOURCE OF SURPRISE DICTATE THE RELATIONSHIP BETWEEN FEEDBACK-RELATED EEG SIGNALS AND LEARNING.

Matthew Nassar[1], Rasmus Bruckner[2], Michael J. Frank; [1]Department of Cognitive, Linguistic, and Psychological Sciences, Brown University, Providence, RI, USA, [2]International Max Planck Research School LIFE, Max Planck Institute for Human Development, Berlin, Germany — Successful decision-making requires learning expectations based on experience. This learning should be calibrated according to the surprise associated with each outcome, but also to the most likely source of surprise. For example, when occasional change points are expected, surprising outcomes render past information irrelevant and demand increased learning. In contrast, when signal corruption is expected to occur occasionally, surprising outcomes can suggest a corrupt signal that should be ignored by learning systems. To explore whether and how the brain contextualizes surprise signals to optimize learning, we collected EEG and behavioral data in a task that required subjects to make inferences based on noisy observations of a process that included either change points or signal corruption. In change point blocks participants increased learning from surprising outcomes, whereas in the signal corruption blocks participants decreased learning from surprising outcomes. Thus the effects of surprise on learning depended on subjective expectations about the source of the surprise. Despite this behavioral interaction, feedback-related EEG signals were agnostic to the source of surprise. A large positive medial prefrontal deflection peaking 350 ms after outcome presentation was enhanced for surprising outcomes in both conditions equally. Computational fits to behavior showed that the impact of this signal on learning differed across conditions: larger EEG deflections predicted more learning in change point blocks but less learning in signal corruption blocks. Taken together these findings suggest that medial prefrontal surprise signals do not naively reflect increased behavioral updating, but may be used adaptively to modulate learning in either direction.

D163

A HIERARCHICAL REINFORCEMENT LEARNING / DRIFT-DIFFUSION MODEL REVEALS KEY FEATURES OF HABITUAL DECISION MAKING

Vincent Moens[1], Alexandre Zenon[1]; [1]Universite Catholique de Louvain — Computational models of habitual and goal-directed behaviors – respectively model-free and model-based reinforcement learning algorithms – are commonly used to fit choice data but are usually oblivious to the time needed to reach a decision. Here, we introduce a Model-Free Hierarchical Reinforcement Learning (HRL) algorithm based on drift-diffusion models (DDM) to account for both accuracy and reaction time data in behavior. We developed a novel task aimed at generating and testing the presence of habitual behavior through formation of action sequences and in which the time pressure changed over time. In this 2-step task, participants reported the side of a cued stimulus on the screen by a mouse click with the corresponding hand (left or right). In the first step, the cued stimulus was presented amongst 4 items while, at the second step, only the 2 items which were selected at the first step were shown. The side of cued stimulus presentation in each step varied with a certain predictability. We found that participants learned this contingency and used it to concatenate single actions into action sequences. We compared our new DDM-HRL algorithm to a more standard HRL algorithm based on the Softmax function. We tested also how parameters of the DDM model were affected by learning and variation in time pressure. We show that the DDM-HRL model accounts better for key features of the task, and provides evidence for larger bias and lower sensitivity to time pressure for the habitual than for the goal-directed behavior.

D164

A DISTINCT OSCILLATORY MECHANISM FOR METACOGNITION DURING PERCEPTUAL DECISION-MAKING

Martijn E. Wokke[1,2], Axel Cleeremans[1], K. Richard Ridderinkhof[2]; [1]Université Libre de Bruxelles, [2]University of Amsterdam — Decision-making is one of the most fundamental parts of our daily life. Undoubtedly, when having to select a course of action reflective monitoring and control of our decision process (metacognition) is of crucial importance. For instance, when a doctor has to make a medical decision, information from different sources are being accrued and combined to form a diagnosis (e.g., information from MRI images and from the anamnesis), but when a doctor is uncertain about the quality of the decision additional tests can be considered. Despite the importance of metacognition for effective decision-making, it remains unclear how metacognitive knowledge emerges. Here I will address how metacognition develops during decision-making and how it relates to first order performance (task accuracy). We recorded EEG signals while participants were asked to make a diagnosis after seeing a sample (a complex visual pattern) of fictive patient data. This sample could either belong to a sick or to a healthy patient. Participants gradually learned to distinguish sick from healthy patterns, while indicating on each occasion how they made their decision (i.e., guessing, intuitive or rational choice and indicating their level of confidence). Single-trial EEG analyses demonstrate that although task accuracy is related to occipital-parietal beta band activity, metacognition is specifically associated with late emerging (anterior) frontal theta band activity. These findings indicate that first order task performance and metacognition operate via distinguishable oscillatory mechanisms.

D165

ASYMMETRY IN ATTENTION AND MEMORY WHILE LEARNING IN GAIN VERSUS LOSS DOMAINS

Kylie Fernandez[1], Melissa Merz[1], James Ross[1], Camelia Kuhnen[2], Nichole Lighthall[1]; [1]University of Central Florida, [2]University of North Carolina at Chapel Hill — Consistent with well-known asymmetries in economic behavior in the gain versus loss domain (Kahneman & Tversky, 1979), recent research indicates people are more pessimistic about the likelihood of relatively good probabilistic outcomes when losing versus gaining money (Kuhnen, 2015). The mechanism of this valence effect is unclear, but may be related to differences in the salience of positive and negative information or the difficulty in evaluating smaller losses as rela-

tively positive outcomes. To test these hypotheses, we examined how gain and loss information affect attentional processing speed and incidental encoding during an investment task. In separate gain and loss blocks, participants chose between stocks and bonds to earn cash payouts and learned about the stock payoff probabilities with experience. After observing stock payouts on each trial, participants estimated the likelihood that the current stock was "good" (better option than the bond). Processing speed was assessed during the stock payout phase, and at the end of the session, participants completed a surprise memory test for outcome stimuli. Findings replicated previous research, such that participants were overly pessimistic in their assessment of the quality of stocks when learning in the loss domain than when learning in the gain domain. Further, results indicated slower processing for relatively good loss outcomes (small losses) and poorer memory for stimuli presented with loss outcomes. These findings provide support for both hypotheses, suggesting that loss outcomes capture more attention than gain outcomes, and additional cognitive resources are required to interpret relatively small losses as positive events.

D166

COMMON AND DISTINCT NEURAL REPRESENTATION OF EFFORT AND DELAY COSTS

Vaida Rimeikyte[1], Joshua Buckholtz[2,3], Adam Anderson[1]; [1]Cornell University, [2]Harvard University, [3]Massachusetts General Hospital — The ability to integrate costs and benefits to choose the optimal course of action is an essential component of adaptive human behavior. Temporal delays and effort requirements are two such costs, and there is a wealth of evidence that both serve to bias action selection by discounting the subjective value of choice options. Lesion work in rodents and primates, as well as human functional neuroimaging studies, suggest that delay and effort cost representations are anatomically segregated. By the same token, other work indicates that the cost-discounted subjective value of choice options is represented by striatal activity, irrespective of the specific cost. Here, we use Activation Likelihood Estimation (ALE) meta-analysis to uncover common and distinct neural representations of cost during effort-based decision-making and inter-temporal choice. We identified 14 studies of effort-based decision-making and 17 studies examining inter-temporal choice. Contrast analyses showed that dorsolateral and ventromedial prefrontal cortex preferentially encoded delay costs, while dorsal Anterior Cingulate Cortex activity was selective for effort costs. Conjunction analysis identified dorsal striatum as being sensitive to both cost types, consistent with its putative role in representing cost-discounted values to guide action selection. Together, these findings suggest that while cost representations may be initially segregated according to specific cost type, these representations converge in striatum to modulate the subjective value of choice options and bias action selection.

THINKING: Problem solving

D167

HIGH CREATIVE INDIVIDUALS ARE MORE TOLERANT TO SEMANTIC DISTANCE THAN LOW CREATIVE INDIVIDUALS: AN ERP STUDY

Yoed Kenett[1], David Anaki[2], Miriam Faust[2]; [1]Brown University, USA, [2]Bar-Ilan University, Israel — The associative theory of creativity posits that high creative individuals have a more flexible semantic memory structure that enables novel semantic combinations. However, this theory has been empirically tested in only a few studies. We conducted an Evoked Response Potentials (ERP) study to examine the effect of semantic distance on low and high creative individuals. Both groups underwent a recently developed semantic relatedness judgment task. In this task, semantic distance is operationalized as path length between words in a semantic network. Low and high creative individuals judged whether word-pairs were related or unrelated in six semantic distance conditions (three close/related and three far/unrelated conditions), while their ERPs were being recorded. Specifically, we focused our analysis on the N400 component, the hallmark ERP component for semantic processing. At the behavioral level, we found that both low and high creative individuals are affected similarly by semantic distance. Our findings only weakly indicate that high creative individual's judge weaker/farther semantic relations between words as more related, compared to low creative individuals. However, at the electrophysiological level we found that high creative individuals, compared to low creative individuals, exert less integration efforts, as indicated by less negative N400 amplitudes. Finally, high creative individuals are more tolerant to semantic distance, indicated by less modulation of the N400 amplitude by semantic distance. Our results shed further neurocognitive light on the differences between low and high creative individuals and relate to recent findings on the importance of controlled retrieval from memory in the creative process.

D168

A MULTI-MODAL APPROACH TO DISENTANGLE UNDERLYING MECHANISMS OF THE CLINICAL MEASURE: PROCESSING SPEED

Nicolas Langer[1,2], Erica Ho[1], Enitan Marcelle[1], Lindsay Alexander[1], Cameron Craddock[1], Kenneth Schuster[1], Michael Milham[1], Simon Kelly[2]; [1]Child Mind Institute, New York, USA, [2]Department of Biomedical Engineering, City College New York, New York, USA — Following a recently launched initiative (RDoC) to develop reliable dimensions of observable behavior and neurobiological measures for classification of mental disorders we have constructed a set of new paradigms that provide objective, interpretable psychophysiological phenotypic markers in children. From eighty children between 6 and 18, neurophysiological activity measured with EEG, continuous eye-tracking and behavioral responses were obtained during a processing speed test. From the eye tracking data we calculated the number of saccade steps, pupil size and protracted gaze dwell. This newly established inventory of objective measures was complemented with topographic spatial and power analyses of the concurrently acquired EEG data. The results demonstrated that the performance in the symbol search task was positively correlated with age of the subject. Further we found that higher the inattention score correspond with low (age-corrected) processing speed score. Moreover, we developed an objective eye-tracker based uncertainty measure, operationalized by the time spent for a trial, in which target was present vs. not present in the search group. The uncertainty measure significantly correlated with anxiety measure (CTAS) obtained from questionnaire. The duration of eye fixation on the target symbols explained most of the variance in the processing speed performance. In addition, resting-state EEG revealed a significant relationship between frontal theta power and the performance in processing speed capacity. The present study demonstrates that a multimodal approach that combines observable behavior and neurobiological measures improves the understanding of underlying mechanisms of low performance in the processing speed task.

D169

WHITE MATTER INTEGRITY IN TOWER OF LONDON PERFORMANCE

Adrian Paneto[1], Steven Green, Ph.D.[1], Sharlene Newman, Ph.D.[1]; [1]Indiana University-Bloomington — The Tower of London (ToL) has been used extensively as a measure of high-order cognitive processes; mainly those associated with problem solving and planning (Berg 2002). Not only is neural activation important to cognition, but also structural white matter integrity. For example, white matter integrity has been linked to executive processes such as planning, shifting, and working memory, all of which are related to ToL performance. In this study, we analyzed fractional anisotropy (FA) measured with diffusion tensor imaging (DTI) to characterize the white matter integrity linked to planning time and accuracy in the Tower of London task. The included sample of twenty-five subjects (14 females), completed six and seven-move ToL problems. The de-meaned values for average planning time and percent accuracy were entered as regressors of interest to identify voxels in which FA values were significantly correlated with these behavioral measures across subjects. The results indicated that FA positively ($p<.05$) correlated with planning time in the second superior longitudinal fasciculus (SLF-II) which connects the dorsolateral prefrontal cortex (dlPFC) to parietal areas. Furthermore, for accuracy was negatively correlated with FA in the cerebellum and the parietal lobe which may be due to the dorsal-ventral connections of the vertical occipital fasciculus (VOF)(Yeatman, 2014). The identified white matter tracts that connect frontal and parietal cortical areas have been implicated in problem-solving so using planning time and accuracy as behavioral correlates of FA indicates that white matter integrity supports ToL performance.

D170

HOW SUBLIMINAL REWARD ENHANCES AHA! MOMENTS Carola Salvi[1,2], Irene Cristofori[2,3], Mark Beeman[1], Jordan Grafman[3,4]; [1]Department of Psychology, Northwestern University, Illinois, USA, [2]Rehabilitation Institute of Chicago, Illinois, USA, [3]Department of Physical Medicine and Rehabilitation, Feinberg School of Medicine, Northwestern University, Chicago, Illinois, USA, [4]Department of Neurology, Feinberg School of Medicine, Northwestern University, Chicago, Illinois, USA — Insight problem solving involves processing below the threshold of awareness, perhaps supported by the integration of weak associations. Recent research suggests that explicit reward cues, in the absence of awareness, can enhance people's reasoning and associative learning. However, the effect of subliminal motivation on problem-solving strategies has not been explored yet. We hypothesized that subliminal reward would enhance the integration of weak associations and insight more than it would enhance analytic solving. Forty-one participants attempted one hundred Compound Remote Associate (CRA) problems. This task has been extensively used to study insight problem-solving (or "Aha!" moment) in contrast to a deliberate, analytic strategy. At the beginning of each problem, a potential reward ($ 0.01 or $ 0.25) was displayed, either subliminally (17 ms) or supraliminally (100 ms), and participants earned the displayed reward if they solved the problem correctly. Forced-choice responses to display indicated participants were at chance for subliminal displays. Participants solved more problems via insight following high subliminal rewards, compared to low subliminal reward and to high supraliminal reward, with no corresponding effect on analytic solving. Our findings reveal that insight problem solving can be motivated by subliminal reward. We speculate that significant subliminal rewards activate the dopamine system, enhancing and reinforcing integrative processes leading to greater insight, primarily when presented below the threshold of awareness. On the other hand, rewards presented above the threshold of awareness have little effect on insight.

D171

BLOCKS ROCK! THE EFFECT OF BLOCK BUILDING ON MENTAL ROTATION Mitchell Hansen[1], Arianna Gutierrez[1], Sharlene D. Newman[1]; [1]Indiana University, Bloomington — There is a growing issue of STEM (science, technology, engineering, and math) in the United States. Performance wise, US students have fallen behind and are not choosing majors or careers in growing STEM fields. Solutions need to be found to reverse this troubling trend that gets young Americans to choose STEM fields. Spatial thinking can play an important role in mathematical and problem solving abilities. Students with high scores on spatial tests in high school are more likely to major in STEM disciplines and go into STEM careers than those with lower scores (Newcombe, 2010). Additionally, spatial thinking can be improved through training and is durable (Newcombe, 2010). Block building uses key aspects of spatial thinking, such as spatial visualization and mental rotation (Casey et al, 2008). The fundamental question is whether implementing a training program that focuses on block building can increase spatial thinking skills in children. We performed a pre-training and one post-training fMRI scan to examine spatial thinking via a mental rotation task. The experimental group played a block building game, Blocks Rock!, while the control group played Scrabble for 5 days. The experimental group showed increased activation in left precentral cortex and medial temporal cortex extending into the parahippocampus while the control group showed increased activation in the left anterior insula after training indicating that differential strategies were used. The results suggest that the block building game encouraged the use of a holistic rotation strategy while the controls used a more piecemeal comparison strategy.

THINKING: Reasoning

D172

FUNCTIONAL NETWORKS OF COUNTING ACQUISITION IN PRESCHOOL CHILDREN Alyssa Kersey[1], Jessica Cantlon[1]; [1]University of Rochester — Between 2 and 5 years of age, children undergo a change in numerical reasoning that allows them to map symbols (e.g, number words) onto their precise quantitative meanings. To date the only neural data examining this learning process comes from single-cell recordings in monkeys who were trained to recognize Arabic numerals. These studies with monkeys and some research in older children who had already learned to count suggest that connectivity between the intraparietal sulci (IPS) and inferior frontal cortex is important for symbolic number acquisition, but weakens after numerical representations solidify. However, no one has tested the predictions of this functional connectivity pruning model in children who are in the process of learning to count (ages 3-5 years). Here we examine functional connectivity in preschooler's brains during natural viewing of early childhood mathematics videos, using functional magnetic resonance imaging (fMRI). We take a novel analytic approach to test for correlations between individual differences in numerical knowledge and functional connectivity with the IPS across the entire brain. Importantly, this approach is unconstrained, which means that associations between counting knowledge and functional connectivity to the IPS could manifest anywhere in the brain. We find that as children's counting ability increases, functional connectivity between the IPS and inferior frontal cortex decreases. These data, obtained from unconstrained, whole-brain analyses provide strong support for the functional connectivity pruning model of number word acquisition, indicating that the acquisition of counting is associated with decreased fronto-parietal connectivity in preschool children.

D173

INDIVIDUAL DIFFERENCES IN SPATIAL REPRESENTATIONS OF FRACTIONS RELATE TO FORMAL MATH ACHIEVEMENT Elizabeth Y. Toomarian[1], Edward M. Hubbard[1]; [1]University of Wisconsin-Madison — Recent studies have successfully linked cognitive numerical processes to formal tests of mathematics achievement and other behavioral and neural measures. Specifically, fraction magnitude knowledge predicts individual differences in both fraction arithmetic and standardized math test scores (Siegler & Pyke, 2013), and individual differences in white matter correlate with performance on a math aptitude test (Matejko et al., 2013). The present study investigated how individual spatial representations of fractions are related to a range of outcomes, including an explicit measure of fraction knowledge. Adult participants completed a simple comparison task in which they compared the magnitude of single digit, irreducible fractions to ½, a task that has reliably produced a Spatial-Numerical Association of Response Codes (SNARC) effect in our previous work. In the same session, participants completed additional numerical tasks measuring explicit fraction knowledge, abstract/spatial problem solving, and general aptitude. We observed a significant group-level SNARC effect based on overall fraction magnitude, but there was notable individual variability. While there was no direct relationship between SNARC slopes and abstract problem solving or overall intelligence, there was a weak but reliable correlation between individual SNARC slopes and fraction knowledge- participants who associated increasing fraction magnitude with the right side of space had higher overall fraction test scores. These relationships not only further characterize the nature of adults' mental representations of fractions, but also illuminate the nature of individual differences in spatial representations and formal math knowledge. These behavioral differences may be supported by structural and functional differences in parietal regions.

D174

GENERATING A NOVEL REPRESENTATIONAL SPACE THROUGH DEDUCTIVE REASONING Katherine Alfred[1], Andrew C. Connolly[1], David J. M. Kraemer[1]; [1]Dartmouth College — How does the brain generate a newly-learned representational space? Representational similarity analysis (RSA) has revealed the neural basis of common representational spaces that are innate or learned early in development, such as those comprising manmade artifacts and natural kinds. This study uses RSA to examine a newly-learned representational space created through deductive reasoning. A stimulus set of to-be-learned individuals was generated by pairing male names with unfamiliar photographs. Participants learned the relative heights of pairs of individuals and used deductive reasoning to generate a linear hierarchy of heights (e.g. Matthew is taller than Thomas; Thomas is taller than Andrew; therefore Matthew is taller than Andrew). During fMRI, participants recalled the approximate height of each individual relative to the group, and judged whether that person was tall, average, or short. As input for RSA, a model was generated based on the relative heights of the individuals, forming a hierarchy from tallest to shortest. Patterns of neural activity were then tested on an item-specific level for correlation with this

model. This analysis revealed that the intraparietal sulcus (IPS) encodes the newly-learned representational space of individuals' heights. Regions of prefrontal cortex (PFC) were also correlated with the model. These findings are consistent with prior research that demonstrates involvement of IPS and PFC in deductive reasoning tasks, as well as the role of IPS in judgments of spatial distance and magnitude. To our knowledge, this is the first study to show the creation of representational spaces as they are used in the reasoning process.

D175

THE ROLE OF MOTOR REGIONS IN REPRESENTING ENGINEERING CONCEPTS

Joshua Cetron[1], Andrew Connolly[1], Solomon Diamond[1], Vicki May[1], David Kraemer[1]; [1]Dartmouth College — According to the sensorimotor hypothesis of semantic knowledge, physical experience shapes conceptual representations. Consistent with this hypothesis, neuroimaging research demonstrates that motor regions support knowledge about tool use and motor actions. However, few studies have examined whether abstract concepts that may also be learned through experience are also rooted in the sensorimotor systems of the brain. Here, we focus on the mechanical engineering concept of static equilibrium. We aim to determine whether advanced understanding learned, in part, through physical laboratory experience leads to a neural representation of this concept in motor regions. In order to test this hypothesis, students with no prior engineering training, and those who have completed one or more college lab-based courses on structural engineering completed an fMRI task involving mechanical analysis of structures. The task included a carefully chosen set of 24 photographs of real-world structures (e.g., streetlamp) each with one component highlighted (e.g., vertical column). Specifically, some pairs of images were matched on visual similarity (VS) but mismatched on mechanical similarity (MS) whereas other pairs of items were matched on MS and mismatched on VS. This design allowed for the dissociation of surface details (VS) from deeper understanding of static equilibrium (MS). Results revealed that VS correlated with activity in early visual cortex both for novices and for engineering students, whereas MS correlated with activity in motor regions - but only for the engineering students. These results support the hypothesis that some abstract concepts are also rooted in sensorimotor experience.

D176

OSCILLATORY CORRELATES OF BELIEF BIAS IN DEDUCTIVE REASONING

Vivek Nandur[1], Chad Dubé[1], Geoffrey Potts[1]; [1]University of South Florida — Modern theories of human reasoning assume two systems are operative (Stanovich & West, 2000). System 1 is fast-acting, pre-attentive, and driven by prior knowledge and beliefs. System 2 is slower, demanding of visual attention, and resistant to belief-based errors. The belief bias task (Evans, Barston, & Pollard, 1983) may be used to dissociate the systems' contributions. Here, subjects evaluate the logical validity of syllogisms differing in their conclusions' believability. Subjects tend to accept or reject conclusions as "Valid" or "Invalid" depending on their consistency with prior beliefs rather than their logical validity. Attention's putative role in System 2 processing suggests alpha-band desynchronization as a measure of System 2's contribution. Yet, of the handful of imaging studies of belief bias (e.g., Goel & Dolan, 2003), none have considered the role of neural oscillations in the effect. We measured electroencephalography while subjects evaluated the conclusions of abstract problems, following which we administered the belief bias task. Spectral analysis revealed that individuals with higher levels of pre-stimulus alpha power in frontal and occipital electrodes were more susceptible to the influence of prior beliefs. Interestingly, the correlation between alpha and reasoning success in belief-laden stimuli was restricted to unbelievable arguments. A parallel effect was found for the neutral arguments, suggesting a similar attentional signature for reasoning with unbelievable and abstract content. These results suggest that the contribution of visual attention is reduced when reasoning with believable conclusions, and that System 2's involvement in overriding belief bias is amplified in reasoning with unbelievable conclusions.

Poster Session E

ATTENTION: Spatial

E1

SPATIOTEMPORAL EXPECTATIONS IN COMPLEX SEQUENCES Simone G. Heideman[1,2], Anna C. Nobre[1,2]; [1]Oxford Centre for Human Brain Activity, University of Oxford, [2]Brain and Cognition Lab, University of Oxford — Many studies investigating temporal orienting of attention look at simple, regular rhythms and probabilities, or use explicit cues to induce expectations about when a target can be expected or when a response has to be made. However, a lot of our behaviour entails more complex patterns of temporal information embedded in sequences of events, i.e. non-isochronous rhythms. These types of temporal expectations are often acquired in a more implicit manner, over longer periods of time. This study investigates the implicit acquisition and learned performance of combined ordinal (spatial/effector) and temporal sequences using magnetoencephalography (MEG) and functional magnetic resonance imaging (fMRI). A modified version of a serial reaction time task was used, in which not only the series of targets, but also the series of intervals between subsequent targets was repeated. Occasionally probe blocks were presented, where a new (unlearned) ordinal-temporal sequence was introduced. A previous behavioural study using a similar task showed that adding the temporal sequence greatly facilitates the learning of the ordinal sequence, but that temporal information is not learned when presented in isolation. Our behavioural results show that participants not only get faster over time, but that they are slower and less accurate during probe blocks, indicating that they (implicitly) learned the sequence information. The oscillatory signature of these combined ordinal (spatial/effector) and temporal preparatory effects is shown for a range of frequency bands, over motor and sensory areas. The fMRI localiser task shows which areas are important in this process.

E2

SPATIO-TEMPORAL BRAIN DYNAMICS UNDERLYING ATTENTIONAL BIAS MODIFICATIONS Etienne Sallard[1], Léa Hartmann[1], Lucas Spierer[1]; [1]Neurology Unit, Medicine Department, Faculty of Sciences, University of Fribourg, Fribourg, Switzerland — Exaggerated attentional biases toward specific elements of the environment have been advanced to characterize and putatively participate in the maintenance of many psychiatric conditions, as e.g. emotionally negative faces in anxiety disorders. Although recent literature demonstrates that attentional biases can be modified with behavioral interventions, the underlying neurophysiological mechanisms remain unclear. Healthy participants (n=24) performed a modified dot-probe task in which pair of cues (neutral, meaningless colored shapes) was replaced by probes (horizontally or vertically aligned double-dots) that participants were instructed to discriminate. To induce the development of an attentional bias toward or away specific colors, the probes were systematically presented either at the same (Attend condition) or at the opposite position (Avoid condition) of a given cue color. Half of the participants developed a relative bias toward the Attend cue ('approach' bias: Toward group) and half away from the Avoid cue ('avoidance' bias: Away group). A three-way ANOVA on the electrical neuroimaging responses to the cues with factors Group (Toward; Away); Cue (Attend; Avoid); and Session (Beginning; End of the training), evidenced a significant triple interaction between 50-84ms post cue onset within the left temporo-parieto-occipital junction. This network was less activated at the end of the training in (i) Attend condition for the Toward group and in (ii) Avoid condition for the Away group. Our results suggest interindividual differences in the sensitivity to positive (approach) vs negative (avoidance) cue-probe associations and that attentional bias modifications depend on changes at the level of bottom-up saliency-related mechanisms.

E3

CROSS-FREQUENCY COUPLING BETWEEN ALPHA OSCILLATIONS AND SELECTIVE ENTRAINMENT: A CORRELATE OF SELECTIVE ATTENTION Tommy Wilson[1], Sophie Molholm[1], John J Foxe[1,2]; [1]The Sheryl and Daniel R. Tishman Cognitive Neurophysiology Laboratory (CNL) and Children's Evaluation and Rehabilitation Center (CERC), Albert Einstein College of Medicine, Bronx, New York, [2]Ernest J. Del Monte Institute for Neuromedicine, University of Rochester Medical Center, Rochester, New York — A crucial function of attention is to select relevant inputs from an environment filled with multiple, competing sources of information. Oscillations in the alpha band (8-12 Hz) are hypothesized to index one potential stratagem for such selection; specifically, they are thought to index suppression of irrelevant information processing. Recently, another mechanism of selection has been discussed: oscillatory entrainment to environmental rhythms. By syncing neural oscillations to environmental inputs, entrainment is thought to coordinate the firing probabilities of large neuronal assemblies so as to ensure optimal processing of pertinent information. One outstanding question then is to what extent these two mechanisms interact. Our work pairs high-density electroencephalography recordings with a continuous, visuospatial selective attention task to observe the time-course and topography of alpha oscillations across the scalp. We then quantify cross-frequency coupling (specifically phase-amplitude coupling) between oscillations entrained to rhythmic stimuli presented in the delta frequency band (1-3 Hz) and ongoing power fluctuations in the alpha band. We observe that these two mechanisms of selective attention interact, such that attending to rhythmic environmental stimuli shapes the temporal profile of ongoing activity in the alpha band over occipital electrodes. Cross-frequency coupling between rhythmic environmental events and power in the alpha band constitutes a novel, physiologically relevant mechanism for shaping the temporal profile of visuospatial selective attention. Therefore, we posit that by leveraging rhythmic information to shape alpha band power, the brain actively generates temporal predictions that are used to more effectively suppress irrelevant information processing.

E4

SPONTANEOUS ALPHA LATERALIZATION REVEALS A COVERT ATTENTION STRATEGY IN AN UN-CUED DETECTION TASK Gonzalo Boncompte[1], Mario Villena-González[1], Diego Cosmelli[1,2]; [1]Universidad Católica de Chile, Santiago, Chile, [2]Centro Interdisciplinario de Neurociencias — Brain oscillations in the alpha band range (8 - 12Hz) have a strong influence on visual perception. Recent studies have shown that both the amplitude and phase of ongoing alpha waves strongly predict the detection probability of an upcoming stimulus. Moreover, when the side of presentation of a target stimulus is cued, alpha amplitude over ipsilateral posterior areas increases. This effect has been attributed to the focusing of covert attention guided by the cue. Here we tested whether these two alpha band effects, general amplitude modulation and lateralization, could be evoked and detected in the absence of an explicit exogenous cue. To do this we registered EEG data from subjects during a stimulus-detection paradigm in which the target could appear either at the left or right of the screen but without any preceding cue. The number of distracters was manipulated to produce detection rates of approximately 50%. We analyzed the induced alpha power across ipsilateral and contralateral electrodes to where the target was presented. We found that 1) pre-stimulus alpha amplitude was not different for seen and unseen trials, but 2) pre-stimulus alpha band activity showed a lateralization effect towards the ipsilateral side to target presentation, which was significantly higher different for detected and undetected trials. Although subjects weren't cued to a specific side, our results suggest that they unconsciously pre-allocated visual attention towards a particular side of their visual field as a way to enhance their performance.

E5

FUNCTIONAL CONNECTIVITY IN A DORSAL FRONTO-PARIETAL NETWORK REFLECTS GOAL-DIRECTED ATTENTION IN NEGLECT PATIENTS

Julia Fellrath[1,2], Anais Mottaz[1], Adrian G. Guggisberg[1,2], Radek Ptak[1,2,3]; [1]Laboratory of Cognitive Neurorehabilitation, Faculty of Medicine, University of Geneva, Switzerland, [2]Division of Neurorehabilitation, Department of Clinical Neurosciences, University Hospitals Geneva, Switzerland, [3]Faculty of Psychology and Educational Sciences, University of Geneva, Switzerland — Functional imaging studies with healthy subjects have identified a dorsal fronto-parietal network that is involved in shifts of attention and whose activity is sensitive to the behavioural relevance of stimuli. In patients with severe deficits of spatial attention this network is often structurally preserved. Here, we show that diminished EEG functional connectivity in the dorsal fronto-parietal attention network predicts impaired goal-directed attention in stroke patients with spatial neglect. Eleven right-hemisphere damaged patients with left neglect and sixteen age-matched healthy controls performed an attentional task in which they had to react to a central target while ignoring task-relevant distracters presented left or right of the upcoming central target. Unlike controls, neglect patients didn't show an effect of distracter relevance on manual reaction times to the central target. Resting-state EEG was acquired in each participant with a 128 channel system at 512 Hz during 15 min. Functional connectivity analyses revealed in neglect patients a significant decrease in theta-band connectivity between the right middle frontal and the right superior parietal regions as compared to controls. Moreover, in both groups we observed a significant correlation between fronto-parietal connectivity and the behavioural effect of distractor relevance. These findings indicate that fronto-parietal functional connectivity a) predicts effects of goal-relevant distractors on spatial attention and b) is impaired in patients with spatial neglect. Functional connectivity computed from resting-state EEG provides a promising approach to study the function and organization of cortical networks in neglect patients.

E6

ZERO IN THE BRAIN

Silvia Benavides-Varela[1,2], Laura Passarini[2], Brian Butterworth[3], Giuseppe Rolma[1], Francesca Burgio[1,2], Marco Pitteri[2,4], Francesca Meneghello[2], Tim Shallice[3,5], Carlo Semenza[1,2,6]; [1]University of Padova, Italy, [2]IRCCS San Camillo Hospital Foundation, Lido-Venice, Italy, [3]University College London, United Kingdom, [4]University of Verona, Verona, Italy, [5]Scuola Internazionale Superiore di Studi Avanzati-SISSA, Trieste, Italy, [6]Cognitive Neuroscience Centre, Padova, Italy — Transcoding numerals containing zero is more problematic than transcoding numbers formed by non-zero digits. However, it is currently unknown whether this is due to zeros requiring brain areas other than those traditionally associated with number representation. We hypothesized that transcoding zeros entails visuo-spatial and integrative processes typically associated with the right hemisphere. The investigation involved 22 right-brain-damaged patients and 20 healthy controls who completed tests of reading and writing Arabic numbers. As expected, the most significant deficit among patients involved a failure to cope with zeros. Moreover, a voxel-based lesion–symptom mapping analysis showed that the most common zero-errors were maximally associated to the right insula which was previously related to sensorimotor integration, attention, and response selection, yet for the first time linked to transcoding processes. Error categories involving other digits corresponded to the so-called Neglect errors, which however, constituted only about 10% of the total reading and 3% of the writing mistakes made by the patients. We argue that damage to the right hemisphere impairs the mechanism of parsing, and the ability to set-up empty-slot structures required for processing zeros in complex numbers; moreover, we suggest that the brain areas located in proximity to the right insula play a role in the integration of the information resulting from the temporary application of transcoding procedures.

E7

VENLAFAXINE REDUCES THE DEFICIT OF EXECUTIVE CONTROL OF ATTENTION IN PATIENTS WITH MAJOR DEPRESSIVE DISORDER

Yanghua Tian[1], Jing Du[1], Alfredo Spagna[2], Melissa-Ann Mackie[2], Jin Fan[2,3], Kai Wang[1]; [1]the First Hospital of Anhui Medical University, China, [2]Queens College, USA, [3]Icahn School of Medicine at Mount Sinai — Attention plays an essential role to support other cognitive functions and behavior, and disturbance of attention is one of the most common symptoms in psychiatric disorders, including major depressive disorder (MDD). Although treatment with antidepressants, such as venlafaxine, an effective treatment for MDD symptoms, has been shown to reduce deficits in cognition and emotion regulation, it remains unclear whether venlafaxine improves specific attentional functions. We used the attention network test to measure the attentional functions of alerting, orienting, and executive control pre- and post-treatment with venlafaxine in patients with MDD (n = 34) compared to the measures of the first and second test sessions of healthy controls (HC, n = 30). The Hamilton rating scale for depression and the Self-Rating Depression Scale were used to measure the severity of clinical symptoms in the patient group. Pre-treatment, the MDD group showed a selective impairment in alerting and executive control of attention, while there were no significant group differences in the orienting function. After treatment with venlafaxine, the performance of the MDD group on executive control of attention was not significant different to that of controls, the interaction, i.e., the pre-treatment group difference compared to the post-treatment group difference in executive control, was significant, and symptoms reported were significantly reduced. There was no evidence of a relationship between the improvement of executive control of attention and symptom improvement. Treatment with venlafaxine selectively improves the attentional functions and clinical symptoms in MDD.

E8

PUPILLOMETRY, SELECTIVE ATTENTION, AND THE RELATIONSHIP WITH THE BROADER AUTISM PHENOTYPE

Antoinette Sabatino DiCriscio[1], Vanessa Troiani[1]; [1]Geisinger Autism & Developmental Medicine Institute — Pupillometry measures changes in pupil dilation, which are tightly linked with activity in the Locus Coeruleus (LC). The LC controls baseline arousal as well as stimulus-locked, or "phasic", responses that focus attention in response to environmental cues. One hypothesis suggests a 'hyperphasic' LC underlies enhanced visual search abilities in Autism Spectrum Disorder (ASD) and the inflexibility and hyperfocused attention that leads to restricted interests present in ASD. We measured task-evoked changes in pupil diameter during a spatial attention task to investigate the relationship between pupil response and quantitative traits associated with the Broader Autism Phenotype (BAP). We designed a Navon Figures eyetracking paradigm (i.e. large letter composed of small letters), requiring an individual to vary only the information attended to within an image. This controlled for low-level visual features such as luminance that impact pupil changes. Participants (N=49; mean age = 25.2) display larger changes in task evoked pupil response when identifying local information (smaller letter) within objects relative to global information (larger letter) ($p<0.001$). We also show a relationship between relative change in pupil diameter (Local:Global conditions) and behavioral measures associated with the BAP, specifically the rigidity subscale, which measures flexibility and preoccupation with details ($r=0.58$, $p<0.003$). This effect was specific to stimulus-locked ("phasic") responses and was not linked to baseline pupil diameter. This work represents the first characterization of the specificity in phasic pupil response and the relationship with the BAP and suggests that mechanisms that control the earliest parts of visual selection are associated with autism traits.

E9

ATTENTIONAL LOAD EFFECTS ON NORMAL AND PATHOLOGICAL SPATIAL PROCESSING

Mario Bonato[1], Elvio Blini[2], Zaira Romeo[2], Chiara Spironelli[2,3], Matteo Lisi[4], Konstantinos Priftis[2], Carlo Umiltà[2], Marco Zorzi[2,3,5]; [1]Ghent University, Ghent, Belgium, [2]University of Padova, Padua, Italy, [3]Center for Cognitive Neuroscience, Padua, Italy, [4]Laboratoire Psychologie de la Perception, Université Paris Descartes, Paris, France, [5]IRCCS San Camillo Hospital, Lido Venice, Italy — Efficient spatial processing depends on a complex interplay between spatial attention and awareness. This interplay can be dramatically and asymmetrically hampered by a brain lesion as in the case of Unilateral Spatial Neglect, which is now known to be strongly modulated by task demands. Nevertheless, spatial processing can also become difficult for healthy participants when multiple features have to be processed in parallel. In six different studies (4 with brain-damaged patients and 2 with healthy participants) we capitalized on a task recruiting both

lateralized and non-lateralized attention (i.e. load). Twenty stroke patients with chronic brain damage (10 left and 10 right hemisphere damaged) but with no clinical signs of neglect and 39 healthy participants completed a computerized spatial monitoring test with and without a concurrent secondary task (visual or auditory). In patients, severe contralesional space unawareness emerged in the computer-based task when attentional load was increased by the concurrent task, whether visual or auditory. Strikingly, this pattern emerged also in patients with left brain damage and at a temporal distance of several years from the brain insult. In healthy participants neurophysiological measures (ERPs and pupil dilation) were also collected. ERPs revealed an early suppression of visual areas under load while pupil dilation allowed to disentangle the load due to the focusing on different features from the load due to their increased number. This approach mimics everyday life requirements, maximally triggers competitive mechanisms and selectively exacerbates contralesional spatial deficits after brain damage.

E10

INCREASING DISTRACTOR SET SIZE REDUCES CONCEPTUAL INTERFERENCE DURING TARGET ENCODING

Kate Nussenbaum[1], Julie Markant[2], Dima Amso[3]; [1]University of Oxford, [2]Tulane University, [3]Brown University — Selective attention mechanisms support learning and memory by suppressing distraction and enhancing target representations. But it is unclear how varying levels of distraction differentially engage these mechanisms and affect learning. Here we investigated whether increasing visual distraction would elicit stronger engagement of attentional control mechanisms during target selection and lead to better memory for targets encoded in the context of greater distraction. Across two eye-tracking experiments, participants identified and categorized a target image among zero, one or three distractors, and then performed a subsequent recognition memory test. In Experiment 1 (60 trials), participants (N = 62) demonstrated better memory for images encoded in the Three Distractor relative to the One Distractor condition ($p = .002$), despite the fact that their eye movement latencies and response times were slower in the Three relative to the One Distractor case ($p's < .001$). In Experiment 2 (90 trials), the distractors were manipulated such that they contained no meaningful information or category information that either conflicted with or matched that of the target. Here, the number and content of the distractors interacted in their effects on participants' (N = 53) memory ($p = .038$), with distraction impairing memory only in the One Distractor conflict condition, and not in any of the Three Distractor conditions. These data suggest that increasing numbers of distractors can benefit memory by triggering the engagement of suppressive mechanisms that prevent interference from distracting conceptual information during encoding.

E11

ORIENTING ATTENTION BASED ON MEMORY FOR TARGET AND DISTRACTOR LOCATIONS

Nora Malika Roüast[1,2], Eva Zita Patai[1,2], Anna Christina Nobre[1,2]; [1]Brain and Cognition Lab, University of Oxford, [2]Oxford Centre for Human Brain Activity, University of Oxford — Long-term memory and spatial attention are highly complex cognitive systems, which are known to interact to bias and guide human perception. In the present study, a memory-guided visual search paradigm (Summerfield et al, 2006) was modified to evaluate the behavioural and neural processing of irrelevant, distracting information as well as that of relevant, target information. The study was structured in three stages: A learning task to associate target and distractor memory with spatial locations in natural scenes, followed by an attention task (using either a cueing or change-detection task), and a direct recall spatial memory task. We hypothesised that the presence of the distractor would alter the bias of spatial attention towards the valid target location. Further we predicted that the memory of the scene (and the target location within it) would be distorted relative to the distractor location. Contrary to what we predicted, the distractor had a clear attractor function, drawing target memories towards the distractor location. Its presence appeared to counteract the memory-based orienting effect at the behavioural level. Electroencephalography recordings during performance of the memory-based orienting task enabled us to track how the presence of learned target and learned distractor locations modulated perceptual and cognitive processes in turn.

E12

RIGHT POSTERIOR PARIETAL CORTEX IS CRUCIAL FOR ATTENTIONAL CONTROL OF EMOTIONAL TASK IRRELEVANT STIMULI: A 1 HZ REPETITIVE TRANSCRANIAL MAGNETIC STUDY

Manon Mulckhuyse[1], Jan Engelmann[1], Dennis Schutter[1], Karin Roelofs[1]; [1]Donders Institute for Brain, Cognition and Behaviour — The right posterior parietal cortex (PPC) is proposed to constitute a central part of the fronto-parietal attention network and has been implicated in both top-down and bottom-up driven attention control. We investigated the causal role of the right PPC in attentional selection of task-irrelevant emotional stimuli. In a sham-controlled crossover design inhibitory slow frequency repetitive magnetic transcranial stimulation (rTMS) was applied to the left and right PPC. Following 1 Hz rTMS, participants performed a visual search task with a task irrelevant color singleton distractor that was either threatening or non-threatening. Threat was established using a fear-conditioning procedure in which one colored distractor (CS+) was paired with an aversive stimulus (US), whereas the other colored distractor (CS-) was not. Results showed the typical reaction time costs of the distractor. That is, reaction time was increased when a distractor was present relative to absent. Exclusively after inhibitory rTMS to the right PPC, reaction time costs were larger in the threatening distractor condition than in the non-threatening distractor condition. Moreover, the effect of right PPC stimulation was specific for the threatening distractor, as mean reaction time significantly increased relative to the threatening distractor condition in the sham stimulation. These findings suggest that disrupting the right PPC reduces attentional control over task-irrelevant emotional stimuli. We therefore propose that the right PPC is involved in disengagement of attention from emotionally salient distractors in order to re-orient attention voluntarily to task relevant stimuli that are central for goal-directed behavior.

E13

DIFFERENTIAL MODULATION OF VISUAL RESPONSES BY DISTRACTOR OR TARGET PREDICTIONS?

MaryAnn P Noonan[1], Yannik Bauer[2], Alex H Von Lautz[3], Chris Summerfield[1], Mark S Stokes[1]; [1]Department of Experimental Psychology, University of Oxford, Oxford, UK, [2]International Max Planck Research School, University of Tübingen, Germany, [3]Bernstein Center for Computational Neuroscience, Berlin, Germany — We have recently suggested that flexible top-down mechanisms of cognitive control are specialised for target-related attention, whereas distractor suppression only emerges when the predictive information can be inferred directly from past experience. Specifically, we found that distractor cueing is only effective when distractors repeat across a block of trials and not when distractor location is cued on a trial-wise basis (Noonan et al., in press, JON). We now explore how these expectations build up across trials as well as the time course and neural components involved in distractor suppression. In a speeded target discrimination task subjects are implicitly cued to the location of the target or distractor via manipulations in the underlying predictability of the two stimuli. In different sessions we collected EEG and MEG data from the same subjects. Behaviourally, reaction times were reduced when either stimuli was more spatially predictable. A reinforcement learning model generated trial-wise estimates of the spatial priors for each location independently for targets and distractors. This analysis revealed that learning rates were higher for targets than distractors. Analysis of the EEG data replicated our previous study showing a bilateral reduction in the amplitude of the P1 after distractor stimulus repetitions. This was mirrored by a trend towards an increase in P1 amplitude after target stimulus repetitions in electrodes contralateral to targets. Lateralized N2pc effects were also less pronounced after distractor repetition than non-repetition trials. This is consistent with a predictive coding model of expectation suppression that is selective for task-irrelevant information.

E14

PRISM ADAPTATION ALTERS ELECTROPHYSIOLOGICAL MARKERS OF ATTENTIONAL PROCESSES IN THE HEALTHY BRAIN

Elisa Martín-Arévalo[1,2,3], Inga Laube[1,2], Eric Koun[1,2,4], Alessandro Farnè[1,2,4], Karen T. Reilly[1,2], Laure Pisella[1,2]; [1]ImpAct team, Lyon Neuroscience Research Center, INSERM U1028, CRNS-UMR5292, [2]Lyon 1 University, France, [3]Mind, Brain, and

Behavior Research Center (CIMCYC), University of Granada, Spain, [4]Hospices Civils de Lyon, Neuro-immersion & Mouvement et Handicap, France — Neglect patients typically show a rightward attentional orienting bias and a strong disengagement deficit, such that they are especially slow in responding to left-sided targets after right-sided cues (Posner et al. 1984). Prism adaptation (PA) can reduce diverse neglect symptoms and it has been hypothesized that PA's effects are so generalized that they might be mediated by attentional mechanisms (Pisella et al. 2006; Redding and Wallace 2006). In neglect patients, performance on spatial attention tasks improves after rightward-deviating PA (Jacquin-Courtois et al. 2013). In contrast, in healthy subjects, while there is evidence that leftward-deviating PA induces neglect-like performance on some visuospatial tasks, behavioral studies of spatial attention tasks have mostly yielded negative results (Morris et al. 2004; Bultitude et al. 2013). We hypothesized that these negative behavioral findings might reflect the limitations of behavioral measures in healthy subjects. Here we exploited the sensitivity of event-related potentials to test the hypothesis that electrophysiological markers of attentional processes in the healthy brain are affected by PA. Leftward-deviating PA generated asymmetries in attentional orienting (reflected in the cue-locked N1) and in attentional disengagement for invalidly cued left targets (reflected in the target-locked P1). This is the first electrophysiological demonstration that leftward-deviating PA in healthy subjects mimics attentional patterns typically seen in neglect patients.

EMOTION & SOCIAL: Emotion-cognition interactions

E15

DISSOCIATING EFFECTS OF INHERENT AND ASSOCIATED EMOTIONAL SALIENCE IN HUMAN FACE PROCESSING–AN EVENT-RELATED POTENTIAL STUDY

Wiebke Hammerschmidt[1], Annekathrin Schacht[1]; [1]University of Göttingen, Germany — Emotional and motivational factors have been demonstrated to modulate stimulus processing at various stages, ranging from initial perception to elaborate stimulus evaluation. The resulting processing advantage for stimuli of emotional/motivational relevance is reflected at both behavioral and neural level. In the present study, we aimed at dissociating effects of inherent emotional salience and associated motivation-based salience in face processing by means of event-related brain potentials (EPRs). During a learning session, participants (N = 24) learned to associate faces with neutral expressions with monetary gain, loss, or zero outcome. In a delayed test session, participants had to perform a gender decision task on the previously learned faces and on unfamiliar faces showing happy, angry, or neutral expressions, while ERPs were recorded. ERP effects of associated motivation-based salience differed from those of inherent facial expressions of emotion in terms of both latency and topography. Inherently neutral faces associated with reward elicited ERP modulations starting as early as about 50 ms after stimulus onset while no typical later ERP effects occurred. In contrast, facial expressions of emotion elicited typical emotion-related ERP components at longer latencies (i.e., Early Posterior Negativity, Late Positive Complex), whereas earlier effects were absent. Our findings indicate that salience based on learned associations shapes perceptual processing at very initial processing stages. Elaborate, sustained relevance processing, however, seems to be restricted to biologically-determined emotional valence as in the case of inherent facial expressions of emotion.

E16

COGNITIVE-EMOTIONAL AND INTOLERANCE OF UNCERTAINTY TASKS CHARACTERIZING ANXIETY- AND PANIC-RELATED BRAIN CIRCUITS

YH Peterse[1], VI Spoormaker[1], PG Saemann[1,2], M Czisch[1,2]; [1]Max Planck Institute of Psychiatry, Munich, Germany, [2]Equal contributions — Within the framework of an imaging genomics study inspired by single nucleotide polymorphisms (SNPs) associated with panic and anxiety phenotypes (Erhardt et al., Mol Psychiatry 2012;TMEM132D gene), 150 healthy young participants were investigated using functional magnetic resonance imaging during the rest state and five selected paradigms focusing on: (i) fear learning and generalization, (ii) feedback processing during time-estimation, (iii) Emotional Face Matching (EFM), (iv) Color and Emotional Stroop (ES), (v) Unpredictable Threat (UT), with tasks (I) and (v) involving combined fMRI/neurophysiology. After accomplished data acquisition, we report task main effects before genomic associations for the last three tasks. During EFM, robust (de)activation differences were noted between fearful and happy faces in the default mode network and frontoparietal regions including the dorsal anterior cingulate cortex (dACC), and weaker in the amygdala. During the CES task, expected activation of the dACC and dorsolateral prefrontal cortex (DLPFC) was found in the conflict condition. Additionally, frontoparietal regions were differentially activated depending on the affective word valence, with frontostriatal hyperactivation during negatively versus neutrally valenced words. The UT paradigm revealed ventromedial PFC (including subgenual) and posterior cingulate activation during the safety context, and increased insula and ventrolateral PFC activation during both predictable and unpredictable threat contexts. As the main effect of these tasks are in line with expectations from previous reports, future analyses will focus on analysis of all paradigms and on examining differences in activation patterns in these tasks in relation with SNPs in the TMEM132D gene.

E17

BEAUTY REQUIRES THOUGHT: THE EXPERIENCE OF BEAUTY IS SELECTIVELY IMPAIRED BY A COGNITIVE TASK

Aenne A. Brielmann[1], Denis G. Pelli[1]; [1]New York University — People readily distinguish beauty experiences from other mundane pleasures. This intuition is confirmed by fMRI evidence that prefrontal regions involved in working memory and the default mode network are selectively involved in experiencing beauty. This suggests that Immanuel Kant's notion that "beauty requires thought" may apply to neural processes underlying the experience of beauty. Here we experimentally test Kant's hypothesis that beauty differs from "ordinary" pleasures in requiring cognitive capacities. We manipulated cognitive capacity by requiring participants to execute an auditory 2-back task in 50% of trials. Participants were presented with beautiful images (self-selected or experimenter-selected), ordinary pleasures (pretty image or eating candy), or neutral images for 30 s each. During stimulus exposure and a further 60 s after, participants continuously rated pleasure using a custom smartphone app (EmotionTracker.com), which samples the distance between two fingers once per second and converts it to a numerical rating (1-10). At the end of each trial, we asked participants if they felt beauty. Only for beautiful stimuli, continuous-pleasure and final beauty ratings were much lower for trials with vs. without the 2-back task (maximum pleasure throughout the trial: M=7.7 vs. 5.5 for self-selected images, and 7.3 vs. 5.4 for experimenter-selected, SE≈0.7). Pleasure and beauty ratings for all other stimuli were unaffected. These results suggest that the process underlying a beauty experience has specially high cognitive demands, and that the involvement of the associated brain networks is not just correlative, but necessary.

E18

RESTLESSNESS IN PTSD: ABERRANT RESTING-STATE ALPHA AND GAMMA OSCILLATION AND TOP-DOWN CAUSAL CONNECTIVITY

Kevin Clancy[1], Mingzhou Ding[2], Edward Bernat[3], Norman B. Schmidt[1], Wen Li[1]; [1]Florida State University, [2]University of Florida - Gainesville, [3]University of Maryland — The pathophysiology of post-traumatic stress disorder (PTSD) is characterized by prefrontal cortical hypo-activity and amygdala hyper-reactivity. However, aberrant activity in the sensory brain, potentially responsible for sensory hypervigilance, a key symptom in PTSD, is poorly understood. Using electroencephalogram (EEG) spectral analysis, we evaluated visual cortical activity (reversely indexed by alpha power; 8-12Hz) and frontal cognitive control (indexed by gamma power; 30-50Hz) during two behavioral states (resting state and passive picture viewing) in PTSD vs. Generalized Anxiety Disorder (GAD) patients and healthy controls (HC). A significant interaction effect between State and Group [$F(2,52)=6.43$, $p=.003$] on occipitoparietal alpha power revealed decreased resting alpha (i.e., heightened resting-state visual sensory activity) in PTSD compared to HC and GAD ($p's< 0.05$). In addition, a State-by-Group interaction in frontal gamma power [$F(2,52)=4.66$, $p=0.01$] demonstrated increased frontal activity during resting (vs. picture viewing) in PTSD group only, reflecting strong frontal inhibition to suppress hyperactive visual response during rest. In support of this notion, fronto-occipital Granger causality analysis showed heightened top-down drive in the alpha range during resting (vs. viewing) in PTSD patients [$t(17)=3.08$, $p=0.007$; but not HC and

GAD patients], suggesting enhanced inhibition from the frontal cortex to the occipital visual cortex. These data thus implicate a hyperactive sensory brain in PTSD accompanied by compensatory (albeit unsuccessful) frontal inhibition to downregulate sensory activity. Taken together, sensory cortical hyperactivity combined with elevated frontal control load during the resting state contributes to the pathophysiology of PTSD, potentially accounting for symptoms of hypervigilance and cognitive deficits in this disorder.

E19

MOOD AND TWO TYPES OF IMPLICIT LEARNING

Eileen C. Rasmussen[1,6], Chelsea M. Stillman[1,5], Erica L. Rabinovich[1], James H. Howard Jr.[2,3,4], Darlene V. Howard[1,2]; [1]Department of Psychology, Georgetown University, [2]Center for Brain Plasticity and Recovery, Georgetown University Medical Center, [3]Department of Neurology, Georgetown University Medical Center, [4]Department of Psychology, The Catholic University of America, [5]Department of Psychiatry, University of Pittsburgh, [6]Department of Psychology, Brandeis University — Implicit learning underlies activities such as skill acquisition and language learning. The effect of mood on explicit processes has been widely investigated, but its effect on implicit learning (IL) remains unclear. Some research suggests mood affects cortical-dependent explicit processes (e.g., MTL) more than it affects implicit processes, which are often thought to be subcortical. However, both language IL and the early, but not later, stages of perceptual IL have recently been found to be associated with MTL activation. This study examined whether state mood related to two IL tasks. Participants completed the Positive Affect Negative Affect Scale (PANAS) prior to 3 sessions of the Triplets Learning Task (TLT) tapping perceptual IL, as well as a language IL task. During the TLT, participants viewed cue events and responded to a third target in discrete, three-event sequences (called "triplets"). Unbeknownst to participants, the location of the first cue predicted target location on 80% of trials (HP) and another location on the remaining trials (LP). Learning was assessed by the difference in RT between LP and HP trials. During the language task, participants listened to streams of sounds, unaware sounds were three-syllable words from an artificial language. During a subsequent test, participants rated the familiarity of full and part words. Here, learning was assessed by mean familiarity ratings for full- minus part-words. We found increased negative mood was significantly associated with lower overall language learning, and less learning in TLT session 1. These findings suggest that mood influences IL processes involving the MTL.

E20

NEURONAL CHARACTERISTICS OF EMOTION PROCESSING AND REGULATION IN FEMALE ADOLESCENTS WITH AND WITHOUT CONDUCT DISORDER

Willeke Martine Menks[1], Nora Maria Raschle[1], Lynn Valérie Fehlbaum[1], Martin Prätzlich[1], Linda Kersten[1], Felix Euler[1], Iyad El Qirinawi[1], Sandra Mannstadt[1], Christina Stadler[1]; [1]Psychiatric University Clinics Basel, Switzerland — Conduct disorder (CD) and predisposition for aggression are associated with deficient emotion processing and regulation. Neuroimaging studies in males link aggressive behavior with neuronal alterations during emotion processing in areas including limbic and prefrontal cortices. Neuroimaging studies in female CD are scarce and thus we aim to investigate neuronal characteristics during emotion regulation in girls with and without CD. Whole brain functional magnetic resonance imaging was conducted in 45 female adolescents. Participants had to either look at or decrease feelings associated with emotional pictures presented (as indicated by cue), followed by self-report of negative-affect intensity through button press. Contrasts of interest target emotional reactivity (neuronal response to neutral/negative images) and emotion regulation (decrease vs. look negative). Preliminary analysis in 18 CD and 18 control girls (15y) was performed and in-scanner data indicates that controls are more successful during emotion regulation (significantly lower affect ratings for 'decrease' vs. 'look'). Neuroimaging reveals significant differences for emotional reactivity and regulation when comparing CD with controls. Control girls display stronger emotional reactivity in areas including insula, amygdala, anterior cingulate and prefrontal regions. During emotion regulation, CD is characterized by hypoactivations in left prefrontal, inferior temporal and limbic areas, whereas left inferior temporal and parietal areas are hyperactivated when compared to typically developing controls. Our results demonstrate neuronal alterations in female CD during emotion processing and regulation, which could support novel treatment development to improve emotion regulation in CD.

E21

WHEN MORE IS LESS: EXCESSIVE ACTION MONITORING IN WORRY IS ACCOMPANIED BY ABNORMAL AFFECTIVE PROCESSING OF ACTIONS

Lien De Saedeleer[1], Gilles Pourtois[1]; [1]Ghent University — Performance monitoring enables the swift evaluation of actions as correct/good or incorrect/bad. At the neurophysiological level, the error related negativity (ERN/Ne) component arising from the rostral cingulate zone is assumed to capture in part this evaluative process. Recently, worry was found to alter/augment this ERP component even though its actual impact on performance monitoring remains unclear (Moser et al., 2013). In this study, we sought to assess whether worry could actually impair the rapid processing of actions as good or bad at the ERN level. Fifteen low trait worriers and 15 high trait worriers (as defined based on the Penn State Worry Questionnaire) performed a speeded go/nogo task interleaved with an emotional word discrimination task, while 128-channels EEG was recorded concurrently. Unknown to the participants, actions made with the former task served as primes for the subsequent emotion word discrimination task, such that negative words are usually judged faster than positive words following incorrect than correct actions made with the (preceding) speeded go/nogo task (Aarts et al., 2012). Our results show that this evaluative priming effect was strongly reduced in high compared to low worriers. Moreover, high worriers showed an enhanced ERN (as well as correct-related negativity-CRN) component during the go/nogo task, suggesting that overactive action monitoring may actually reflect a lower evaluative processing of (self-generated) actions. We discuss these new findings against theoretical models that postulate that worry can hijack important processing resources during performance monitoring and thereby influence the way (self-generated) actions are eventually evaluated.

E22

EXAMINING THE IMPACT OF MOOD ON EXECUTIVE FUNCTION USING A NOVEL MEASURE OF EMOTION REGULATION FLEXIBILITY

Alexandra E. Fowler[1], Evangelia G. Chrysikou[1]; [1]University of Kansas — The ability to regulate one's emotional responses to different situations (emotion regulation, ER) has been at the center of much cognitive and affective neuroscience research on frontal lobe function, due to the potential significance of different ER strategies for the treatment of different psychopathological disorders. Although past research has largely focused on the neural correlates and efficacy of such regulatory strategies (e.g., expressive suppression, cognitive reappraisal), recent findings have shown that executive function may also involve ER flexibility, namely, the ability to implement ER strategies that match particular contextual demands. Despite extensive research on cognitive flexibility (i.e., the regulation of cognitive strategies depending on context) much less work has examined ER flexibility. The aim of this study was to develop a novel measure of ER flexibility based on the widely accepted measure of cognitive flexibility, the Wisconsin Card Sorting Task (cWCST). We examined the strength of this new emotion regulation measure (eWCST) to capture ER flexibility in healthy adults and depressed individuals who are characterized by cognitive and ER flexibility impairments. Behavioral and psychophysiological (facial electromyography) data showed that individuals with depression were less flexible on emotional sorting in the eWCST relative to healthy controls, results that mirrored their performance on the cWCST. These findings contribute to the developing literature on ER flexibility, while allowing for novel comparisons between cognitive and emotion regulation domains.

E23

STRESS ATTENUATES VALENCE DRIVEN DEFICITS IN DECISION-MAKING

Seth Koslov[1], Vaibhav Sapuram[1,2], Jessica Cooper[1], Joanna Capanzana[1], Marissa Gorlick[1], Todd Maddox[1]; [1]University of Texas at Austin, [2]University of North Carolina at Greensboro — Recent neuroscience research suggests that emotion and cognition are subserved by overlapping neural systems, and that stress enhances striatally-mediated reflexive processing at the expense of frontally-mediated reflective processing. However, this relationship has not been explored in decision-making. In the present study, we examined the interactive effects of stress, feedback emotionality, and

feedback valence on decision-making performance and strategy engagement. Each participant completed four reflexive-optimal decision-making tasks under stress or control conditions. A cold pressor task was used to induce stress. The underlying structure of the four tasks was identical, but the four conditions were constructed from the factorial combination of feedback type (emotional vs. non-emotional) and feedback valence (reward vs. punishment). In both the emotional and non-emotional feedback conditions, participants performed worse when their task was to minimize punishments relative to maximizing rewards. However, this deficit was attenuated by stress, with punishment participants under stress performing better than punishment participants under no stress. To examine the mechanism driving this effect, two computational models were fit to the data: a simple reinforcement-learning model that captures reflexive processes, and a reflective (heuristic) win-stay lose-shift model. Under punishment-minimization conditions for both emotional and non-emotional feedback, a higher proportion of participants in the stress condition than control condition were best fit by the reinforcement-learning model. Under reward-maximization conditions, stress had no effect on performance or strategies relative to controls. These results indicate that stress attenuates deficits in reflexive decision-making under punishment-minimization conditions through enhancement of striatally-mediated processing.

E24

HEART RATE VARIABILITY REVEALS BRAIN-BODY LOOPS IN THE INSULAR CORTEX

Ross Markello[1], Amber W. Lockrow[1], Wen-Ming Luh[1], R. Nathan Spreng[1], Adam K. Anderson[1]; [1]Cornell University — Heart rate variability (HRV), the beat-to-beat modulation of heart rate, originates from the brain and reflects central visceromotor regulation. Its high frequency component is associated with parasympathetic regulation and is often considered to reflect heart health. In addition to its relationship to longevity, HRV has been associated with higher-level cognitive and affective regulatory capacities. While HRV is typically assessed as a stable, trait-based measure used to examine differences reflecting between-individual variability, HRV also indexes state-related shifts in how the brain regulates autonomic outflow to the heart. In the current study we explored the neural bases of state-related variation in HRV within individuals. We analyzed resting state fMRI and peripheral physiological data in a sample of 96 young adults to assess the neural underpinnings of such variability. HRV was calculated via finger pulse plethysmography as a sliding 15-second window of the root mean square of successive differences. After controlling for respiratory frequency, beat-to-beat fluctuations in heart rate correlated with activity in the putative primary interoceptive cortex—the mid to posterior insula—as well as activity in the primary somatosensory cortex, primary visual cortex in the calcarine sulcus, precuneus, and inferior frontal gyrus. Examinations of BOLD response as an antecedent or consequent of HRV provide support for the insula as both primary interoceptive and primary visceromotor cortex. These results suggest the central regulatory origins of HRV are related to attentional states in primary exteroceptive and interoceptive cortices and may originate from parasympathetic feedback loops regulating the moment-to-moment state of the heart.

E25

THE EFFECTS OF ACUTE STRESS ON THE CALIBRATION OF PERSISTENCE

Karolina M. Lempert[1], Joseph T. McGuire[2], Danielle B. Hazeltine[1], Joseph W. Kable[3], Elizabeth A. Phelps[1,4]; [1]New York University, [2]Boston University, [3]University of Pennsylvania, [4]Nathan Kline Institute — People often fail to wait for delayed rewards, even after expressing a preference for them. While this failure to persist is sometimes maladaptive, there are environments in which limiting persistence is advantageous. Persistence should be calibrated to the statistics of delay times in a given environment. Previous work has shown that individuals can calibrate how long to persist for delayed rewards after experience with an environment, and optimal calibration depends on a signal in the ventromedial prefrontal cortex, which tracks the subjective value of waiting over time. Since acute stress can impair prefrontal cortex function, here we tested whether stress would impact the calibration of persistence, in a between-subjects design (four groups; n = 30 each). Half the participants performed a task in which persistence was optimal (high persistence, HP), either after an acute physiological stressor or no stress. The other half performed a task in which it was optimal to quit waiting for a reward soon after each trial began (limited-persistence, LP), either under stress or no stress. There was no main effect of stress on persistence, nor was there a stress x environment interaction. Thus, calibration of persistence is preserved under stress. However, among the stressed participants, both the cortisol response to stress ($\beta = 0.38$; $p = 0.01$) and baseline cortisol ($\beta = 0.39$; $p = 0.01$) independently predicted better calibration under stress (less waiting in LP, more waiting in HP). This suggests that increased systemic cortisol output after stress predicts more optimal behavior in this task.

EMOTION & SOCIAL: Emotional responding

E26

IMPACT OF EARLY LIFE STRESS ON NEURAL NETWORK DYSREGULATION AND MAJOR DEPRESSIVE DISORDER IN ADULTHOOD

Matthew Crain[1], Erin Walsh[2], Andrew Crowther[2], Gabriel Dichter[2], Moria Smoski[1]; [1]Duke University, [2]University of North Carolina — Early life stress (ELS) during childhood has been found to be directly associated with serious psychopathology in adults, which is often resistant to conventional treatment. There is growing evidence that ELS is linked to dysregulation of functional neural networks in adults. Specifically, previous studies of adults with ELS have demonstrated altered activation among the default mode network (DMN), executive control network (ECN), salience network (SN), and dorsal attention network (DAN), though findings have been inconsistent. The aim of the current study was to examine the relationship between retrospective self-reported ELS, including sexual, physical, and emotional abuse and neglect, and the extent and nature of impaired connectivity among functional neural networks using a resting-state fMRI paradigm with 35 adult outpatients diagnosed with major depressive disorder (MDD) and 20 non-depressed control participants. The degree of self-reported ELS was significantly higher in the MDD group than in controls. Furthermore, MDD was significantly associated with widespread hypo-connectivity between the DMN and DAN and the ECN and SN as well as hyper-connectivity within the DMN and DAN. Finally, ELS severity was associated with even greater hyper-connectivity within the DMN for MDD patients. This functional neural network dysregulation, potentiated by ELS, may play a critical role in producing the more pervasive and serious emotional lability, rumination, impaired self-reference, dysfunctional stress response, and obsessions and compulsions seen in MDD and related psychopathology. These findings suggest the importance of developing treatment methods that directly restore healthy balance to these critical functional neural networks impacted by childhood trauma.

E27

LOSING TOUCH: CHRONIC DEPERSONALIZATION AND DEREALIZATION MAY BE INSTIGATED BY CANNABIS AND ANXIETY

Sean Madden[1], Jeff Abugel, Patrick Einhorn[1], Adam Benzekri[1], Fahd Abdus-Sabur[1]; [1]Columbia University, Teachers College — The altered states of consciousness, depersonalization (DP) and derealization (DR), are defined as sensations of detachment from one's body and surroundings, as well as feelings of unreality affecting a broad scope of perceptions such as that of one's identity or familiar places. DP and DR are often transient phenomena that follow ordinary events like sleep deprivation. There is, however, a chronic form in which these intrusions persist for years, causing individuals significant distress. Previous research implicates recreational drug use and anxiety in the etiology of chronic DP/DR; unfortunately, efforts to understand this matter have been scarce. The present study sought to identify potential causes of chronic DP and/or DR in a sample of 71 chronically depersonalized and/or derealized individuals. Participants were recruited from online forums established for chronic DP and DR sufferers to complete a questionnaire. The mean age among male and female respondents was 42.5 (SD = 40.31). The majority of cases reported chronic DP and/or DR lasting for over 6 months (89%), 27% of whom indicated a duration in excess of 10 years (n = 19). The two most common triggers were anxiety and recreational drug use, the most common of which was cannabis (61.1%, n = 11). Other respondents noted stressful events and panic attacks as precursors to their symptoms. Thirteen percent of the sample, most of whom exhibited symptoms

the longest, could not attribute a cause responsible for symptom onset. Our findings warrant further investigation of the etiology of chronic DP and DR.

E28

FIGHTING BACK: NEUROENDOCRINE INFLUENCES ON WOMEN'S REACTIVE AGGRESSION.

Macià Buades-Rotger[1], Frederike Beyer[2], Christin Engelke[1], Ulrike M. Krämer[1]; [1]University of Lübeck, [2]University College London — Reactive aggression is a complex social behavior that arises in response to an interpersonal provocation. In a previous functional magnetic resonance imaging (fMRI) study in men, we found that orbitofrontal cortex (OFC) reactivity to angry faces was negatively related to aggression in an interactive paradigm. Here, we sought to expand on our previous findings by exploring the joint influence of testosterone, cortisol and neural reactivity to anger on women's reactive aggression. We employed a competitive reaction time task devised to elicit reactive aggression in the scanner: the Taylor Aggression Paradigm (TAP). In this version of the TAP, the opponent displayed either an angry or a neutral face at the beginning of each trial and behaved more aggressively over time, successfully provoking the participants. We measured participants' cortisol and testosterone levels in saliva and blood, controlling for scanner novelty, menstrual cycle, and contraceptive use. While we found no relationships between OFC activation and aggressive behavior, reactivity to angry faces in the left superior temporal gyrus (STG), right temporo-parietal junction (TPJ), and bilateral amygdala were all positively related to aggression. Mediation analyses revealed that salivary testosterone and STG activity fully and positively mediated the relationship between amygdala reactivity and reactive aggression. Our results suggests a fine-tuned neural mechanism by which threat signals processed in the amygdala can be modulated by the current endocrine state and by other mentalizing areas in order to facilitate aggressive retaliation in women.

E29

THE INFLUENCE OF AFFECTIVE CONTEXT ON BRAIN AND BEHAVIORAL RESPONSES TO NEUTRAL STIMULI

Chelsea Boccagno[1], Bruce Doré[1], Damaris Fuster[2], Tanya Singh[2], Rhea Kotecha[1], Jochen Weber[1], Sadia Chaudhury[2], Barbara Stanley[2], John Mann[2], Kevin Ochsner[1]; [1]Columbia University, [2]New York State Psychiatric Institute — The context in which a stimulus is presented can influence processing of the stimulus's value. Though functional neuroimaging studies have begun to assess general emotional intensity (e.g., whether or not an emotion is elicited) in response to neutral images (e.g., in clinical populations; Lakis & Mendrek, 2013), little is known about the influence of emotional context on the affective evaluation of neutral stimuli. In order to assess whether emotional evaluation of neutral stimuli is affected by the context in which the stimuli are presented, the current study examined brain and behavioral responses to neutral images within a positive versus negative context in 19 healthy individuals (age: 18-65). While undergoing a functional magnetic resonance imaging scan, participants viewed neutral images within blocks of either positive or negative International Affective Picture System images. Following each image, participants were asked to rate their affect. Results indicate that neutral images evoked a greater response in the ventromedial prefrontal cortex (vmPFC)—a region involved in computing the value of emotional stimuli (Winecoff, 2013)—when intermixed with negative relative to positive images. Furthermore, individuals who reported greater positive affect in response to neutral images within a negative versus positive context also showed increased vmPFC activity and more negative vmPFC-amygdala connectivity. These analyses indicate that the context in which a neutral stimulus is presented influences brain regions associated with evaluation and positive value, and that the degree of this activation correlates with positive affective response.

E30

CONTROL OVER AVERSIVE OUTCOMES IN HUMANS: EFFECTS ON THREAT RESPONSES AND NEURAL MECHANISMS

Emily A. Boeke[1], Justin M. Moscarello[1], Joseph E. LeDoux[1,2], Elizabeth A. Phelps[1,2], Catherine A. Hartley[3]; [1]New York University, [2]Nathan Kline Institute, [3]Sackler Institute for Developmental Psychobiology, Weill Cornell Medical College — Research in rodents has indicated that instrumental control over an aversive outcome can result in reduced defensive Pavlovian reactions. We sought to investigate whether this phenomenon extends to humans and understand the neural mechanisms underlying this effect. Subjects (N=48) underwent a 2-day threat learning protocol in an fMRI scanner. On day 1, subjects underwent the acquisition phase, in which they viewed a stimulus (CS+) that coterminated with mild shock and a stimulus not paired with shock (CS-). Next, subjects in the "Master" group underwent an avoidance phase in which they learned an instrumental response to avoid the shock. "Yoke" subjects underwent yoked extinction where they saw the same CSs and received the same number and timing of shocks as a particular Master subject, but they had no control over the shock. On day 2, we assessed defensive Pavlovian responses during the recall and novel acquisition phases. Our measure of threat responses was the conditioned response (CR, CS+ minus CS- skin conductance). Yokes showed the typical increase in CR from safety learning to recall phases, while Masters did not. Master subjects also showed reduced CR during novel, compared to initial acquisition, whereas Yoke subjects showed equivalent CR across the two days. Masters showed decreased amygdala and increased vmPFC BOLD response, compared to Yokes, during the avoidance/extinction phase. The results suggest that the effects of having control over an aversive outcome generalize to new episodes of threat learning and highlight a potential behavioral and neural pathway to resilience in humans.

E31

DELAYED ACQUISITION OF CONTEXTUAL FEAR IN HUMAN CB1-POLYMORPHISM

Dorothea Neueder[1], Marta Andreatta[1], Robert Blum[3], Jürgen Deckert[2], Paul Pauli[1]; [1]Department of Psychology I, Würzburg, [2]Department of Psychiatry, Psychosomatics and Psychotherapy, Würzburg, [3]Institute of Clinical Neurobiology, Würzburg — Sustained fear and fear generalization are two crucial mechanisms involved in the etiology and maintenance of anxiety disorders. Recent studies indicated interactions of the cannabinoid receptor 1 gene (CNR1) and learning deficits in cued and contextual fear conditioning. To investigate the impact of CNR1 variants on contextual fear conditioning, participants were genotyped for the functional CNR1 rs2180619 polymorphism and underwent a conditioning and generalization paradigm in virtual reality (VR). During two acquisition phases (Day1), one virtual office (anxiety context, CTX+) was paired with an unpredictable electric stimulus (unconditioned Stimulus, US), whereas another virtual office (safety context, CTX-) was never paired with the US. During two generalization phases (Day2), three additional generalization contexts (G-CTX1: 75%; G-CTX2: 50%; G-CTX3: 25%) were presented, creating a continuum of similarity between the anxiety (100%) and the safety (0%) context. We found successful context conditioning as indicated by more negative valence, higher arousal, anxiety and contingency ratings for the CTX+ as compared to the CTX-. However, homozygous for the A allele (n=12) showed delayed acquisition of the conditioned anxiety (i.e., after second acquisition phase) as compared to G-allele carriers (n=15). During generalization test, ratings demonstrated a linearly declining generalization gradient as the presented office becomes less similar to the CTX+. This effect was not modulated by genotype. Our results suggest slower acquisition of contextual anxiety in A/A homozygotes. This indicates a modulatory role of CNR1 gene variation in sustained anxiety responses to contextual information.

E32

NEURAL CORRELATES OF PROCESSING GENERAL THREAT-RELATED SCENES IN GENERALIZED ANXIETY DISORDER RELATIVE TO PANIC DISORDER, SOCIAL PHOBIA AND NONANXIOUS HEALTHY CONTROLS

Christine Wilhelm[1], Paula Neumeister[1], Katharina Feldker[1], Carina Heitmann[1], Thomas Straube[1]; [1]University of Muenster — Generalized anxiety disorder (GAD) is characterized by chronic, excessive and uncontrollable worry about a variety of topics. From a neurobiological perspective it is still poorly understood how patients process adverse complex scenes. Here, we investigated brain activation to general threat-related and neutral scenes in GAD using functional magnetic resonance imaging (fMRI). To particularly elucidate GAD-specific neural correlates, brain response patterns were compared to healthy controls (HC) but also to patients suffering from panic disorder (PD) or social phobia (SP). Rating data revealed significantly increased anxiety to threat in GAD compared

to the other groups. FMRI results show common effects across all groups in several regions, including amygdala, insula and frontal areas. However, GAD as compared to the other groups showed additional hyperactivation in left insula, dorsolateral prefrontal cortex (dlPFC), dorsal anterior cingulate cortex (dACC), mid cingulate cortex (MCC) and posterior cingulate cortex (dPCC) to general threat-related versus neutral scenes. These activations suggest cortical regions, mainly in cingulate cortex, associated with GAD specific abnormal processing of general threat.

EMOTION & SOCIAL: Person perception

E33

EXPLORE THE CODING OF EMOTIONAL VALENCE OF FACES USING MULTIVOXEL PATTERN ANALYSIS (MVPA)

Maria Antonieta Bobes Leon[1], Agustin Lage[1], Marlis Ontiveiro[1], Pedro Guerra[2], Alicia Sanchez-Adam[2], Jaime Vila[2], Mitchell Valdes-Sosa[1]; [1]Cuban Neuroscience Center, Cuba, [2]University of Granada, Spain — Interpersonal relationship modulate the affective valence assigned to faces. On the other hand, valence for unfamiliar faces can depend solely on physical appearance. It is not clear if processing of affective valence of familiar faces implicates a specific functional network, or if it relies on a more general face-emotional system, which could also process attributes such as attractiveness or trustworthiness. Here we contrasted these two options by means of an fMRI MVPA study. We obtained high spatial resolution fMRI responses to four face conditions, resulting from the crossing of two factors: familiarity (familiar vs. unfamiliar) and emotional valence (agreeable vs. disagreeable). Peripheral measures and subject's ratings were used to validate the categorization of the stimuli. MVPA was performed on functional ROIs that had been previously described to be part of the face processing networks. Results showed that unfamiliar face valence was decoded in early visual areas and core face areas (OFA, FFA and pSTS), whereas familiar faces valence was decoded in areas within ventro-lateral frontal cortex and insula. The response-pattern dissimilarity matrices analysis corroborated the presence of different types of ROIs, those responding to all face stimuli, located in the occipito-toremporal lobes, those coding familiarity like CP, and those like AC and mOF, which distinguishes familiarity, and valence of faces. Our findings suggest that the valence associated to personal significance, and the valence associated to the physical appearance of faces, are processed in largely dissociable neural systems.

E34

FAMILIARITY FACILITATES FEATURE-BASED FACE PROCESSING

Kelsey Wheeler[1], Matteo Visconti di Oleggio Castello[1], M. Ida Gobbini[1,2]; [1]Dartmouth College, [2]University of Bologna, Bologna, Italy — Familiar faces are processed more efficiently than unfamiliar faces. Extensive exposure to an identity leads to the formation of a robust representation, facilitating faster response times for those identities (Tong & Nakayama, 1999). Robust representations were also shown to mediate reliable and rapid choice saccades to familiar faces with unfamiliar faces as distractors at a latency (180 ms) that precedes any known neural response differentiating familiarity (Visconti di Oleggio Castello & Gobbini, 2015). We asked if feature-based face processing could be driving these rapid responses for robustly represented identities. Inversion has been shown to disrupt configural processing, solicit feature-based processing and control for low-level confounds (Farah et al., 1995). Thus, we tested how face inversion and personal familiarity affected subject performance in a visual search paradigm. As expected, subjects responded more quickly to familiar targets than unfamiliar targets in the upright condition. Interestingly, subjects were also faster to respond to familiar faces than unfamiliar faces in the inverted condition. Additionally, subjects were faster to indicate the target was absent when searching for a familiar face relative to an unfamiliar face among identical sets of 2, 4, or 6 unfamiliar distractors. These results suggest that the processing mechanism for robust representations is maintained across conditions, pointing to the use of a feature-based processing system for efficient recognition of faces.

E35

FAMILIARITY AND RECOLLECTION OF OWN-RACE AND OTHER-RACE FACES MEASURED WITH AN OBJECTIVE MEMORY-JUDGMENT TASK

Greta Minor[1], Makenzie Adkins[1], Grit Herzmann[1]; [1]The College of Wooster — People are better at memorizing and recognizing faces from their own race as compared to faces from a different race. Research on subjective memory judgments found that recollection but not familiarity is enhanced for own-race faces. We used an objective memory-judgment task and event-related potentials (ERPs) of memory encoding and retrieval. East Asian and Caucasian subjects studied Chinese and Caucasian faces presented on different backgrounds. Subjects were asked to recognize the studied faces among novel faces. Only for "old" faces, subjects had to indicate the color of the background on which the face appeared during study. Recollection was measured as correct face and background recognition. Familiarity was measured as correct face but incorrect background recognition. Instead of using own-race and other-race groups as subject variables, social contact was used as covariate in data analysis. No influence on familiarity was found. Subjects reporting high contact with Chinese people recollected Chinese faces more accurately. Study phase ERPs showed an increased recollection effect for Chinese faces in subjects with higher contact. At test, subjects with higher contact to Chinese people showed smaller differences between the ERP recollection and familiarity effects. This suggests that the objective memory-judgment task caused subjects to encode all Chinese faces deeply such that they subsequently possessed strong memory traces whether or not the background was correctly recognized. Caucasian faces did not show any differences which might be due to all subjects living in a predominantly Caucasian environment. This study confirms previous predictions about memory for own-race and other-race faces.

E36

PATIENTS WITH CHRONIC FACIAL PALSY DISPLAY IMPAIRMENTS IN EARLY ENCODING OF FACES: ERP SUPPORT FOR THE FACIAL FEEDBACK HYPOTHESIS

Christian Dobel[1], Jessica Komes[1], Helene Kreysa[1], Fabian Volk[1], Holger Wiese[2], Orlando Guntinas-Lichius[1], Stefan Schweinberger[1]; [1]Friedrich Schiller University Jena, [2]Durham University — Unilateral chronic facial palsy is a neuromuscular disorder impairing facial movement. This affects not only habitual tasks/requirements/occupations such as eye closure, eating and drinking, but also the display of emotional expressions. To date, it is unclear whether the perception of emotions, as predicted by the facial feedback hypothesis, is also altered in these patients. To this end, we tested twenty patients suffering from chronic peripheral facial palsy, (patients with central neurological defects were excluded) and an age- and gender-matched control group. Pictures of faces displaying happy, surprised, angry, sad and neutral expressions were presented as stimuli. Emotional expressions were shown with morphed emotion intensities of 50 and 100%. To create task demands, pictures of butterflies served as rare filler items which had to be detected. Analyses of amplitudes and latencies of event-related potentials revealed interactions of the factor group with intensity and/or emotional expression for early components such as the P1 and, more strongly, the N170. Most importantly, patients displayed larger amplitudes of the N170 to negative emotional expression, i.e. angry faces, presented with an intensity of 50%. We interpret these results as the recruitment of attentional resources in order to clarify the ambiguous emotional expression. Taken together, the study demonstrates that early encoding of faces is altered in patients with facial paresis, providing support for the facial feedback hypothesis.

E37

THE RELATIONSHIP BETWEEN GENDER, AUTISTIC TRAITS, AND EYE MOVEMENT PATTERNS DURING MENTAL ROTATION AND EMOTIONAL FACE PROCESSING IN COLLEGE STUDENTS

Mary Foggo[1], Sarah Godfrey[1], Brennan McFarland[1], Tess Wiggin[1], Jennifer Stevenson[1]; [1]Ursinus College — The current study explored accuracy, response time, and eye movement patterns during mental rotation and emotional face tasks. It was hypothesized that men would be more accurate and faster on mental rotation whereas women would be more accurate and faster on the emotional face task, consistent with research on gender differences. This study also hypothesized that adults with more autistic traits would perform better

on mental rotation than the emotional face task, consistent with the extreme male brain theory of autism. Finally, it was hypothesized that adults with more autistic traits would fixate more on the mouth region whereas adults with fewer autistic traits would fixate more on the eye region. Ninety-seven college students (38 males) viewed pairs of shapes and faces to determine if these images were the same or different while their eye movements were recorded. Participants also completed the Autism-Spectrum Quotient to assess number of autistic traits. Men were more accurate, but not faster, than women on mental rotation. However, there were no gender differences in accuracy or response time on the emotional face task. Furthermore, participants spent more time fixating the mouth region than the eye region and participants with more autistic traits tended to spend more time fixating both regions. Additional analyses will include eye movement patterns during mental rotation. The extreme male brain theory was not supported, but results suggest there are gender differences for mental rotation and different strategies of emotion processing for people with varying levels of autistic traits.

EXECUTIVE PROCESSES: Monitoring & inhibitory control

E38

NEURAL EVIDENCE FOR RETRIEVAL ATTEMPTS AS AN EXPLANATION FOR THE DELAYED JOL EFFECT

Timothy Kelley[1], Debbie Magreehan[1], Michael Serra[1], Tyler Davis[1]; [1]Texas Tech University — Research on the neurobiology of metacognition is sparse and has thus far focused primarily on immediate judgments of learning (JOLs). When monitoring their learning behavior, however, people often make delayed JOLs separated temporally from their initial study. Research in the behavioral literature suggests that delayed JOLs differ in notable ways from immediate JOLs, particularly in the higher overall accuracy of delayed JOLs. There are several competing theories of why delayed judgments are associated with higher accuracy, the most prominent of which suggests that people make a retrieval attempt when they make delayed JOLs. The current study used fMRI to provide neural evidence to evaluate this account. Participants studied pairs of faces, scenes, and objects. They made JOLs predicting their future memory for each item either immediately or at a random delay from the study of an item before completing a recognition memory test. fMRI analysis revealed that during both immediate and delayed JOLs, category-specific regions associated with perceiving these objects were reactivated. Reactivation was greater during delayed JOLs compared to immediate JOLs, which suggests that participants attempted to retrieve the response of a pair when making their delayed JOLs, consistent with the retrieval-attempt account of the delayed JOL effect.

E39

REACTIVATION STRENGTH UNDERLIES SUCCESSFUL STOPPING IN SELF-PACED LEARNING

Sean O'Bryan[1], Eric Walden[1], Michael J. Serra[1], Savana Gierstorfer[1], Tyler Davis[1]; [1]Texas Tech University — When weighing decision evidence, individuals are continually faced with the choice to gather more information or to act on what they have already learned. The present experiment employed a self-paced category learning task using fMRI to examine the neural indices of stopping behavior and how they vary as a function of individual differences. Participants learned to classify image triads as belonging to one of two categories via feedback. The triads consisted of face, object, and scene cues presented simultaneously. Only one class of cue was predictive of category membership, and subjects were tasked with solving this category rule. After each trial, participants were given the option to explicitly solve the rule (indicating whether faces, objects, or scenes were predictive) or to continue learning. Once a subject opted to solve, both the rule and accompanying stimuli were randomly reset. Behaviorally, subjects displayed substantial variability in both frequency of solving (stopping) and response accuracy. Analysis of the fMRI data revealed widespread activation centered in medial prefrontal cortex for opting to solve compared with opting to continue. Higher accuracy on the task was associated with activation of object selective ventral occipitotemporal cortex when subjects chose to solve the rule, despite no images being present on the screen at this time. Accuracy was also predictive of increased signal in medial prefrontal cortex. Together, these findings suggest that reactivating the information associated with a rule when deciding whether to stop may be a strategy that increases accuracy in stopping behavior.

E40

P3B AND PE AS NEURAL INDICES OF CONFIDENCE

Paul J. Beatty[1], George A. Buzzell[1], Daniel M. Roberts[1], Craig G. McDonald[1]; [1]George Mason University — Previous work investigating the neural basis of performance monitoring has identified several event-related potential (ERP) components that have been linked to confidence judgments. Recent work suggests that the error positivity (Pe) and P3b component (P300) may provide a graded index of subjective confidence during decision-making tasks. However, most studies that have investigated the relationship between these components and confidence have not severely taxed perceptual discrimination processes. In the present experiment, EEG was recorded while participants performed a difficult visual discrimination task and reported their subjective certainty of response on a trial-by-trial basis. We investigated the electrophysiological correlates of perceptual confidence by comparing Pe, P3b, and ERN/CRN amplitude for subjectively-reported sure and unsure trials. Analysis revealed that, during a difficult stimulus discrimination paradigm, although variations in ERN/CRN amplitude did not predict changes in confidence, both the Pe and P3b provided a graded index of decision confidence, irrespective of trial accuracy. Our findings provide support for the notion that the Pe and P3b are sensitive indices of confidence, even in situations where the ability to monitor objective performance is severely constrained by task difficulty. These findings reinforce the notion that the P3b and Pe can be used as a robust index of confidence in studies where it may not be possible to assess a direct subjective report of confidence.

E42

COGNITIVE CONTROL AND PTSD SYMPTOMS AS INDEPENDENT PREDICTORS OF OPIATE USE DISORDERS AMONG ACTIVE DRUG USERS IN BALTIMORE, MD

Tabitha E H Moses[1], Pia M Mauro[2], Jonathan J Rose[1], William W Latimer[1]; [1]School of Health Sciences, Human Services and Nursing, Lehman College, City University of New York, Bronx, NY, [2]Columbia University Mailman School of Public Health, New York, NY — Background: Individuals with lower cognitive control and those with trauma exposure are more likely to meet substance use disorder criteria. We assess whether trauma exposure moderated the relationship between opiate use disorder (OUD) and cognitive control in a community sample of active drug users. Methods: Data were obtained from 260 drug-using adults ages 18-59 (mean=41.5, SD=9.9) in a randomized controlled trial in Baltimore, MD; 43.4% were male and 68.1% were non-white. Interviews assessed substance use, trauma, and neuropsychological function. Separate logistic regressions measured the association between lifetime OUD and Stroop interference t-score quartiles, as well as Post Traumatic Stress Disorder (PTSD) symptoms (mean=4.59, SD=3.41), adjusting for age, gender, and race. We assessed whether trauma exposure moderated the relationship between OUD and Stroop interference. Results: 60.8% met OUD criteria. Relative to the lowest interference quartile, the third quartile was associated with increased odds of OUD (odds ratio (OR)=2.65, 95% confidence interval (CI) 1.25-5.62, p=0.011), as was the highest quartile (OR=3.22, 95% CI=1.53-6.81, p=0.002). Reporting more PTSD symptoms was associated with increased odds of OUD (OR=1.10, 95% CI 1.02-1.19 p=0.014); however, PTSD symptom count did not moderate the OUD-interference relationship. Conclusions: Higher trauma and lower cognitive control independently increased likelihood of OUD among active drug users. Interventions targeting cognitive control to reduce OUD could have attenuated effects unless concurrently addressing PTSD symptoms.

E43

MONITORING AND ACCUMULATION MECHANISMS IN ACTION VOLITION

Holly Phillips[1,2], Laura Hughes[1,2], Jiaxiang Zhang[2,3], James Rowe[1,2]; [1]University of Cambridge, [2]MRC Cognition and Brain Sciences Unit, [3]University of Cardiff — We can choose whether, when or what action to make. Whilst there is evidence for accumulation-to-threshold mechanisms underlying many different types of decision making process, few studies have investigated the accumulation-to-threshold mechanisms underlying voluntary action. FMRI studies suggest the presence of accumulators in pre-supple-

mentary motor areas and premotor cortex, and distinguished these from a monitoring role associated with the ventrolateral prefrontal cortex (vPFC). The vPFC has been suggested to inhibit motor accumulators in premotor regions, with the effect of reducing repetition of voluntary action choices. Here, we investigated action decisions using direct electrophysiological recordings, exploiting the greater temporal resolution. Synchronous neural activities were recorded using magnetoencephalography, while participants either pressed a specified button or were given choice of which button to press (with no overt rewards or external cuing between possible responses). Behavioural data were fitted using linear ballistic accumulators, with model fitting and selection of free parameters by BIC. Model parameters were used to interrogate the M/EEG data, with the predicted accumulator activity to correlate with the envelope of beta and gamma power. We found evidence for activity accumulation in medial frontal cortex (cf the fMRI studies), and evidence for the monitoring role of the vPFC during choice. Using an evoked dynamic causal modelling of connectivity in the extended motor system, we observed modulated connections from vPFC to parietal and premotor areas. Our findings confirmed the central role of medial frontal cortex in evidence accumulation, and provide new evidence for the vPFC's monitoring and modulatory role in action selection.

E44

TDCS OVER PREFRONTAL CORTEX PREVENTS TASK-RELEVANT INHIBITION IN AN UNCOMMON ENDING SENTENCE COMPLETION TASK

Emilio R. Tamez[1], David S. Rosen[2], Sharon L. Thompson-Schill[1]; [1]The University of Pennsylvania, [2]Drexel University — The left inferior frontal gyrus' (LIFG) role in inhibitory cognitive control is well characterized. Previous work has indicated that decreases in cognitive control might improve subjects' ability to generate uncommon uses for familiar objects. Here, we explore the effects of varying levels of cognitive control on creative language production via anodal or cathodal transcranial direct current stimulation (tDCS) over the LIFG. Our sample (N=46) was roughly balanced between stimulation conditions, gender, and age. Stimuli were grammatical sentences with cloze probabilities for completion between 0.7-0.9. Subjects completed an FAS phonemic fluency task (FAS), a reading span test, and a short practice before stimulation. We stimulated at 1.5mA over F7 (mastoid reference) for 17min (30s sham), with 180s fixation pretask. Participants were given 5s per sentence to generate an "uncommon" ending as quickly as possible. Response times (RT) were collected. Semantic similarity of responses to cloze completions was assessed using Latent Semantic Analysis (LSA). Analysis of RTs and LSA was done using linear mixed-effects regression, while logistic mixed-effects regression was used on accidental cloze responses (errors). We found no effect of stimulation on RTs or LSA relative to sham. However, anodal stimulation doubled the odds of error relative to sham (odds ratio=2.03, p=0.026, Wald test). Cathodal had no effect relative to sham. These results suggest that the LIFG may be responsible for selecting a non-cloze response over the cloze response, though more analyses are necessary to determine the region's specific contributions to task performance.

E45

PREPARING FOR HARD TIMES – SCALP AND INTRA-CRANIAL PHYSIOLOGICAL RECORDINGS SHOW PREPARATION FOR HARD MENTAL CALCULATIONS

Clio Janssens[1], Eliana Vassena[1], Leen De Taeye[2], Alfred Meurs[2], Dirk Van Roost[2], Robrecht Raedt[2], Paul Boon[2], Gilles Pourtois[1], Tom Verguts[1]; [1]Ghent University, [2]Ghent University Hospital — Investing mental effort is sometimes necessary but also costly. Cognitive control is needed to regulate effort investment based on predictive information regarding task difficulty and potential reward. fMRI studies show that both types of information lead to similar preparatory brain activity. In EEG, preparation between cue and target is reflected in the contingent negative variation (CNV), with increased CNV amplitude when reward is predicted compared to no reward. Comparable preparation might be expected following cues predicting difficulty, but for now there is little evidence for this. In the current study we investigate the CNV in a mental arithmetic task. In contrast to previous studies, here an immediate motor response following the preparation was avoided, eliminating motor preparation from the CNV. A difficulty cue (3000 ms) was followed by two consecutive arithmetic operations to be performed. After the calculations, a choice had to be made between two possible outcomes. Results showed a more negative amplitude for the CNV following 'hard' than 'easy' cues, indicating increased mental preparation to invest effort. The CNV amplitude was also correlated to behavioral accuracy, supporting the fact that preparation reflected in the CNV aids task performance. Importantly, such modulation was recorded in absence of a motor preparation, thus showing that mental preparation alone affects the CNV. Intracranial recordings from anterior insula (AI) in a refractory epileptic patient, using the same paradigm, reveal a cue-locked negative wave (similar to the scalp CNV) affected by difficulty information, suggesting contribution from AI to signal the need for effort investment.

E46

IMPLICIT LEARNING FACILITATES COGNITIVE CONTROL IN A RESPONSE SWITCHING TASK

Silvia Isabella[1], Charline Urbain[1], J. Allan Cheyne[2], Douglas O. Cheyne[1]; [1]University of Toronto and Hospital for Sick Children, [2]University of Waterloo — In previous work we demonstrated that performance during rapid choice response tasks correlated with cortical oscillations in specific brain regions (Isabella et al., 2015). The primary objective of this study was to determine whether performance can be facilitated by implicit learning of stimulus sequences with the overarching goal of identifying brain activity underlying corresponding changes in cognitive control. Seven subjects performed seven blocks of a go/switch task, where digits '1', '2' and '4' required a right index finger button press (Go), and '3' a left index finger press (Switch). Unbeknownst to the subjects, the stimuli were presented in a repeating 8-trial semi-probabilistic pattern (3-1-4-3-2-4-1-2), known to induce implicit learning in a serial reaction time task (Gabriel et al., 2011). To assess sequence learning, 90% of trials presented the same pattern (probable), whereas 10% of trials presented a deviation from the pattern (improbable). Reaction times (RT) for improbable Switches ('3' stimulus, pattern deviation) were longer than probable Switches ('3' stimulus, intact pattern; $p = 0.01$). Additionally, RT for improbable Go trials in place of Switches (i.e. the pattern called for '3') were longer than probable Go trials ($p < 0.001$). Longer RT following improbable stimuli over probable stimuli demonstrates that subjects implicitly learned to anticipate Switch trials and subsequently improved performance on the cognitive control task. This provides a novel paradigm for studying neural activity accompanying implicit learning in a repetitive motor response task, which may underlie the development of automatic control of goal-directed actions.

E47

ADOLESCENT RISKY DECISION-MAKING: IMPULSIVE ACTION OR MOTIVATED CHOICE?

Diane Goldenberg[1], Adriana Galvan[1]; [1]University of California, Los Angeles — Adolescence is characterized by increased risk-taking, potentially related to immature inhibitory control. Recent work has begun illuminating adolescent decision-making as motivated and goal-directed; however, the extent to which adolescent risk-taking is a product of motivated choice or impulsive action is unclear. The present study used a task designed to examine the neural correlates of inhibitory control and motivated choice within a single paradigm. Thirty-five adolescents (ages 15-18 years; 59% female) underwent functional magnetic resonance imaging (fMRI) while performing the Driving Game, which was adapted from the Stoplight Task (Chein et al., 2011). In the Stoplight Task, individuals can stop (cautious choice) or go (risky choice) at yellow lights in pursuit of monetary reward. The Driving Game includes an inhibition component that requires individuals to stop for unexpected red lights. In this way, yellow lights represent motivated risky choice and red lights represent inhibition. During red lights, participants successfully inhibited 94.91% of trials (SD=10.57) with a mean response time of 535.90 ms (SD=72.44 ms). During yellow lights, participants made a risky choice 37.53% of the time (SD=27.87). Mean response time for cautious trials was 599.70 ms (SD=90.37). Main effects during inhibition revealed significant activation in regions involved in cognitive control (e.g. right inferior frontal gyrus) and reward (e.g. caudate). Decision-making evoked activation in the anterior cingulate. Receipt of reward elicited response in the caudate and medial prefrontal cortex, implicated in reward-guided learning. Findings suggest that adolescent risky decision-making is, in part, a deliberative process guided by evaluation of outcomes.

EXECUTIVE PROCESSES: Other

E48

FUNCTIONAL CONNECTIVITY CHANGES REFLECT SYSTEM INTERACTIONS DURING DIFFERENT STAGES OF CUED TASK TRIALS

Haoxin Sun[1], Caterina Gratton[1], Timothy Laumann[1], Babatunde Adeyemo[1], Steven Petersen[1]; [1]Washington University in St. Louis — Goal directed attention tasks involve activity of top-down control and bottom-up sensory systems. However, how and when these systems interact remains unclear. Here, we used a cue-target paradigm to compare changes in functional connectivity (FC) between control (e.g., frontoparietal and dorsal attention) and processing (e.g. visual and motor regions) systems during cue and target portions of a Posner task. We used predefined gray-matter regions for all FC analyses. To diminish influences from frank evoked activity, time-series correlations following regression of a mixed block/event-related GLM were used to calculate FC related to rest, cue, and target periods. Overall, FC changed significantly across different portions of the task. Cue-related FC showed primarily integration of control systems with both sensory and other control regions. Compared to cue, frontoparietal and ventral attention regions showed right-lateralized FC increases with visual regions and bilateral FC increases with dorsal attention regions. FC within specific control systems increased as well. Moreover, target-related FC showed primarily separation of systems. Compared to cue, between-system FC among dorsal attention, ventral attention, and cingulo-opercular control systems decreased towards rest. Additionally, frontoparietal regions showed right-lateralized FC decreases with visual regions and bilateral decreases with motor regions. Lastly, compared to rest, target-related FC showed further increases within cingulo-opercular, visual, and motor systems. Our results exhibited complex and dynamic relationships among functional systems, even during a single trial. The cue-driven integration and target processing-driven separation of control and processing systems suggest control systems mostly need to modulate down-stream processes early in a goal-directed context.

E49

NEURAL SYSTEMS THAT UNDERLIE CLINICAL DECISION MAKING: AN ELECTROENCEPHALOGRAPHIC INVESTIGATION

Chad Williams[1], Mike Paget[2], Sylvain Coderre[2], Kelly Burak[2], Bruce Wright[3], Olave Krigolson[1]; [1]Neuroeconomics Laboratory, University of Victoria, [2]Faculty of Medicine, University of Calgary, [3]Division of Medical Science, University of Victoria — Clinicians face a difficult task – faced with an abundance of information, sometimes conflicting - they have to make decisions about the diagnoses of clinical cases. Typically, clinical decisions are framed within a conceptual framework that posits the existence of two decision systems – a Type I system that reflects fast, "gut hunch" decisions and a Type II system that reflects a slower, more analytical decision process. In the present experiment we utilized electroencephalography (EEG) to examine the neural processes that play as participants learned to make clinical decisions. Using the "CARDS" paradigm developed at the University of Calgary, we had participants with no medical training learn to diagnose clinical cases using a trial and error reinforcement learning process while EEG data was recorded. Our behavioural data indicated that undergraduate students with no medical training were able to learn to diagnose clinical cases. Interestingly, feedback evaluation by participants was associated with medial-frontal neural activity. Specifically, feedback stimuli evoked a reward positivity – a component of the human event-related brain potential associated with a reinforcement learning system within the medial-frontal cortex. Further, we observed increased theta activity when participants deliberated clinical decisions to a greater extent than when they made rapid judgments – a result in line with previous work from our laboratory relating medial-frontal theta activity to Type II decision processes. In sum, our results demonstrate that the same cognitive processes that play a role in learning and decision-making within a general context also underlie clinical decision-making.

E50

EXECUTIVE FUNCTION PREDICTS READING AND SOCIO-EMOTIONAL OUTCOMES IN CHILDREN WITH DEVELOPMENTAL DYSLEXIA

Caoilainn Doyle[1], Lorraine Boran[1], Alan Smeaton[2], Geraldine Scanlon[3]; [1]School of Nursing and Human Sciences, Dublin City University, [2]INSIGHT and School of Computing, Dublin City University, [3]School of Education Studies, Dublin City University — Dyslexia is characterized by a difficulty in developing reading skills despite adequate instruction and intellectual ability. Also, socio-emotional control difficulties are associated with dyslexia. Despite extensive research, there remains little consensus on the neuro-cognitive underpinnings of dyslexia and associated behaviors. Executive function (EF) is a candidate factor for explaining both reading and socio-emotional difficulties in dyslexia. Addressing methodological issues from previous EF profiling studies, this study aims to (1) examine EF in dyslexia using Miyake's 3 factor model, and (2) examine the predictive relationship of EF with reading and socio-emotional control difficulties in dyslexia. Fifty five children (27 dyslexia, 28 control) aged 10-12 years completed a battery of executive function (inhibition, updating, and switching), reading and socio-emotional (parent rating scale) measures. Children with dyslexia made significantly more errors compared to controls on all measures of executive function (inhibition: $F(1,52)=6.78$, $p<.05$; updating: $F(1,53)=20.54$, $p<.001$; and switching $F(1,53)=11.57$, $p<.01$), reading ability ($F(1,53)=64.46$, $p<.001$) and socio-emotional behaviour ($U=132.5$, $p<.001$). Switching ability predicted severity of reading impairment in dyslexia ($R2 =.47$, $p<.001$), while inhibition predicted severity of social control problems in dyslexia ($R2 =.28$, $p=<.01$). Results suggest that EF may be implicated in the symptom expression of dyslexia and may be a candidate cognitive training intervention for children with dyslexia.

E51

EXERCISE INDUCED CHANGES IN HIPPOCAMPAL FUNCTION FOR SPATIAL NAVIGATION

Andreas Becke[1,2], Alondra Chaire[1], David Berron[1,2], Thomas Wolbers[1], Emrah Düzel[1,2]; [1]German Center for Neurgodegenerative Diseases, Magdeburg, [2]Institute of Cognitive Neurology and Dementia Research, Otto-von-Guericke-University, Magdeburg — Recent studies revealed the positive impact of aerobic exercise on memory function. Animal studies suggest that aerobic exercise is the critical factor for hippocampal (HC) neurogenesis and spatial navigation learning, a HC-specific function. In the current study, we implemented a 4-month exercise training program with sedentary young adults, and examined whether aerobic exercise resulted in improved spatial navigation learning and structural changes within the medial temporal lobe. 42 sedentary subjects (19-34y) were assigned to either an aerobic exercise training group (TG) or a control group (CG). The TG exercised 45-75 minutes, three times a week, at 70-90% of their maximum heartrate (CG walked 15 minutes twice a week at 50% HRmax). Before and after the intervention, individual fitness was examined via VO2-consumption in an incremental treadmill walking test. 7T-MRI was used for the aquisition of ultra-high resolution (0.4x0.4x1.0mm) T2-weighted images orthogonal to HC. Participants' spatial navigation abilities, were tested using a virtual environment comprising a 4-way intersection, which they learned from an egocentric perspective. When approaching the intersection from a different direction they had to indicate the initial starting position. We observed improvements in behavioral performance on the navigation task as a effect of aerobic exercise. Specifically, the TG's reaction times were significantly faster than the CGs. Furthermore, correlation analysis showed that subjects with greater increase in fitness (more VO2 at respiratory compensation) improved more in reaction times during the navigation task and that these effects correlate specificly with volumetric changes in HC regions.

E52

THE EFFECTS OF CONCUSSIONS ON INHIBITION AND ATTENTION

Jon Sigurjonsson[1], Nishanthi Anthonipillai[1,2], Mohibur Rahman[1], Nicole Begani[1], Ashley Kurian[1], Diego Zarate[1], Christopher Polidura[1]; [1]The City College of New York, [2]NYU Langone Medical Center — Researchers suspect that concussions are underreported due to various factors. This has increased the need for more objective tests for concussions such as EEG markers. Various EEG markers for concussion have been proposed, the P3 has been reported to be the most consistent indicator of attentional problems following a concussive event. Sixty three males, aged 18-28 from athletic and non-athletic backgrounds, were recruited to estimate their awareness of their concussion history, and the effects of concussions to their cognitive function. Participants completed the Think First concussion questionnaire, Trail Making Test (TMT), the Mismatched Negativity Task (MMN), and the SART attention and inhibition task. 10 participants reported diagnosed concussions

while an additional 21 participants reported other symptoms of concussions after receiving blows to the head, indicating a possible concussive episode. Differences in completion time on part B of the TMT and the SART were found between the concussed and non-concussed participants. Morlet wavelet analysis was used to analyze brain activity 300 milliseconds after the onset of the N stimulus in the MMN task. Frontal and posterior activity bursts were diminished in the concussed compared to the non-concussed group. The non-concussed group also displayed activity in the beta frequency in the DLPFC but this burst minimal in the experimental group. The results indicate a lack of awareness of concussions, that few blows to the head can cause a disruption of cognitive and electrophysiological activity, which in turn highlights the need for objective physiologically based tests for the symptoms of concussions.

E53

PRELIMINARY RESULTS FOR A DISSOCIATION BETWEEN PTSD AND MTBI USING ERPS

Heather E. Soder[1], Taylor K. Haggerty[1], Patricia L. Johnson[1], Cynthia R. Cimino[1], Geoffrey F. Potts[1]; [1]University of South Florida — Symptoms of Post Traumatic Stress Disorder (PTSD) and mild Traumatic Brain Injury (mTBI) overlap, but impact different neurocognitive systems. Event-related potentials (ERPs) provide a sensitive assessment of cognitive function, thus may distinguish between these diagnoses. This study examined student veterans returning from Operation Iraqi Freedom/Operation Enduring Freedom diagnosed with PTSD, mTBI, or neither (veteran controls), and a group of healthy non-veteran students (non-veteran controls). P300 data were collected with visual oddball and color Stroop tasks. Neuropsychological tests were also administered, including the Continuous Performance Task (CPT). The PTSD group displayed a reduced P300 in both ERP tasks, while the mTBI group was similar to both control groups on the oddball but had a reduced Stroop P300. Veterans with mTBI had slower reaction times on both ERP tasks, suggesting the impairment may be motor related rather than perceptual. Less attentiveness on the CPT (assessed by individual variation) was associated with a reduced P300 on the oddball; however, there were no group differences on the CPT. These results suggest veterans with PTSD may have general cognitive efficiency impairment (reduced P300), while veterans with mTBI are only impaired when the task is cognitively challenging (the Stroop is more cognitively demanding). These results suggest a potential dissociation between veterans with PTSD and those with mTBI using ERPs.

E54

COGNITIVE CHANGES AFTER REASONING TRAINING IN INDIVIDUALS WITH BIPOLAR DISORDER

Erin Venza[1], Jeffrey Spence[1], Sandra Bond Chapman[1]; [1]The University of Texas at Dallas — This study examined the benefits of a gist-based reasoning training program on measures of executive control in adults with bipolar disorder. Although a substantial amount of literature has examined both manic and depressive states in bipolar disorder, there is relatively little information about the cognitive functioning of bipolar patients when they are in a euthymic or stable state, and even less research is available on the potential benefit of cognitive training in this population. We hypothesized that gist-based reasoning training would show generalized gains to untrained domains of executive control in memory, inhibition, switching, fluency, and nonverbal reasoning. Twenty-seven participants (11 male, 16 female), aged 21 to 75 years old, completed the study. Participants completed cognitive testing before their training, eight hours (2 hours/week) of gist-based training in small groups, and then underwent post-testing using the same pre-training measures. The training taught information processing strategies that were implemented and practiced through a variety of daily living contexts. Each strategy built upon previous strategies to transform the concrete meaning into abstracted gist-based meanings through reasoning and inferencing. Results indicated that participants showed significant gains in the trained domain of abstract reasoning ($p < 0.05$). Benefits of training extended to untrained domains of inhibition (Color-Word Interference Test), mental flexibility (DKEFS Card Sorting Test), and memory (Rey-Osterrieth Auditory Verbal Learning Test) ($p < .05$). This current study provides preliminary evidence that 8 hours of gist-based reasoning training can enhance cognitive performance in adults with Bipolar Disorder.

EXECUTIVE PROCESSES: Working memory

E55

THALAMIC ACTIVITY MODULATES CONNECTIVITY BETWEEN PREFRONTAL AND PARIETAL CORTICES DURING WORKING MEMORY

Anna Huang[1], Hoi-Chung Leung[1]; [1]Stony Brook University — Lesion and electrophysiological studies indicate that the thalamus plays an important role in working memory. While it is well established that working memory involves a network of regions that include the prefrontal and posterior parietal cortex, how the thalamus interacts with these regions during working memory is not clear. Studies of nonhuman primates suggest that the thalamus has a role in mediating information transfer between the prefrontal and posterior parietal cortices. This fMRI study seeks to examine this issue in human subjects by analyzing the influence of thalamic activity on prefrontal and posterior parietal connectivity during a working memory task. FMRI data were collected from a group of 40 adult subjects during a working memory task (1-back) using face and scene stimuli. We identified a region within the thalamus using resting state fMRI data that showed significant connectivity to both prefrontal and parietal cortices. We then examined changes in the connectivity strength between the prefrontal and parietal cortices during working memory when thalamic activity is taken into account. We found that regressing out thalamic connectivity weakened connectivity between the prefrontal and parietal cortices during working memory. This suggests that the thalamus is an important node within the network of regions involved in working memory, and that it enhances prefrontal-parietal connectivity during working memory.

E56

EXPECTATIONS AND NON-INVASIVE BRAIN STIMULATION: DO THEY INFLUENCE COGNITION?

Sheida Rabipour[1], Allan D. Wu[2], Marco Iacoboni[2], Patrick S. R. Davidson[1]; [1]University of Ottawa, [2]University of California, Los Angeles — Researchers, clinicians, and commercial interests have advocated for transcranial direct current stimulation (tDCS) as a safe method for improving executive functions, including attention and memory. Nevertheless, inadequate study designs have led to unsuccessful replications and obscured the mechanism(s) through which tDCS may influence cognition and behavior. Notably, studies of tDCS rarely account for psychological factors such as expectations of outcomes, which may influence response to tDCS through placebo-like effects. We assessed expectations of tDCS outcomes in 51 healthy young adults (31 women; 18-27 years of age) on three occasions: i) at baseline; ii) after reading information implying either high or low effectiveness of stimulation; and iii) after a single-session of sham-controlled anodal tDCS applied to the left dorsolateral prefrontal cortex, with online working memory training. Participants were randomly assigned to the information (implying high or low effectiveness) and stimulation (active or sham) conditions. We observed high expectations of the effectiveness of stimulation in improving cognitive function at baseline, as well as a significant change in these expectations after reading the information provided. Ratings nevertheless decreased significantly across all groups following the intervention. Similarly, despite trends towards a stronger influence of expectation over stimulation on performance, behavioral results suggested no significant effect of baseline expectations, information, stimulation, or individual characteristics on measures of working memory, executive function, and verbal fluency, regardless of whether these cognitive functions were evaluated individually or as a composite score.

E57

NEUROPLASTICITY IN THE CONGENITALLY BLIND: LARGE-SCALE INTERACTIONS DURING WORKING MEMORY PROCESSING AND TRAINING

Johanna Rimmele[1,2], Helene Gudi-Mindermann[3], Guido Nolte[1], Brigitte Röder[3], Andreas K. Engel[1]; [1]University Medical Center Hamburg-Eppendorf, Germany, [2]Max Planck Institute for Empirical Aesthetics, Frankfurt am Main, Germany, [3]University of Hamburg, Germany — In visually deprived humans, task-dependent networks might be reorganized due to neuroplasticity, particularly resulting in the integration of the visual cortex into existing networks. In a working memory (WM) training paradigm, we found that train-

ing strengthened theta-band networks in sighted and beta-band networks, including visual cortex, in congenitally blind participants. Here, we investigated whether differences in WM networks already existed prior to the training, or whether new functional connections were established during the training. Magnetoencephalography was recorded in congenitally blind (n=27) and sighted (n=27) participants during resting state (RS) and while participants performed a two-back WM task with voices prior to a four-day WM training. Overall, the congenitally blind compared to the sighted participants showed reduced beta-band power in visual cortex during the WM task. Beta-band connectivity (imaginary coherency) within visual cortex was reduced in congenitally blind compared to sighted participants. When the neural activity recorded during the WM task was baseline corrected (i.e. contrasted with the RS data), congenitally blind and sighted participants showed no differences in power. However, in congenitally blind participants theta-band connectivity between areas involved in auditory WM was reduced compared to sighted participants. In summary, differences in theta-band WM networks existed between congenitally blind and sighted participants prior to WM training, while we found no differences in beta-band networks during task-performance. Together with the WM training findings, these findings suggest that besides strengthening existing connections, WM training resulted in establishing new connections.

E58

"PINGING THE BRAIN" TO REVEAL LATENT WORKING MEMORY STATES

Michael Wolff[1,2], Janina Jochim[2], Elkan Akyürek[1], Mark Stokes[2]; [1]University of Groningen, Groningen, Netherlands, [2]University of Oxford, Oxford, UK

— It has been proposed that information in working memory (WM) can be maintained in an "activity-silent" neural state. We recently developed an approach that is analogous to echolocation to reveal hidden neural states in electroencephalography (EEG). Participants performed a simple visual WM task while EEG was recorded. A task-irrelevant "impulse" stimulus was presented during the memory delay period. The impulse response could be used to decode the orientation of the maintained memory item. While this provides some promising evidence that otherwise hidden neural states can be revealed by driving brain activity with a visual stimulus, it remained unclear whether this effect is specific to WM. Therefore, we have conducted a follow-up EEG experiment to dissociate stimulus- from WM-driven effects. Participants memorized two simultaneously presented grating stimuli at the beginning of each trial. Subsequently, a visual cue indicated which of the two items would later be tested. In the following delay a high contrast irrelevant visual "impulse" stimulus was presented. The orientations of both items could be decoded from the posterior EEG channels during and shortly after initial presentation, though not towards the end of the first delay. However, the visual evoked potential of the impulse enabled us to decode the cued memory item, but not the uncued item. These results provide clear evidence that the decodable signal from the irrelevant stimulus is specific to information held in WM.

E59

MULTIVARIATE ANALYSES OF PRIMATE PREFRONTAL CORTEX ACTIVITY REVEAL SIMULTANEOUSLY STABLE AND DYNAMIC CODING FOR WORKING MEMORY

Eelke Spaak[1], Kei Watanabe[1], Shintaro Funahashi[2], Mark Stokes[1]; [1]University of Oxford, [2]Kyoto University

— Influential theories typically assume that visual working memory (WM) depends on the persistence of stable neural representations. However, recent advances in decoding neural signals with high temporal resolution have yielded evidence which suggests that neural states are highly dynamic. We applied several types of multivariate pattern analysis to explore the population dynamics of primate lateral prefrontal cortex (PFC) during the execution of multiple variations of classic working memory tasks: the memory-guided saccade and stimulus change detection. We observed dynamic coding even when the cognitive state remained stable. Dynamic coding could be characterized by two distinct processes. A rapid cascade of cell involvement during memory processing resulted in an early dynamic trajectory (i.e., a temporally dynamic population), whereas changing per-cell selectivity to task conditions contributed to time-varying coding over longer time scales (i.e., dynamic selectivity). Crucially, the representational geometry of the neural population remained remarkably constant over time, indicating a flexible mapping between the PFC dynamic neural code and the mnemonic state. Taken together, these results indicate that even in a task requiring very little cognitive manipulation like the classic memory-guided saccade task, PFC neurons display a dynamic population code, which can be maintained in the absence of above-baseline firing, and which supports a stable representational geometry coding for WM contents.

E60

SPATIAL CODING OF ORDINAL INFORMATION IN VERBAL WORKING MEMORY AS REVEALED IN UNILATERAL SPATIAL NEGLECT

Sophie Antoine[1], Mariagrazia Ranzini[1], Hichem Slama[1,2], Ann Tousch[1], Mario Bonato[3], Jean-Philippe van Dijck[3], Jean-Christophe Bier[2], Wim Gevers[1]; [1]Université Libre de Bruxelles, [2]Erasme University Hospital, [3]Ghent University

— Working memory refers to our ability to actively maintain and process a limited amount of information during a brief period of time. Often, not only the information itself but also its serial order is crucial for adapted task performance. However, the nature of ordinal information remains unclear. Recently, Abrahamse et al. (2014) proposed that ordinal information in working memory is spatially represented, with attention shifts occurring when searching through the memorized sequence. Here, we assessed verbal working memory performance of a group of right brain-damaged patients with spatial attention deficits (unilateral spatial neglect). Participants memorized sequences of consonants at span level and had to judge whether a target consonant belonged to the memorized sequence (item task) or whether a pair of consonants were presented in the same order as in the memorized sequence (order task). We observed that, while item processing was spared, order processing was specifically impaired in these patients as compared to healthy controls. On top of that, performance of patients with spatial neglect in the order task correlated with neglect severity. These results support the item-order dissociation (e.g. Majerus et al., 2006) and the recent hypothesis that spatial attention is crucially involved in order processing. Importantly, these results are also of clinical relevance: despite the fact that serial order coding in working memory is a fundamental component of many other cognitive domains (e.g. reading and reasoning), this ability is not typically investigated in neglect patients.

E61

AGING REDUCES THE BENEFIT OF SPATIAL RETROCUEING ON VSTM FOR COMPLEX OBJECTS

Lauren Morgan[1], Jonathan Strunk[1], Audrey Duarte[1]; [1]Georgia Institute of Technology

— Previous evidence suggests that spatially informative retrospective attentional cues can increase VSTM performance in young adults to a greater extent than in older adults. However, factors including interference resulting from stimulus repetition and cue expectancy might have influenced previous findings. In the current event-related potential (ERP) study, we measured the effect of retrocueing on VSTM performance and the contralateral delay activity (CDA) index of VSTM maintenance in the young and old. Arrays of trial-unique real world objects were used in conjunction with trial-by-trial randomized cueing. Although response times were faster following retrocues for both age groups, only young adults showed retrocue benefits in VSTM accuracy. ERP results showed equivalent CDA effects for young and older adults prior to cue onset, however, the CDA was greatly diminished following cue offset in older adults. These results suggest that older adults may be less able to use retrospective attention to enhance VSTM performance due to disrupted maintenance of memory representations resulting from cue-related perceptual interference.

E62

THE FUNCTIONAL ROLE OF FRONTAL THETA BAND ACTIVITY IN VISUOSPATIAL WORKING MEMORY

Janina Jochim[1], Lisa Lin[2], Mark Stokes[1]; [1]University of Oxford, [2]University of California, San Francisco

— Working memory (WM) is fundamental for flexible adaptive cognition. Previous research suggests that neural oscillations in the theta band (4-7 Hz) are involved in active maintenance and recall of working memory representations. In electroencephalography (EEG), frontal midline theta measured during the delay period of a working memory task increases with increasing memory load for serially presented working memory items. Intracranial recordings also implicate theta oscillations in working memory in serial presentation working memory tasks. In the present study, we developed a novel visuospatial working memory task to optimally drive hippocampal theta, and correspondingly, theta in the frontal midline scalp record-

ings. Recording extracranial EEG during the an extended memory delay period, we observed a significance effect of memory load in midline theta (F1,Fz,F2). Theta power was higher for a high memory load (4 items) relative to low memory load (2 items). This provides important evidence that visuospatial working memory also elicits load-dependent theta oscillation in prefrontal cortex. We consider the potential relationship to hippocampal theta observed in comparable visuospatial working memory paradigms.

LANGUAGE: Other

E63

ALTERED NEURAL CIRCUITS DURING NARRATIVE COMPREHENSION IN CHILDREN WITH READING DIFFICULTIES: AN FMRI STUDY

Tzipi Horowitz-Kraus[1,2], Catherine Buck[1], Mark DiFrancesco[1], Jen Vannest[1]; [1]Cincinnati Children's Hospital Medical Center, [2]Technion — The goal of the current study is to define the neural circuitry involved in a narrative-comprehension task in 8-12 year-old children with reading-difficulties (RD) compared to typical-readers (TRs). Method Ten children with RD and nine TRs (mean age = 9.91 years, SD = 0.08) were scanned during a 5-minute narrative-comprehension task (story-listening). Imaging data were analyzed using SPM12 and the CONN functional-connectivity toolbox. Results In addition to low reading scores [phonological-processing scores: $t(18)=-6.836$, $P<0.001$], children with RD demonstrated low narrative-comprehension scores compared to TRs [$t(18)=-4.260$, $P<0.001$]. Whereas TRs demonstrated the typical bilateral temporal activation while listening to stories, RDs showed more diffused frontal, occipital, and temporal activation. Regions of interest for the functional connectivity analysis were chosen based on the activation map (Brodmann Areas). Stronger left-lateralized functional connectivity (nodal global efficiency) was found in children with RD. Overall global efficiency scores among all brain nodes in both RDs and TRs were positively correlated with phonological-processing scores ($r=-0.511$, $P<0.05$). Conclusions 1)Children with RD may suffer from narrative-comprehension difficulties due to diffuse activation of language areas (compared to TRs) observed during a narrative-comprehension task. The diffuse activation may reflect more engagement of frontal executive regions, i.e. they may require more effort to discern mistakes and monitor outcomes. 2)Greater integration in the right hemisphere may necessary for phonological processing 3)Accommodations given to children with RD for reading aloud in the classroom may need to be revised due to the observed difficulty in this domain

E64

STRUCTURAL BRAIN CORRELATES OF MATHEMATICAL PROCESSING IN BILINGUALS

Jennifer Legault[1], Kaitlyn A. Litcofsky[1], Shin-Yi Fang[1], Ping Li[1]; [1]The Pennsylvania State University — Bilinguals must manage distinct representational systems for processing arithmetics in each language. We conducted a study to examine the processing of easy or hard arithmetic equations in the first (L1) and second (L2) languages in 24 Chinese-English bilinguals. While equations in both L1 and L2 recruited mathematical processing regions (horizontal segment of the intraparietal sulcus, posterior superior parietal lobule), equations in L1 additionally recruited areas relating to calculation and verbal coding strategies (precentral gyrus, superior frontal gyrus). We also ask whether neural structure, specifically gray matter volume (GMV), is correlated with abilities of mathematical processing in bilinguals' two languages. Preliminary results indicate (1) better math performance during an off-line basic math ability task was associated with increased GMV in the left precuneus and fusiform gyrus, suggesting the importance of memory and visual processing for mathematics; (2) higher scores on Chinese hard math questions were positively correlated with GMV in the right supramarginal gyrus, an area implicated in functions concerning both language and mathematical equations; (3) positive correlations for working memory (assessed by a letter number sequencing task) performance and GMV in the right parahippocampus; and (4) positive correlations for English language performance (as assessed by the Peabody Picture Vocabulary Task) and GMV in the right inferior frontal gyrus. These findings suggest strong relations between multi-modal, cross-modal representation and processing with structural and functional properties of the brain. They also point to individual differences in linguistic and non-linguistic performance that can be captured by cognitive abilities and brain correlates.

E65

PROSODIC INFLUENCES ON QUESTION/ANSWER FOCUS IN ENGLISH DITRANSITIVES: AN AUDITORY ERP STUDY

Ellen Guigelaar[1], John Drury[1]; [1]Stony Brook University — ERP studies of prosodically marked focus have yielded a diversity of brain response patterns (see Wang et al. 2006 review). However, some common findings include a broad positivity for appropriately accented focus and a negative-going response when focused elements are unaccented. The present study employed question/answer prosodic mismatches in English ditransitives. Answers were stressed/accented on either the direct or indirect object (e.g., "Steve only gave [BORIS] [the bulldog]"/"Steve only gave [Boris] [the BULLDOG]"). Collapsing over dative and double object constructions, we examine the contrast between ACCENT on the first versus the second object in a 2x2 design with FOCUS on OBJ1/OBJ2 determined by lead-in questions. These questions rendered the answer felicitous (e.g., Q:"Who did Steve give the bulldog to?" A:"Steve only gave [BORIS] [the bulldog]"), or not (e.g., A:"Steve only gave [Boris] [the BULLDOG]"). We also included cases where unaccented/unfocused (old/topic) information mismatched with the lead-in question (e.g., Q:"Who did Steve give the bulldog to?" A:"Steve only gave [BORIS] [the #mermaid]"). Native English speakers (N=16) listened to these question/answer pairs and performed match/mismatch judgments. Our results revealed main effects of Focus (broad negativity), Accent (central positivity), and Focus x Accent interactions. Accent on an unfocused object yielded an early posterior positivity; unaccented focus yielded a broad negativity. Accented objects also elicited Closure Positive Shift (CPS) effects (Hruska et al. 2001). Mismatches involving irrelevant old/topic information yielded an N400/P600 pattern. We argue these findings shed light on which ERP response patterns are reliable markers of the processing mechanisms of interest.

E66

HEMODYNAMIC RESPONSES DURING ORAL AND SILENT READING

Allison S. Hancock[1], Nicholas J. A. Wan[1], Vicki Simionsmeier[1], Ronald B. Gillam[1]; [1]Utah State University — Researchers have claimed that one advantage of functional near infrared spectroscopy (fNIRS) is that the measures of cortical hemodynamics are less susceptible to motion artifacts than other neuroimaging techniques. This study was designed to test the extent to which fNIRS measures of oxygenated (HbO) and deoxygenated (HbR) values differ during oral reading, mouthing (with no voicing) or silent reading with no oral movement. We predicted greater concentrations in HbO in motor areas (but not in language areas) for reading aloud as compared to silent mouthing or silent reading with no mouth movements. Fifteen typically developing adults were instructed to read 3 paragraphs: each one aloud, silent mouthing, and silently with no mouth movements. Conditions were counterbalanced and pseudorandomized. HbO and HbR were examined in 5 regions of interest (ROI's): inferior parietal lobule (IPL), pre-motor area (PMA), primary motor cortex (MOT), inferior frontal gyrus (IFG), and superior temporal gyrus (STG). We found a main effect for condition, indicating greater HbO values during oral reading as compared to silent mouthing and silent reading. Contrary to our original prediction, there was not a Condition x ROI interaction. The pattern for increased concentration values during oral reading held for all ROIs. We used a subtraction method to control for mouth movement during oral reading tasks, which yielded oral reading concentration values in language areas that were similar to the concentration values for silent reading. These findings suggest claims about fNIRS readings being minimally affected by motion artifacts are overstated, especially for tasks requiring speaking.

E67

TALKER LEARNING EFFECTS OBSERVED IN EARLY, PREATTENTIVE ACOUSTIC PROCESSING: A MISMATCH NEGATIVITY STUDY

Alexis R. Johns[1], Emily B. Myers[1,2]; [1]University of Connecticut, [2]Haskins Laboratories — Listeners adjust to talker-specific idiosyncratic speech, resulting in phonetic category boundary shifts to accommodate unusual phonetic tokens. Adaptation to new talkers is fast, stable, relies on word knowledge (e.g. Kraljic, Samuel, & Brenan, 2008; Jesse & McQueen, 2011), and recruits

right-lateralized frontal and temporal brain areas (Myers & Mesite, 2014). However it is unclear whether shifts in phonetic categorization that result from talker learning influence early, preattentive stages of processing. We used the mismatch negativity event-related component and tested whether phonetic category boundary shifts that are conditioned by exposure to a particular talker modulate early acoustic-phonetic processing. During exposure, listeners performed a lexical decision task on a series of words, among which were words that contained 's' and 'sh' sounds. Crucially, in one group of participants, 's' words contained ambiguous s/sh blends (denoted '?', e.g., 'epi?ode'), whereas the other group instead heard ambiguous 'sh' sounds (e.g., 'flouri?ing'). A subsequent passive auditory oddball paradigm measured contrasts for different combinations of points from a synthetic s-sh continuum (asi-ashi). Results: As expected, the endpoint-endpoint pair elicited an MMN response for both groups. Furthermore, different MMNs for each group emerged consistent with the talker-conditioned shift in phonetic category boundary. Specifically, for the ambiguous 'a?i' standard, an MMN emerged to a deviant token that was a more canonical phonetic category member. The exposure-related MMNs also patterned with subsequent behavioral phoneme identification scores for the same asi-ashi points. Conclusion: Phonetic adaptation to novel talkers affects even early stages of preattentive acoustic processing.

E68

THE EFFECT OF LANGUAGE IMPAIRMENT ON NONVERBAL COUNTING TASKS

John Verbos[1], Sarah Wallace[1], Alexander Kranjec[1]; [1]Duquesne University, Pittsburgh, PA — What is the effect of language impairment on individuals' ability to represent non-symbolic exact quantities? Recent research (Everett & Madora, 2012; Frank, Fedorenko, Lai, Saxe, & Gibson, 2012) found that both English-speakers whose access to language for number is artificially compromised by verbal interference and the Pirahã (an Amazonian tribe without exact number words) rely on analog magnitude estimation when asked to represent non-symbolic exact quantities greater than 3. In this study, participants with aphasia resulting from stroke (n=9; 3 Wernicke's, 2 Broca's, 2 Conduction, 2 Anomic) performed the same 5 tasks from previous studies: a one-to-one matching task, a "chunked" matching task, an orthogonal matching task, a hidden matching task, and a "nuts-in-a-can" task. Participants managed 79% correct responses across tasks, performing poorest on tasks where targets are not visible during response (task 4, 69% correct; task 5, 68%) and best when targets are presented as "subitizable" groups of 2 and 3 (task 2, 98%). Significant correlations were found between error rates and target magnitude (r=0.97) and target magnitude and magnitude of error (r=0.94). Participants' overall Aphasia Quotient (AQ) on the Western Aphasia Battery-Revised (WAB-R) was predictive of task performance across tasks (r=0.59), and performance on individual tasks (e.g., task 1, r=0.56; task 5, r=0.75). WAB-R subtests were also reliably correlated with overall performance across tasks (Spontaneous Speech, r=0.62; Naming and Word Finding, r=0.65), and with performance on several individual tasks. These results can help us better understand the relationship between particular language impairments and non-symbolic exact quantity representation.

E69

NEURAL CORRELATES OF READING COMPREHENSION IN STRUGGLING AND TYPICAL READERS

Mary Abbe Roe[1], Lauren Deschner[1], Joel E. Martinez[2], Jeanette A. Mumford[3], Dana M. DeMaster[4], Jenifer J. Juranek[4], Jessica A. Church[1]; [1]The University of Texas at Austin, [2]Princeton University, [3]The University of Wisconsin-Madison, [4]The University of Texas Health Science Center at Houston — A multi-city, in-school 4th grade reading intervention project aimed to assess the role of attention and executive function in reading comprehension. Participants completed an fMRI visit and a battery of reading performance measures before and after a one-year in-school intervention. Data from 21 non-struggling, 29 pre-intervention, and 28 post-intervention struggling readers passed quality control measures, and were investigated with regions derived from the reading and task control literature. Behavioral analyses of a sentence comprehension task found that struggling readers were slower and less accurate than typical readers; accuracy, but not response time, improved after the intervention year. Regions of difference between struggling and non-struggling readers before intervention included left occipitotemporal, supramarginal, and frontal control regions. Regions of difference post-intervention included the same left frontal and supramarginal regions, and also left mouth motor and superior temporal cortex. Additionally, the struggling readers were subgrouped based on their improvement in standard scores on a battery of reading tests. Before intervention, "low-improvement" struggling readers had significantly greater activity in left mouth motor cortex than non-struggling readers, while "high-improvers" differed from non-struggling readers in bilateral occipitotemporal and left frontal control regions. After reading intervention, "high-improvers" and "low-improvers" had significantly different activity from non-struggling readers in a right occipitotemporal region, but only "high-improvers" differed from non-struggling readers in left frontal and mouth motor regions. Our results highlight regions of plasticity and stability in struggling readers over time, and examine how functional differences from non-struggling readers might correspond to reading improvement.

E70

EXAMINING EFFECTS OF FAMILY SOCIOECONOMIC STATUS AND BILINGUALISM ON BRAIN STRUCTURE AND COGNITIVE SKILLS DURING EARLY CHILDHOOD

Natalie Brito[1], Maritza Morales[2], Kimberly Noble[2]; [1]Columbia University Medical Center, [2]Teachers College Columbia University — Family socioeconomic status (SES) is strongly associated with children's cognitive development (Brooks-Gunn & Duncan, 1997). Past studies have reported socioeconomic disparities in both neurocognitive skills (Noble et al., 20007) and brain structure (Noble et al., 2015) across childhood. In other studies, bilingualism has been associated with cognitive advantages during early childhood (Carlson & Meltzoff, 2008) and differences in brain structure during adulthood (Olsen et al., 2015). The aim of the current study is to examine the joint and independent effects of family SES and bilingualism on brain structure and cognitive skills during early childhood. A subset of data from the Pediatric Imaging, Neurocognition and Genetics (PING) study was analyzed – propensity score matching established an equal sample (N = 150) of monolinguals and bilinguals with similar socio-demographic characteristics (M age = 6.6, SD = 1.5, Range = 3-9 years). Differences in cortical surface area (SA), but not cortical thickness (CT), were observed in relation to SES ($F(1, 142) = 6.06$, $p = .02$), with higher SES children having increased SA. Examining bilingualism, differences in both SA ($F(1, 142) = 9.17$, $p = .003$) and CT ($F(1, 142) = 3.83$, $p = .05$) were found, with monolinguals having increased SA, but no interactions were observed between SES and bilingualism ($p = .21$) Additionally, bilingualism was not related to any of the cognitive assessments and did not moderate the association between SES and cognitive skills. These results suggest independent effects of both SES and bilingualism on early brain development. NIH Grant RC2DA029475.

E71

BILINGUAL ADVANTAGE IN LEARNING TO DETECT HIDDEN OBJECTS IN A COMPLEX VISUAL ENVIRONMENT

Angela Combs[1], Aaron P. Jones[1], Michael C. Trumbo[1], Michael A. Hunter[1], Charles S. Robinson[1], Kinsey Steueterman[1], Vickey Massey[1], Brian A. Coffman[2], Vincent P. Clark[1]; [1]University of New Mexico, [2]University of Pittsburgh — The theory of linguistic relativism suggests that language shapes perspective (Greiffenhagen & Sharrock). Thus, multilingual fluency may facilitate multiple perspectives for the same stimuli. Based on this theory and evidence that bilingual individuals perform better on spatial (Pederson, 2012) and working memory tasks (Adesope, 2010), it was hypothesized that bilinguists would perform better at an object detection task than monolinguists. Our goal was to evaluate the effect of prior language learning when learning to identify hidden objects in a complex visual environment. Sixty-six participants (16 bilingual) received active (2.0 mA, anode over cerebellum or F10, cathode on left arm) or sham (0.1 mA) transcranial direct current stimulation (tDCS) while training to detect hidden objects. Learning scores were calculated as post-training minus baseline pre-training test performance. A two-way analysis of covariance with stimulation condition and language acquisition (monolingual, bilingual) as independent variables was performed controlling for age and gender. Main effects of tDCS and language acquisition were observed ($F(1,60)=4.578$, $p=0.036$, tDCS condition; $F(1,60)=5.008$, $p=0.029$, language acquisition) with no interaction. This showed a significant advantage for bilinguists over monolinguists (improvement for monolinguists =19.10%, 12.02% standard deviation, bilinguists = 27.10%, 12.40% standard devia-

tion). These findings support the theory of linguistic relativism and suggest that bilingualism provides an advantage over monolingualism in performing complex visual search tasks.

LANGUAGE: Semantic

E72

TASK AND TRAIT INFLUENCES ON WORD COMPREHENSION

Cybelle Smith[1], Kara D. Federmeier[1]; [1]Department of Psychology, University of Illinois, Urbana-Champaign — Mental processes engaged during word reading vary as a function of our goals and cognitive tendencies. To assess how semantic subprocesses, e.g. mental image generation, are employed differentially across tasks and individuals, we examined the Event Related Potential (ERP) response to 124 concrete and 124 abstract nouns (length, frequency, familiarity, and N matched) presented singly (27 subjects) or as the second word of a sentence read for comprehension (32 subjects). In the single word task, subjects indicated whether a subsequent probe was a synonym. Nouns high in familiarity/frequency elicited a sustained fronto-central negativity when compared to low familiarity/frequency nouns in the synonym judgment task, but not during sentence comprehension, suggesting the synonym judgment task may have elicited an active search for semantic associates. The ERP concreteness effect, which canonically consists of an N400 modulation and a sustained frontal negativity, appeared similarly across tasks. Subjects' tendency to form vivid mental images, assessed using the object-spatial imagery questionnaire (Blajenkova et al. 2006), predicted the size of individual concreteness effects at frontal and central sites 300-500 ms after noun onset ($p < .1$), and at frontal sites at 500-900 ms ($p < .05$). High vividness subjects may thus differentially engage controlled processes associated with mental image generation when reading for comprehension. Our results are consistent with linking the sustained frontal portion of the ERP concreteness effect to mental imagery, as had previously been posited on the basis of task manipulations (West & Holcomb 2000, Gullick et al. 2013).

E73

PROFESSIONAL MUSIC TRAINING AND WORD MEANING ACQUISITION: FROM FASTER SEMANTIC ENCODING TO LONGER-LASTING WORD REPRESENTATIONS

Eva Dittinger[1,2,3], Mylène Barbaroux[1,2], Mariapaola D'Imperio[2,3,4], Lutz Jäncke[5], Stefan Elmer[5], Mireille Besson[1,2]; [1]CNRS & Aix-Marseille Université, Laboratoire de Neurosciences Cognitives (LNC-UMR 7291), 13331, Marseille, France, [2]Brain and Language Research Institute (BLRI), 13100, Aix-en-Provence, France, [3]CNRS & Aix-Marseille Université, Laboratoire Parole et Langage (LPL-UMR 7309), 13100, Aix-en-Provence, France, [4]Institut Universitaire de France (IUF), Paris, France, [5]Auditory Research Group Zurich (ARGZ), Division Neuropsychology, Institute of Psychology, University of Zurich, Switzerland — Word learning, possibly one of the most complex and uniquely human abilities, is a multifaceted task clearly requiring both perceptive and cognitive functions. Nowadays, there is growing evidence that professional music training not only shapes the functional-structural architecture of the auditory system, but also influences a variety of cognitive functions, like attention, memory, and executive functions that are involved in word learning. Here we tested the hypothesis that adult musicians would learn the meaning of novel words through picture-word associations more efficiently than non-musicians. In addition, we expected that musicians would demonstrate faster brain plasticity than non-musicians, as mainly reflected by a differential modulation of the N400 component of Event-Related Potentials (ERPs). In line with our hypothesis, musicians outperformed non-musicians in the most difficult semantic task that tested for generalization of word learning. Moreover, changes in the spatio-temporal dynamics of brain activity developed faster in musicians than in non-musicians, as reflected by the emergence of an N400 after only a few minutes of training and by a rapid fronto-parietal shift in scalp distribution. Finally, musicians showed evidence for faster integration of the novel words' meanings into semantic networks and for better long-term memory for novel learned words five months after the main experimental session. To the best of our knowledge, this is the first report showing that music training influences semantic aspects of language processing in adults, and these results open novel perspectives for applications of music training in the domain of second language learning.

E74

THE ROLE OF SEMANTIC FEATURES IN PROCESSING BASIC-LEVEL CONCEPTS IN MANDARIN CHINESE: AN ERP STUDY

Keng-Yu Lin[1], Shiao-hui Chan[1]; [1]National Taiwan Normal University — The sensory-functional theory claims that different semantic feature types have different impact on processing various semantic categories: perceptual features are more important for natural categories and functional features, artifacts (Warrington & McCarthy, 1983; Warrington & Shallice, 1984). However, most studies supporting the theory did not control the relatedness between semantic features and categories. The current ERP study thus examined this theory by controlling the relatedness between semantic features and categories in Mandarin Chinese. A semantic priming paradigm was adopted, with semantic categories (natural category/artifact) being primed by semantic features (perceptual/functional), yielding a 2 x 2 factorial design. The word frequency, word length, word class, and, most importantly, relatedness between primes and targets were controlled. Twenty-four right-handed subjects (mean age=23.8, Male=7) were recruited to judge whether the prime was a characteristic of the target by button pushing. The analysis on N400 (300ms–450ms) and LPC (500ms–700ms) amplitudes revealed no main effects or interaction; however, the fractional area latency analysis showed a marginal interaction between semantic features and categories in the LPC time window. Follow-up analysis showed that the LPC latency was longer when artifacts were primed by perceptual features than functional features. This finding partly supported the sensory-functional theory even when the relatedness between semantic features and categories were controlled. Since this interaction between semantic feature and category was found only in the LPC latency but not in N400, we argued that the various impact of perceptual/functional features on natural categories/artifacts might not be an automatic process, but a controlled one.

E75

ESTIMATING SUBJECTIVE MENTAL CONTENTS DURING LISTENING TO A NARRATED STORY IN FMRI SCANNER

Satu Saalasti[1], Minna Kauppila[1], Jussi Alho[1], Moshe Bar[2], Mikko Sams[1], Jääskeläinen Iiro[1]; [1]Aalto University School of Science, Finland, [2]Bar-Ilan University, Israel — Our momentary "mental content" depends on the external environment as well as on personal history, mood, and goals. Estimating the variation of mental content of individuals processing everyday-like stimuli such as narrated stories – increasingly used in neuroimaging – is crucial for better understanding of the neural basis of subjective experiences. We have developed behavioral methodology to estimate subjective experiences during listening to a narrative. Healthy subjects (N=12) listened to an 8-min long narrative during functional magnetic resonance imaging (fMRI). Following the fMRI session, the subjects were presented the narrative again, this time in consecutive 128 short segments, and were instructed to generate words (within 20-30s) that best describe what came to their mind when they had heard each segment originally. This way, we obtained estimates of the subjects' mental content during to the story. We used latent semantic analysis (LSA) to obtain between-subjects similarity measures for each word list during each segment. The results show that when individuals listened to the same narrative, they produced words that were contextually related and in most instances relatively close in semantics. However, some variation in mental contents across subjects became evident, as some subjects produced words that were semantically more distant from others. Furthermore, the number of produced words varied greatly. Our next step is to include the estimate of the mental content in the analysis of fMRI data, in addition to information of the stimulus, with the aim of gaining insight into the neural basis of subjective experiences.

E76

SEMANTIC ACTIVATION AND CONNECTIVITY IN POOR COMPREHENDERS ACROSS MODALITY AND PROCESSING LEVEL

Kayleigh Ryherd[1], Yi-Hui Hung[2], Emily Baron[2], Kaja Jasinska[2], Einar Mencl[2], Nicole Landi[1,2]; [1]University of Connecticut, [2]Haskins Laboratories — Recent research has identified a population of children (~10% of a typical 5th grade classroom) who

exhibit poor reading comprehension despite intact word reading, phonological processing, and cognitive skills, called poor comprehenders (PCs; Landi, 2010). Previous research suggests PCs have executive dysfunction, such as poor planning (Locascio et al., 2010). Other research indicates a primary semantic deficit (Nation & Snowling, 1999). One neurobiological investigation showed abnormal connectivity in these PCs between left inferior frontal gyrus (LIFG) and parahippocampal regions for low-frequency words, interpreted as reliance on episodic rather than semantic memory (Cutting et al., 2013). However, this study focused only on processing at the word level. The current study looks at written and spoken comprehension at both word and passage levels to try to understand PCs' specific comprehension deficit. Adolescent participants viewed or heard words and passages in a passive fMRI task. We used behavioral Partial Least Squares (PLS) to explore how experimental conditions (modality: spoken vs. written; level of processing: word vs. passage) interact with behavioral measures of comprehension skill. PCs show less middle temporal gyrus (MTG) and LIFG activation than better comprehenders regardless of processing level (word vs. passage) and modality (spoken vs. written) and more activation of networks involved in effortful processing, attention and executive function. These results suggest that both semantic processing and executive processes contribute to deficits observed in PCs. We also present results from functional connectivity analyses that further clarify the relationship between executive function and semantic networks in PCs.

E77

THE PRIMING OF BASIC COMBINATORY RESPONSES IN MEG

Esti Blanco-Elorrieta[1,5], Victor S. Ferreira[2], Paul Del Prato[3], Liina Pylkkänen[1,4,5]; [1]NYUAD Institute, New York University Abu Dhabi, Abu Dhabi, P.O. Box 129188, UAE, [2]Department of Psychology, University of California, San Diego, La Jolla, CA 92093-0109, USA, [3]Department of Neurology, New York University, NYU Langone Medical Center, New York, NY 10016, USA, [4]Department of Linguistics, New York University, New York, NY 10003, USA, [5]Department of Psychology, New York University, New York, NY 10003, USA — While behavioral research has demonstrated that the processing of syntactic structures can be primed, the computational level of this priming is still unknown. The present work took advantage of recent progress on the neurobiology of basic phrase building and tested whether the brain activities implicated for the simple composition of two words could be primed. In two experiments, magnetoencephalography (MEG) was recorded during a picture naming task where the prime trials were designed to replicate previously reported combinatory effects and the target trials to test whether those combinatory effects could be primed. The manipulation of the primes was successful in eliciting larger activity for adjective-noun combinations than single nouns in the left anterior temporal lobe (LATL) and ventromedial prefrontal cortex (vmPFC), replicating prior MEG studies on similar contrasts. Priming of similarly timed activity was observed during target trials in the LATL, but only when the prime and target shared an adjective. No LATL priming was observed for single word repetition and two control tasks also showed that the priming effect was not elicited if the prime pictures were simply viewed but not named. In sum, this work revealed that basic combinatory responses in MEG can indeed be primed, though some lexical overlap between prime and target is necessary, suggesting combinatory conceptual, as opposed to syntactic processing. Both our combinatory and priming effects were early, onsetting between 100 and 150ms after picture onset and thus are likely to reflect the very earliest planning stages of a combinatory message.

PERCEPTION & ACTION: Multisensory

E78

LANGUAGE FACILITATES TACTILE DISCRIMINATION

Natalie McCormick Miller[1,2], Timo Torsten Schmidt[1,3], Felix Blankenburg[1,2], Friedemann Pulvermüller[1,2]; [1]Freie Universität Berlin, [2]Humboldt Universität zu Berlin, [3]Bernstein Center for Computational Neuroscience Berlin — Linguistic relativity posits that language builds and shapes cognition and perception. Previous work suggested that speakers of languages that include specific verbal labels indexing perceptual features are more efficient in making the congruent perceptual discrimination. However, perceptual differences noted when testing people who speak different languages and who were raised in different cultural backgrounds can hardly be attributed uniquely to the structure of their first language. To adequately test whether perceptual discrimination is facilitated by the availability of concordant verbal distinctions, we trained subjects over the course of 1 week to discriminate fine-grained and minimally different vibro-tactile stimulus patterns. These patterns were either correlated with specific novel meaningless spoken pseudowords or they were paired randomly with such pseudowords. Before and after learning, subjects were tested on their ability to discriminate between vibro-tactile pattern pairs (without auditory stimuli accompaniment). Compared with their performance before training, subjects showed an improvement of pattern discrimination performance for patterns consistently paired with verbal labels, but not for patterns that were randomly paired with language stimuli (significant interaction prepost x consistency). These results demonstrate that consistent verbal labelling of a sensory difference facilitates the perceptual discrimination learning of that same difference. These results constitute strong experimental evidence for Whorfian top-down effects of language on somatosensory perceptual learning.

LANGUAGE: Semantic

E79

AMODAL REFERENCE RESOLUTION IN MEDIAL PARIETAL CORTEX

Christian Brodbeck[1], Laura Gwilliams[1], Liina Pylkkänen[1]; [1]New York University and NYUAD Institute — A fundamental component of language comprehension is referential processing: linking linguistic expressions with the cognitive representations of the entities they refer to. Previous eye tracking and EEG research suggests that resolving reference in a previously seen visual display involves access to modality-specific visual representations, possibly associated with the use of visual short term memory. In this study we asked whether there is a common substrate for reference resolution across visual and auditory referential domains, as opposed to the possibility that reference resolution consists solely in accessing an item in a modality-specific representation. We constructed referential domains in visual and auditory modalities: visual displays containing three objects each, and auditory stimuli consisting of three sounds played sequentially. In each trial, participants were presented with a referential domain, followed by a question about it, presented visually word by word, such as: "Was the grunt in the middle long?". Target words differed in whether they resolved reference or not ("grunt" after a domain with a single grunt vs. two grunts). Source localized MEG responses indicated increased activation for reference-resolving words as compared to their non-resolving counterparts, after both visual and auditory referential domains, in overlapping areas of the medial parietal lobe. The latency of the effect differed somewhat between conditions, with an onset between 375 and 485 ms. Our findings demonstrate that medial parietal cortex is involved in reference resolution regardless of the modality of the referential domain, suggesting a connection between episodic memory and referential language processing.

E80

SEMANTIC ATTRIBUTES AND MATHEMATICAL VALUES IN THE PROCESSING OF CHINESE CLASSIFIERS AND MEASURE WORDS

Ying-Chun Chen[1], One-Soon Her[1], Denise H. Wu[2], Nai-Shing Yen[1]; [1]National Chengchi University, [2]National Central University — The element between a numeral and a noun in Chinese is either a classifier (C) or a measure word (M). Linguistic theories have suggested that C and M not only categorize nouns based on semantic attributes but also denote quantities with a certain mathematical value, e.g., san wei laoshi (three C-human teacher) indicates precisely [3×1 teacher]. However, the cognitive processing and neural mechanism underlying C/M's semantic and mathematical functions remain unclear. This study investigated the effects of semantic attributes and mathematical values on C/M processing with a semantic distance comparison task where participants had to choose between two phrases the one that was closer to the target. In Experiment 1 (N=20), we used two types of [one C/M] phrases, i.e., numerical vs. non-numerical C/Ms. Results showed, for both types of C/Ms, participants favored the C/M with comparable semantic attributes over the one with similar mathematical values. In Experiment 2 (N=20), to control semantic attributes, we used two C/Ms as options in a minimal pair of [one C/M noun] phrases

with the same noun. To understand C/M processing in terms of mathematical values, we manipulated two types of mathematical information among C/Ms, numerical vs. non-numerical and fixed vs. variable value. For both numerical and non-numerical C/Ms, participants made better judgments for C/Ms with fixed rather than variable values. Our behavioral findings demonstrated that semantic attributes and mathematical values both play an important role in C/M processing. Future studies can further investigate neural correlates underpinning quantity processing of C/M with fixed values.

LANGUAGE: Syntax

E81

EVENT-RELATED BRAIN POTENTIALS DISSOCIATE CUE-BASED RETRIEVAL INTERFERENCE AND REANALYSIS DURING SENTENCE COMPREHENSION

Darren Tanner[1], Sarah E. Grey[2], Erika L. Exton[2], Janet van Hell[2]; [1]University of Illinois at Urbana-Champaign, [2]Pennsylvania State University

— Language comprehension requires the ability to construct relationships between words that are not always adjacent to each other. Among the processes contributing to the successful formation of linguistic dependencies is cue-based memory retrieval (Van Dyke & Johns, 2012). Retrievals, however, are sometimes subject to interference from competing items held in memory. Such interference gives rise to "agreement attraction" such as "The key to the cabinets were…" where the verb agrees with the intervening noun rather than with the subject. Electrophysiological evidence has shown that in such cases the P600 effect elicited by the ungrammatical verb is significantly reduced, relative to cases without an intervening noun (Tanner et al., 2014). A crucial question is whether this reduced P600 reflects the retrieval interference itself, or a depletion of cognitive resources which results in reduced engagement of sentence reanalysis processes. To test this, we recorded ERPs during sentence reading, and modulated the amount of cognitive resources available for reanalysis by varying the stimulus-onset asynchrony in a word by word reading task. Participants (n=118) read grammatical and ungrammatical sentences (i.e., subject-verb number agreement violations) with and without attraction interference in one of three SOA conditions: 233ms, 450ms or 650ms. Results showed standard P600 effects for ungrammatical sentences, which were reduced when a plural attractor intervened. SOA additionally modulated P600 magnitude: amplitudes decreased approximately linearly with faster SOAs. Importantly, the attraction effect showed no interaction with SOA. This indicates that although reanalysis processes may reflect interference in retrieval, these two processes are highly independent.

E82

THE BILINGUAL'S MENTAL GRAMMAR SYSTEM: LANGUAGE-SPECIFIC SYNTAX IS SHARED BY BOTH LANGUAGES

Eve Higby[1,2], Ibana Vargas[1,3], Stephanie Perez[1], Wendy Ramirez[1,2], Erika Varela[1,2], Gabriel Campoverde[1,4], Eva Fernandez[1,2], Valerie L. Shafer[1], Loraine K. Obler[1]; [1]The Graduate Center of the City University of New York, [2]Queens College, City University of New York, [3]St. John's University, [4]Hunter College, City University of New York

— Research on syntactic processing in bilingualism suggests that similar syntactic constructions in the bilingual's two languages have overlapping representations (e.g., Hartsuiker, Pickering, & Veltkamp, 2004). It is not known, however, whether language-specific constructions are also shared or whether they are tied to one language. In the current study, we investigated whether bilinguals can use syntactic structures from their second language to interpret novel (ungrammatical) sentences in the first language. The construction we used was the induced motion causative, grammatical in English but ungrammatical in Spanish (e.g., John ran the mouse around the maze; Juan corrió el raton por el laberinto). Electrophysiology (ERPs) and acceptability judgments were used to determine whether native Spanish speakers who know English can process these sentences by comparing the results to constructions that are ungrammatical in both languages (pseudo-causatives). If bilinguals only use their knowledge of Spanish syntax to interpret the sentences, responses for both conditions should consist of low acceptability judgments and an N400 effect, showing difficulty interpreting the sentences. Our preliminary data showed higher acceptability judgments for causatives (scale 1-5, m=3.19, sd=1.58) than pseudo-causatives (m=1.86, sd=1.33). In the ERPs, we observed an N400 for the pseudo-causatives (peak 454 ms, m=-2.15 μV, sd=1.70), but no N400 for causatives (m=0.34 μV, sd=1.69). This suggests that the bilinguals are carrying over knowledge of English syntax to interpret these never-before-heard sentences. We are testing more bilinguals and will compare their results to a group of Spanish monolinguals.

E83

RIGHT HEMISPHERE EFFECTS OF GRAMMATICALITY AND PROBABILITY: AN ERP INVESTIGATION

Michelle Leckey[1], Kara D. Federmeier[1]; [1]University of Illinois at Urbana-Champaign

— The capabilities of the right hemisphere (RH) for syntactic processing are poorly understood. Research in the area has led to contradictory findings ranging from a complete lack of RH involvement to an RH only contribution in some cases. Recent work using event-related potentials (ERPs) alongside the visual half-field paradigm (VF) has helped to provide a clearer picture. Here it was found that the RH was capable of eliciting a P600 response but whether or not it did was influenced by familial sinistrality. Participants who did not have a history of familial sinistrality (FS-) showed a left hemisphere (LH) P600 response alongside a RH N400 response whereas those who did (FS+) showed a P600 in both the LH and the RH. Using the same paradigm with older adults revealed that FS- individuals did not retain this asymmetric pattern but rather the P600 response became bilateral with age. This leads to the question of whether the RH of the FS- young adult group can elicit a P600 in any circumstance. The present experiment presented 48 young adults (24 FS-, 24 FS+) with sentences containing lexically marked morphosyntactic violations, the probability of which was manipulated across blocks. Unlike the previous experiment, the FS- group showed a bilateral P600 response that also remained in the FS+ group and both groups showed bilateral sensitivity to the probability of the violation. These findings suggest that the RH of the FS- group is sensitive to some forms of syntactic violations.

E84

WHO'S SURFING THE SAME (BRAIN)WAVES? ERP INTERFERENCE PATTERNS ACROSS MUSIC, LANGUAGE, ARITHMETIC, AND VISUAL NARRATIVE

Nicole E. Calma[1], Thomas Li[2], Neil Cohn[3], John E. Drury[1]; [1]Stony Brook University, [2]Ward Melville High School, [3]University of California at San Diego

— ERP studies investigating language, music, math, and visual narrative separately have shown similar response patterns linked to combinatorial processing across domains. Further, language/music interference studies have revealed ERP interaction patterns argued to be consistent with shared underlying neurocognitive mechanisms. We extended this approach in a within-participants study of cross-domain interactions between music and arithmetic, language, and visual narratives (comics). Participants listened to musical chord progressions, half of which contained incongruent continuations, while concurrently viewing visually-presented sequences consisting of words, numbers, or comic panels. Half of the language sequences (sentences) contained verb-inflection errors ("They always *bakes…"). Number sequences obeyed a +/-4 rule, with equal numbers of ascending(+4)/descending(-4) sequences, half of which contained violations (+/-2). Comics contrasted coherent narrative climaxes with anomalous panels. This yielded a 2x2 design for each domain (language/math/comics): visual(correct/violation) x auditory(correct/violation). Participants (N=16) performed acceptability judgments on the visual stimuli only. Violations in the visual sequences replicated previous findings for each domain: biphasic negative/positive patterns for language (LAN-P600) and arithmetic, and a fronto-central negativity for the comics violations. The different types of visual sequences influenced music-syntactic violation responses: with language, previously reported negativities (RAN/N500) and positivities (P600s) were evident, but for math/comics only negativities emerged. Interactions/interference manifested for all three visual domains (e.g., non-additive ERP responses for double-violations) but in ways that differed across domains in topography/timing and the affected components. We argue these findings inform our understanding of the functional significance of ERP components as well as the domain specificity/generality of the underlying neurocognitive mechanisms they reflect.

E85

ELECTROPHYSIOLOGICAL CORRELATES OF RHYTHM AND SYNTAX IN MUSIC AND LANGAUGE

Harim Jung[1], Cameron Arkin[1], Psyche Loui[1]; [1]Wesleyan University — Music and language are human cognitive and neural functions that have been shown to share neural resources in syntax processing (Patel, 2003) as well as temporal processing (Large & Jones, 1999). Although recent studies have investigated the sharing of neural resources for music and language, little is known about how music and language processing might interact as syntax unfolds over time. The current electroencephalography (EEG) study investigates the relationship between rhythmic expectancy and musical and linguistic syntax by presenting sentences, broken down into segments, paired with musical chords (adapted from Slevc et al., 2009). Linguistic syntax violations appeared in a garden-path design, and musical expectation violations, presented as out-of-key chords, and rhythmic expectancy violations, through early and late temporal perturbations, were manipulated at the critical region. Participants read sentence segments and listened to the musical chords, and answered questions about the sentences while their EEGs were recorded. Results show that musically irregular chords elicited an early anterior negativity (EAN), whereas linguistically unexpected garden path sentences elicited a late positive complex (P600). Results also show that the N400 decreases in amplitude between pre-critical, critical, and post-critical time regions, suggesting re-analysis of semantic content throughout the course of reading sentence segments. Together, results suggest that the interaction of music and language syntax processing depends on rhythmic expectancy, which in turn affects attentional entrainment.

E86

WHAT'S IN A P600? SOMETIMES A LOT OF N400. IDENTIFYING ANTECEDENTS OF ERP RESPONSE VARIABILITY IN GRAMMATICAL AGREEMENT PROCESSING.

Kailen Shantz[1], Nyssa Z. Bulkes[1], Chase Krebs[1], Amalia Reyes[1], Andrew Armstrong[1], Darren Tanner[1]; [1]University of Illinois at Urbana-Champaign — Although ERP studies of morphosyntactic agreement have traditionally elicited either P600 or biphasic LAN-P600 effects, more recent research shows that there is substantial individual variation in the quality of brain response elicited by agreement anomalies. Specifically, individuals' ERP responses may vary along a continuum between N400 and P600 dominance (Tanner & Van Hell, 2014). The present study investigated linguistic factors related to the prevalence of N400 versus P600 effects across individuals, as some have suggested that agreement violations marked with lexical alternations (e.g., "was" versus "were") may elicit more N400 than violations marked morphologically (e.g., "walk" versus "walks": Molinaro et al., 2015; Tanner & Van Hell, 2014). To directly investigate this hypothesis, we recorded ERPs while participants read sentences where agreement anomalies were signaled either lexically ("The roses are/*is…") or morphologically ("The roses grow/*grows…"). Grand mean results showed reliable P600 effects elicited by both types of agreement violations, preceded by an N400-like negativity. Additionally, the P600 elicited by anomalous auxiliary verbs (is/are) was significantly larger than that elicited by anomalous agreement affixes. Individual difference results showed a similar N400/P600 response dominance continuum as reported by Tanner & Van Hell for both types of agreement violations, with a greater proportion of N400-dominant responses found in the morphological than lexical condition. These findings suggest that instances of N400 effects for agreement violations are not limited to anomalies signaled lexically, and importantly, that individual variability in ERP response quality is a hallmark of morphosyntactic processing more generally.

E87

INTERACTION OF PROSODIC AND PLAUSIBILITY CUES DURING SENTENCE PROCESSING: EVIDENCE FROM ERPS

Shannon Sheppard[1,2], Katherine J. Midgley[1], Tracy Love[1,2], Lewis P. Shapiro[1], Phillip J. Holcomb[1]; [1]San Diego State University, [2]University of California, San Diego — We examined how prosody and plausibility affect the processing of temporary syntactic ambiguities in neurologically healthy adult participants. Consider: 1. While the band played the song pleased all the customers. Here it is initially unclear whether the NP the song is the direct object (DO) of played (incorrect) or the subject of the main clause (correct). The addition of a pause after the verb "played" and pitch contour over the verb can potentially disambiguate the structure. Plausibility cues may also interact with syntactic structure building. When the ambiguous NP "the song" is replaced with an NP that is an implausible DO for "played" the listener could use this cue to predict the correct structure. EEG was recorded from 32 scalp sites in 25 college-age adults who listened to sentences where prosody was manipulated to facilitate (2a & 2b) or disrupt (2c & 2d) syntactic processing. Plausibility between the verb ("played") and the ambiguous NP ("song/beer") was also manipulated. 2a. [While the band played] the song pleased all the customers. 2b. [While the band played] the beer pleased all the customers. 2c. [While the band played the song] pleased all the customers. 2d. [While the band played the beer] pleased all the customers. The prosodic manipulation resulted in an N400-P600 complex at the disambiguation point ("pleased") when comparing both 2a & 2c, and 2b & 2d. Yet the P600 effect was significantly smaller in the comparison with the implausible DO (2b & 2d), suggesting listeners use plausibility to predict syntactic structure.

E88

HEMISPHERIC DIFFERENCES IN PROCESSING SYNTACTIC CATEGORY INFORMATION IN SECOND LANGUAGE

Po-Heng Chen[1], Min-Hsin Chen[1], Chiarung Lu[1], Shu-Kai Hsieh[1], Tai-Li Chou[1], Lily I-wen Su[1], Chia-Lin Lee[1]; [1]National Taiwan University — Prior research indicates important right hemisphere (RH) involvement in second language (L2) processing, especially before native-like proficiency is obtained. To investigate the manner(s) in which RH contributes to L2 processing, we combined a split visual-field design with Event-Related Potential (ERP) measures to examine the hemispheric differences in processing syntactic category information in L2 learners. Intermediate to advanced English-speaking learners of Chinese and native Chinese speakers were recruited. Participants read one-word syntactic cues (either a classifier or an adverb) that were presented centrally to create a syntactic category expectancy that was matched or mismatched by subsequent lateralized nouns and verbs, and judged the grammaticality of the phrase with a button-press response. ERPs to correct trials and trials rated as familiar after the ERP session were analyzed. Native Chinese speakers showed an N400 grammaticality effect with both visual-field presentations, but a P600 grammaticality effect predominantly with right-visual-field (RVF) presentation. English-speaking learners of Chinese as a group showed a P600 effect with RVF presentation and an N400 effect with left-visual-field (LVF) presentation. However, there was greater diversity among Chinese learners' brain responses with right than left visual-field presentation in that while almost all learners showed the LVF N400 effect, only half of the learners showed the RVF P600 effect. Our results thus suggest that during second language learning, the right hemisphere is more likely to achieve native-like response patterns than does the left hemisphere, and may consequently play a larger role in second language processing before second language mastery is achieved.

E89

MUSIC SYNTACTIC PROCESSING IS INFLUENCED BY INTEGRATION OF LOCAL AND GLOBAL HARMONIC STRUCTURES: AN ERP STUDY

Iran Roman[1], Takako Fujioka[1]; [1]Stanford University — In listening to Western tonal music, an unexpected out-of-key chord is known to elicit an ERP component called Early Right Anterior Negativity (ERAN) at right frontal electrodes compared to a standard in-key-chord. However, in more realistic musical pieces, a sense of key can constantly move from a key to another closely-related one. Such movements typically follow the global rule called 'circle of 5ths', which describes the relationship between two keys sharing most chords and scale tones. We recorded EEG from 12 participants to examine whether the ERAN to the out-of-key chord is reduced when preceding local patterns follow the global rule. We examined three conditions: Control (as in previous ERAN studies), Sequential, and Non-Sequential, all of which contained the same out-of-key chord, preceded by different chord patterns. The Sequential condition presented three repetitions of a local pattern including the out-of-key chord, while moving through different keys following the global rule. In contrast, the Non-Sequential condition presented the same local pattern three times without following the global rule; this created jumps across unrelated keys. Compared to the Control condition, the ERAN in the Sequential condition was left-lateralized and delayed about 50ms. This suggests that the integration of local and global information for successful key motions may require left frontal neural resources, compared to simple processing of an out-of-key

chord. Furthermore, a right-frontal positivity with latency around 365ms was found in the Non-Sequential condition, perhaps more related to local pattern violation rather than syntax processing.

LONG-TERM MEMORY: Development & aging

E90

EXAMINING THE EFFECTS OF INTERFERENCE ON SPATIAL RECOGNITION MEMORY IN YOUNG AND OLDER ADULTS

Shannon Y. DeJesus[1], Nicole E. DeFord[1], Heather M. Holden[2], Lisa V. Graves[2], Francesca V. Lopez[1], Carina N. Hartley[1], Kyle Scroggins[1], Paul E. Gilbert[1,2]; [1]San Diego State University, San Diego, CA, [2]SDSU-UCSD Joint Doctoral Program in Clinical Psychology, San Diego, CA — Age-related declines in spatial memory are well documented. Spatial memory may be adversely affected in older adults when interference is increased, possibly due to less efficient pattern separation. We assessed spatial recognition memory using a new test hypothesized to tax pattern separation. On the study phase, healthy young (n=40) and older (n=30) adults remembered the location of a circle on a computer screen. On the test phase, a circle appeared either in the same or a different location separated by distances of 0.5, 1.0, 1.5, or 2.0 cm. Participants indicated whether the circle was in the "same" or a "different" location. Smaller spatial separations (0.5 and 1.0 cm) on "different" trials were hypothesized to result in higher interference than larger separations (1.5 and 2.0 cm), placing greater demands on pattern separation. The "same" trials assessed spatial recognition memory. We found that young adults outperformed older adults on "same" trials at the trend level ($p = .06$), associated with a moderate effect size $d = .46$. Older adults were significantly impaired relative to young adults on "different" trials ($p < .01$); however, both groups performed significantly better on low interference trials compared to high interference trials ($p < .01$). Group differences were associated with a 31% larger effect size on low interference trials. The findings indicate that spatial recognition memory improves in young adults, and to a lesser extent in older adults, when interference is reduced. The age-related differences may stem from less efficient pattern separation in older adults.

E91

RECOGNITION MEMORY CONTEXT EFFECTS IN AGING

Ashley Lawrence[1], Lee Ryan[1]; [1]University of Arizona — Research suggests that recognition memory performance declines with age (Yassa et al., 2011). However, recent work in our laboratory indicates that although older adults perform more poorly at object recognition, their recognition is boosted to the same degree as younger adults when the object is presented in the same context at study and test. Older adults may be using relatively spared scene recognition processing to boost recognition of objects presented in a scene. We predicted that older adults will be impaired at object recognition, relatively intact in scene recognition, and that when identifying objects in scenes they will be able to utilize the scene to boost performance. Young adults (n=15, mean age=19) and older adults (n=15, mean age= 71) were given three continuous recognition tasks consisting of objects, scenes, and objects in scenes. Participants indicated whether each image in the series was either the same as, similar to, or different from an image they had seen previously. Older adults performed more poorly on all three continuous recognition tasks ($t= -2.584$, $p< .01$). However, there were no differences in older adult's performance across tasks (n.s.). Interestingly, individual differences in performance on the scenes only recognition task were related to false positive errors on the objects in scenes recognition task for both younger and older adults ($t=2.47$, $p< .05$). This suggests that individuals who are better at recognizing scenes may be biased by scene information to falsely recognize an object presented in a scene.

E92

PATTERN SEPARATION AND HUMAN HIPPOCAMPAL SUBFIELDS

Demitra Tsivos[1], Serena Dillon[2], Bryony Wood[2], Michael Knight[2], Margaret Newson[1,2], Risto Kauppinen[2], Elizabeth Coulthard[1,2]; [1]North Bristol NHS Trust, [2]The University of Bristol — In order to improve early detection of Alzheimer's Disease (AD) we must improve clinical tools used in diagnosis. To this end there has been widespread research investigating the structural and functional changes that occur in hippocampal subfields as a result of natural ageing and early AD pathology. Based on previous animal and human studies we hypothesize that the Dentate Gyrus (DG) and CA3 regions of the hippocampus are preferentially involved in pattern separation. Thirty-Five cognitively normal adults and 18 cognitively impaired adults with diagnosis of Mild Cognitive Impairment or AD underwent 3T MRI of the hippocampus and completed an episodic memory task probing both pattern separation and pattern completion. A manual segmentation protocol was used to calculate total volumes of the CA1, CA2, CA3, DG, Subiculum and lumped Stratum Lacunosum + Stratum Moleculare + Stratum Radiatum (SRSLSM). Pattern separation in controls was significantly correlated with DG volume $r= .44$, $p <0.5$ but not CA3 ($p= .20$). While pattern completion in the cognitively impaired group was significantly correlated with CA1 volume $r= .52$, $p <.05$ as well as SRSLSM volume $r= .53$, $p <.05$ and Subiculum volume $r=.65$, $p <.001$. Previous research in humans has not clearly distinguished DG and CA3, whereas our segmentation protocol allows for distinction between the DG and CA3 regions. Consequently we propose that perhaps the DG rather than CA3 is critical for human pattern separation.

E93

HOW SCHOOLING INFLUENCES CHILDREN'S MEMORY: THE EFFECTS OF ACQUIRED SCHEMAS

Garvin Brod[1], Yee Lee Shing[1,2]; [1]Max Planck Institute for Human Development, [2]University of Stirling — Memory performance increases dramatically during childhood. One important reason for this is an increase in knowledge. Prior knowledge is assumed to provide the learner with a schema that helps to incorporate new, related information into existing neocortical networks. The ventromedial prefrontal cortex (vmPFC) has been shown to mediate the influence of a schema on memory in young adults, but whether it serves a similar role in children is as yet unknown. A common way to measure this influence is to compare memory for schema-congruent and schema-incongruent new information (i.e. congruency effect). We compared children (average age 6.5 years) with one year of school experience (n=18) with kindergarten children (n=28) of similar age on an object-scene memory task. The study phase took place in the MRI scanner, which allowed us to determine areas associated with successful memory encoding (i.e. subsequent memory effects). Objects were either congruent or incongruent to the scenes. Critically, objects and scenes were related to the 1st grade curriculum, which allowed us to look at the effects of schooling (mediated by increased knowledge) on memory. First graders showed a significantly stronger congruency effect as compared to the kindergarten children and this was linked to enhanced vmPFC activation in the school children (Group x Congruency x Memory interaction). These results suggest that one year of schooling can lead to changes in the neural mechanisms supporting episodic memory, and highlight the role of the vmPFC in mediating the influence of prior knowledge on memory formation already in young children.

E94

SPACING, CONTEXT & MEMORY IN YOUNGER & OLDER ADULTS

Matthew Bell[1], Katherine Bercovitz[2], Patricia Simone[1]; [1]Santa Clara University, [2]Harvard — We examined the importance of contextual consistency in the spacing benefit in younger (YA) and older adults (OA). We previously found that both age groups benefitted from a 24-hr spacing period, even though younger adults outperformed older adults in all phases of the study. Because spacing may rely on context to cue recall and older adults may not use contextual cues efficiently, we hypothesized that contextual inconsistency would not negatively impact OA performance, however, YA performance should suffer. English-Swahili word-pairs were encoded in one session and practiced in either massed or spaced (24 hours) condition in same or different room. Final recall was 10 days after this practice. OA underperform on all aspects of the study. They took significantly longer to learn the word-pairs (a mean difference of 30-trials) and recalled a significantly smaller proportion of words at the test ($M = .42$, $SD = .21$ versus $M = .60$, $SD = .21$ for YA, $p < .001$). Additional analyses lead to three important findings. 1) Context matters. OA are at a disadvantage when the room changed, suggesting they use contextual cues. 2) However, when evaluating relative performance across sessions, both YA and OA performance declines at the same rate over the 10 day period. 3) YA are sensitive to room

change, but in the opposite direction: the room change improved recall of massed words (but not to the same level as spaced words). Thus, context and spacing appear to interact differently across age groups.

E95

ANNUAL CHANGES IN DTI METRICS CORRELATE WITH MMSE SCORE DECLINE IN THE ELDERLY

Artemis Zavaliangos-Petropulu[1], Neda Jahanshad[1], Talia Nir[1], Clifford Jack[2], Michael Weiner[3], Matthew Bernstein[2], Paul Thompson[1]; [1]University of Southern California Imaging Genetics Center, [2]Mayo Clinic, [3]UCSF School of Medicine — Diffusion tensor imaging (DTI) is a non-invasive neuroimaging method used to study white matter microstructure, a potentially powerful biomarker for Alzheimer's disease (AD). DTI measures are strongly correlated with cognitive assessments such as the mini-mental state exam (MMSE), but it is unknown how changes in DTI measures correspond with cognitive impairment. Using longitudinal data from 158 participants in ADNI (Alzheimer's Disease Neuroimaging Initiative; mean age: 72.9±7.2; 101M/57F; 49 controls, 51 early- and 30 late- mild cognitive impairment, 28 AD), we compared changes in DTI measures of fractional anisotropy (FA) and mean diffusivity (MD) to changes in MMSE score over a one year interval. FA and MD in 56 white matter regions were extracted using ADNI DTI processing protocols1. We used multiple linear regressions, controlling for age, sex, and diagnosis to run comparisons of percent change in FA and MD to percent change in MMSE. The false discovery rate method (FDR) was used to account for multiple comparisons. Change in both MD and FA in the left superior longitudinal fasciculus was significantly correlated with change in MMSE. For FA, $p=8.9x10\text{-}6$, $\beta=0.12$. This directionality is expected as a greater loss of FA (or loss in white matter integrity), corresponds to a greater decrease in MMSE (greater memory impairment). MD increases with neurodegeneration, as reflected in the results, as $p=1.4x10\text{-}4$ and $\beta=-0.08$. This study indicates the potential value of DTI for Alzheimer's disease research, and helps reveal noninvasive biomarkers that offer added information on the neurobiological correlates of cognitive deterioration.

E96

THE INFLUENCE OF DISTINCTIVENESS AND SEMANTIC RELATEDNESS ON EMOTIONAL MEMORY IN YOUNG AND OLDER ADULTS

Kylee T. Ramdeen[1,2], Alexandrine Morand[2], Nadia Genty[2], Patrick S. R. Davidson[1], Pascal Hot[2]; [1]University of Ottawa, [2]Université Savoie Mont Blanc, France — The emotional enhancement of memory (EEM) effect is the robust finding that memory is superior for emotionally salient versus neutral stimuli. Previous studies suggest that EEM in young adults (YA) may be influenced by distinctiveness (i.e., the degree to which a stimulus stands out, relative to others) and by semantic relatedness (i.e., the associations between stimuli). Given that EEM has been shown to vary with age, distinctiveness and semantic relatedness may differentially influence the EEM effect in older adults (OA). Thirty-eight YAs and 29 OAs studied 64 pictures (16 negative, 16 positive, 32 neutral) either in blocked sets (i.e., by valence) or in mixed sets. The mixed sets rendered the emotional stimuli more salient than in the blocked sets by making each of the emotional pictures stand out relative to the neutral pictures. The level of semantic relatedness between stimuli was manipulated within-subject: half of the neutral stimuli had a low-level of relatedness (similar to the neutral stimuli most commonly used in previous studies), whereas the other half had a high-level of relatedness (similar to that of the emotional stimuli). A mixed ANOVA on immediate free recall performance revealed significant main effects of age, distinctiveness, and relatedness, with an interaction among the three factors. Increased semantic relatedness led to superior recall in both groups, whereas an increase in distinctiveness led to superior recall in OAs only. This suggests that semantic relatedness influences EEM regardless of age, whereas distinctiveness is differently influential on each age group.

E97

SEMANTIC RELATEDNESS OF THE MEMORANDA PREVENTS OLDER ADULTS FROM BENEFITTING FROM UNITIZATION

Emma Delhaye[1], Roni Tibon[2], Nurit Gronau[3], Daniel Levy[4], Christine Bastin[1]; [1]Cyclotron Research Center, University of Liege, Belgium, [2]MRC Cognition and Brain Sciences Unit, Cambridge, UK, [3]Open University of Israel, Israel, [4]School of Psychology and Sagol Unit for Applied Neuroscience, The Interdisciplinary Center, Herzliya, Israel — Aging is accompanied by a decline in associative memory. However, the age-related associative memory deficit can be alleviated when the components of the association are unitized (i.e. considered as a unique entity). In this case, age-invariant familiarity can contribute to the recognition of unitized associations. Here, we investigated the possibility that semantic relatedness between items could lead to their unitization and favour the use of familiarity at retrieval, thus improving older adults' associative memory. 24 young and 24 older participants studied pairs of object pictures that were either semantically related (e.g. a knife and a cucumber) or unrelated (e.g. an egg and a shoe). At test, participants discriminated between intact, recombined and new pairs. Contributions of recollection and familiarity were estimated with the Remember/Know/Guess (RKG) paradigm. Older adults showed less correct identifications of recombined pairs and more false recognitions to these pairs than young adults. Both groups had poor performance for recombined pairs, particularly when pairs were semantically related. RKG data showed a difference in the use of "know" responses in the false recognitions, with more false recognitions based on familiarity in older adults and for recombined pairs, particularly when those were semantically related. False recognitions for recombined pairs were also accompanied by more "remember" responses than new pairs. Altogether, these results suggest that a semantic relationship between items induced an enhancement of the absolute familiarity in both groups, prevented older participants from using a recall-to-reject strategy, and did not improve the age-related associative deficit.

E98

MAPPING PREFRONTAL CORTEX CONTRIBUTION TO THE DEVELOPMENT OF MEMORY FORMATION

Lingfei Tang[1], Andrea Shafer[1], Qijing Yu[1], Ryan Liddane[1], William Angell[1], Noa Ofen[1]; [1]Institute of Gerontology, Psychology Department, Wayne State University — The prefrontal cortex (PFC) is involved in memory formation; both activation and deactivation in this region support memory formation in adults. PFC shows protracted maturation and age-related increase in activation supporting memory formation. Little is known, however, about possible age effects in the magnitude of PFC deactivation, or the age effects in functional connectivity of PFC with other memory-related brain regions. We tested age effects in PFC activation and connectivity that supported subsequent memory of scenes in 83 participants (ages 8-25 years). Consistent with prior research, we found an age-related increase in subsequent memory activation within the dorsal lateral PFC. In addition, we found an age-related increase in subsequent memory deactivation in rostral lateral and superior regions of the PFC. Interestingly, individual differences in subsequent memory deactivation in the superior PFC mediated the age-related improvement in memory performance. We further investigated age effects in the functional connectivity patterns of PFC regions. The functional connectivity between dorsal lateral PFC and regions in the medial temporal lobe (MTL) was positive and increased with age, whereas the functional connectivity between the superior PFC and MTL was negative and increased with age, suggesting that an age-related increase in the level of anticorrelation between MTL and PFC supports improvement in memory functioning across age. Taken together, these findings demonstrate differential age effects in the contribution of PFC regions to memory formation and underscore the notion that protracted development of the PFC is a key factor in age-related increases in memory functioning from childhood to adulthood.

E99

DISCOVERING THE ROLE OF ABO BLOOD TYPE IN RISK FOR ALZHEIMER'S DISEASE

Brandalyn Riedel[1,2], Roberta Brinton[1,3], Paul Thompson[1,2]; [1]University of Southern California, [2]Stevens Neuroimaging and Informatics Institute, [3]The Kenneth T. and Eileen L. Norris Laboratory for Neuroscience Research, USC School of Pharmacy, University of Southern California — Cardiovascular disease (CVD) and cognitive impairment share an overlapping etiology. The H antigen, epistatic to the ABO locus, is located on the same chromosome as APOE, a key protein in the regulation of lipid homeostasis, and the greatest genetic risk factor for Alzheimer's disease (AD). Despite evidence for ABO in CVD, its role in AD risk is just emerging. Recently it was reported that adult O carriers may have reduced risk for AD due to greater cerebellar and hippocampal volume, and reduced risk for cognitive decline. We report the first study of ABO effects in older adults (N=1152,

mean age:74.1 ± 7; 499 women, 653 men), recruited in ADNI. We analyzed MRI brain scans from these individuals (N=864) and performed region of interest (ROI) analysis. A linear model tested for associations between ICV-normalized ROI volumes and blood type, (controlling for age, sex, education, APOE-ε4 allele number, and baseline diagnosis). Multiple comparisons were adjusted using Bonferroni's correction. Relative risk of progressing to Alzheimer's was calculated for cognitively normal (N=338) and mild cognitive impairment (N=588) individuals. We found O blood type individuals had the greatest risk at 1.16, carriers of the B blood type had the lowest risk at 0.8. ROI analysis found carriers of the AB blood type had increased volume in the left and right entorhinal cortex and the right hippocampus; B carriers had increased volume in the corpus callosum. Contrary to results in a younger cohort, O carriers had significantly reduced right cerebellar volume.

LONG-TERM MEMORY: Episodic

E100

FUNCTIONAL AND STRUCTURAL CORRELATES OF THE TESTING EFFECT

Jaione Arnaez-Telleria[1], Garikoitz Lerma-Usabiaga[1], Manuel Carreiras[1,2,3], Pedro M. Paz-Alonso[1]; [1]BCBL. Basque Center on Cognition, Brain and Language, Donostia-San Sebastián, Spain, [2]IKERBASQUE, Basque Foundation for Science, Bilbao, Spain, [3]Departmento de Lengua Vasca y Comunicación, UPV/EHU, Bilbao, Spain — The way we encode information into long-term memory is crucial for its retention. Learning strategies based on repeated retrieval are efficient in creating more durable episodic memories relative to strategies based on repeated study. This is known as the testing effect, which has been extensively demonstrated in behavioral research. However, the neural mechanisms underlying this effect are still unknown. This study was aimed at investigating the functional and structural correlates underlying episodic memory retrieval for information learned via repeated study or repeated retrieval. Thirty-seven young adults studied 100 Swahili-Spanish word pairs (rafiki-amigo) under repeated retrieval or repeated study conditions and underwent MRI scanning right after initial encoding and also 48 hours later. At the scanner, participants performed cued-recall tasks on studied and non-studied items. Behavioral results confirmed long-term memory benefits of repeated retrieval compared to repeated study. Neuroimaging data revealed stronger hippocampal engagement for successfully remembered items studied under repeated study versus repeated retrieval, and stronger lateral prefrontal cortex (lPFC) recruitment for remembered items learned under repeated retrieval versus repeated study. Functional connectivity analyses revealed tighter coupling among distributed hippocampal-PFC regions for items studied under repeated retrieval versus repeated study, as well as stronger connectivity among hippocampal regions for items studied under repeated study versus repeated retrieval. Structural analyses showed differences in the contribution of white-matter pathways connecting hippocampal and lPFC structures to these effects. Our results suggest that retrieval practice facilitates the engagement of additional routes to trace back information from long-term memory, making this information less hippocampal dependent.

E101

COLLABORATIVE PAIRED-ASSOCIATE LEARNING ENGAGES MULTIPLE MEMORY SYSTEMS

Flora Vanlangendonck[1,2], Atsuko Takashima[3], Roel Willems[1,4,5], Peter Hagoort[1,4]; [1]Donders Institute for Brain, Cognition and Behaviour, Radboud University Nijmegen, The Netherlands, [2]International Max Planck Research School for Language Sciences, Nijmegen, The Netherlands, [3]Behavioural Science Institute, Radboud University Nijmegen, The Netherlands, [4]Max Planck Institute for Psycholinguistics, Nijmegen, The Netherlands, [5]Centre for Language Studies, Radboud University Nijmegen, The Netherlands — Although patients with hippocampal amnesia are unable to learn arbitrary relations in paired-associate learning, they can successfully learn novel, self-generated picture labels across a series of communicative interactions (Duff et al., 2006). Here, we investigated whether different strategies to learn paired picture-label associations would lead to differential neural representations, and whether collaborative learning benefits later performance. Healthy participants (n = 35) learnt labels for sets of abstract shapes in three different tasks. They came up with labels with another person in a collaborative communication task (collaborative self-generated condition), by themselves (individual self-generated condition), or were given pre-determined unrelated labels to learn (individual arbitrary condition). Immediately after learning, participants produced the labels aloud in the MRI scanner when cued with the shapes. Our behavioral results show that the collaboratively generated labels were remembered faster and more accurately than the other labels, even though they were longer. The fMRI results show that while the retrieval of arbitrary labels relied on the hippocampus, the retrieval of self-generated labels activated the semantic memory network (left angular gyrus and temporal poles). The direct comparison of the collaborative with the individual self-generated conditions revealed a set of brain regions involved in autobiographical memory and Theory of Mind (retrosplenial cortex, precuneus, medial prefrontal cortex and temporo-parietal junction), and the striatum. Our findings show that the retrieval of labels generated collaboratively during social interaction engages semantic, autobiographical and mentalizing processes. These results provide interesting insights into the memory benefit of novel labels generated through social interactions.

E102

AUTOBIOGRAPHICAL RETRIEVAL REVEALED IN THE EYES OF THE NARRATOR: DYNAMIC CHANGES IN PUPILLOMETRY

Aoxiang Xu[1], Bauer Patricia[1]; [1]Department of Psychology, Emory University — Autobiographical memory (AM) refers to memory for personally significant events and experiences. Though the products of autobiographical memory retrieval (e.g., narratives) have been well researched, the dynamic processes involved in search and access and subsequent elaboration of autobiographical memories are only beginning to be explored. Moreover, it is unclear how factors such as gender and emotion influence the AM retrieval process. In the present study, we developed a novel method using pupillometry to examine effects of gender and emotion as participants retrieved and narratively described emotional autobiographical events. 22 undergraduates (11 females) were recruited as participants. Pupillary responses were recorded while participants typed narrative descriptions of positive, negative, and neutral autobiographical memories. Participants produced more words and had a longer duration of typing for emotional narratives than non-emotional narratives; females used more words and typed for longer relative to males. A longitudinal analysis applied to the pupil dilation curve revealed no gender differences at the beginning of narrative production; gender differences emerged over time. For males only, pupil size was positively correlated to the number of evaluation words in narratives about negative events, and negatively correlated to the number of emotional words in negative event narratives. Our study confirmed the promising application of pupillometry to the study of AM retrieval, and further explored the temporal process of the effects of gender and emotion on AM retrieval.

E103

EXPLORING THE FUNCTIONAL ORGANIZATION OF THE HIPPOCAMPUS WITH A CATEGORY FLUENCY TASK

Signy Sheldon[1], Mary Pat McAndrews[2], Morris Moscovitch[3]; [1]McGill University, [2]Toronto Western Hospital, [3]University of Toronto — Emerging neuroimaging evidence has confirmed functionally distinct contributions of the anterior and posterior hippocampus to episodic memory retrieval. One view of this functional distinction is that the anterior and posterior hippocampus preferentially process conceptually versus perceptually based information, respectively. Whether this distinction extends beyond traditional episodic memory scenarios is unclear. In this study, we examined anterior and posterior hippocampal contributions to a standard semantic retrieval measure, category fluency. While in an MRI scanner, young healthy participants generated items to categories that were based on personal conceptual (autobiographical categories – 'movies that you have seen') or perceptual (spatial categories – 'items in a kitchen') information. We found that the conceptually based autobiographical categories preferentially recruited the anterior hippocampus whereas the perceptually based spatial categories preferentially recruited the posterior hippocampus. These differences were also evident when we examined how the hippocampus interacted with other cortical regions during item generation. The reported findings extend functional organization models of the hippocampus that are based on conceptual and perceptual retrieval demands to outside the domain of episodic memory.

E104

INVESTIGATING THE NEURAL UNDERPINNINGS OF PRECISION IN LONG-TERM MEMORY RETRIEVAL

Franziska R. Richter[1], Rose A. Cooper[1], Paul M. Bays[1], Jon S. Simons[1]; [1]University of Cambridge — Remembering previous experiences in a detailed manner is one of the hallmarks of episodic memory. The current experiment aims to extend our understanding of recollection by directly contrasting retrieval accuracy and retrieval precision, both behaviourally and neurally. In the fMRI scanner, participants encoded a series of stimulus displays, each consisting of a unique background scene with three superimposed objects that varied randomly in three features: colour, orientation, and location. In a subsequent test phase (also scanned) participants' memory for these features was tested by having them recreate the appearance of the objects using a continuous circular dial. First we assessed how 'accurately' participants remembered these features, by determining the percentage of responses that fell within a pre-specified interval around the original feature value. For trials classified as accurate, we additionally assessed how 'precisely' participants remembered the different object features by measuring the absolute distance from their recreated response to the original colour, orientation, and location values. Precision and accuracy were dissociable behaviourally using model-based analyses, with accurate memories associated with a range of precision levels. This distinction was also reflected in the neural data with different regions responding to accuracy and precision. When directly contrasting accuracy with precision, accuracy was associated with increased activity in inferior parietal, inferior frontal, and occipito-temporal regions, whereas precision scaled with activity in posterior parietal regions (angular gyrus), the posterior cingulate, and medial frontal areas. Our results highlight a distinct set of neurocognitive processes that determine the precision with which we can recollect previous experiences.

E105

AN INFORMATION PROCESSING STREAM FROM MEDIAL TEMPORAL LOBE FOR MEMORY-GUIDED VISUAL BEHAVIOR

Kelly Shen[1], Gleb Bezgin[1], Rajajee Selvam[1], Anthony R. McIntosh[1,2], Jennifer D. Ryan[1,2]; [1]Rotman Research Institute, Baycrest, [2]University of Toronto — Visual behavior is guided by memories from previous experience and knowledge of the visual scene. For example, saccadic eye movements reveal memory for the relations among items (Hannula et al., 2012). Amnesic cases, those with damage to the medial temporal lobe (MTL) and specifically the hippocampus, do not exhibit effects of memory in their visual behavior. These previous findings suggest that MTL memory representations can bias the selection of saccades. However, no direct connections are known to exist between MTL and oculomotor control areas, and how memory representations from the MTL influence the oculomotor system remains unknown. Using network analysis, we examined the neuroanatomical basis for the routing of memory information to oculomotor structures. We derived a connectivity matrix from a database of macaque axonal tract tracing studies that included 74 cortical and subcortical ROIs from the visual, oculomotor and memory systems. Using a data-driven iterative force-directed layout procedure, we detected two distinct processing streams that each represented the visuo-oculomotor and memory systems. We identified a putative set of hub regions that densely interconnect the oculomotor and memory streams. These hubs included the ventro- and dorso-lateral prefrontal cortices, the posterior cingulate, the inferior parietal lobule, the parahippocampal cortex and the supplementary eye field. Interestingly, the frontal eye field also emerged as a hub, suggesting that it is well positioned to directly integrate memory information into the guidance and control of saccades. Our findings reveal a network of hubs that together may mediate the moment-to-moment influence of memory on visual behavior.

E106

TEMPORAL AND ORDINAL MEMORY FOR EVENTS IN LARGE-SCALE VIRTUAL NAVIGATION

Iva Brunec[1,2], Jason Ozubko[3], Morgan Barense[1,2], Morris Moscovitch[1,2]; [1]University of Toronto, [2]Rotman Research Institute, Baycrest, [3]State University of New York at Geneseo — The location and temporal order of individual events are thought to be encoded by the hippocampus and provide a spatiotemporal context used in the disambiguation of events comprising a longer sequence. Little is known, however, about how the duration of a particular event is encoded into this contextual representation and how recollection and familiarity are related to it. In order to investigate the recollection/familiarity distinction in memory for ordinal position and duration, we used a novel naturalistic virtual reality navigation paradigm based on Google Street View where periods of navigation were interspersed with pauses of different durations. In a series of experiments, we found that participants were able to distinguish reliably only the durations of events that were subjectively recollected, but not of those that were familiar. This effect was unique to duration and was not found in ordinal judgments. We further found that active interaction with the environment enhances recollection, highlighting the importance of idiothetic cues and perceptual feedback in subjective timekeeping and temporal encoding. We suggest that time appears to be represented in episodic memory in a manner akin to space, and that the hippocampally-supported ability to recollect or re-experience an event enables the reinstantiation of its temporal and spatial context in order to distinguish it from other events in a sequence.

E107

"BRAIN: THE INSIDE STORY": AGING AND RECOGNITION MEMORY FOR A REAL WORLD MUSEUM EXHIBIT

Nick Diamond[1,2], Kristoffer Romero[2], Nivethika Jeyakumar[2], Brian Levine[1,2]; [1]University of Toronto, [2]Rotman Research Institute, Baycrest Health Sciences — Re-experiencing and spatiotemporal context retrieval are hallmarks of episodic memory function. Accordingly, there has been increasing interest in developing more immersive and naturalistic experimental encoding contexts. Temporal order memory is a sensitive measure of episodic memory ability, yet little is known about memory for the temporal structure of complex real-world experiences involving self-initiated movement, navigation and volitional control – factors found to modulate mechanisms underlying episodic memory encoding. We used an exhibit at the Ontario Science Centre ("Brain: The Inside Story") with a track-like layout as a dynamic and large-scale naturalistic encoding event. 172 healthy adult visitors (M = 41.41 years, SD = 14.29) to the exhibit completed a brief scavenger hunt exercise as part of their museum visit. Approximately three months later (range: 74-133 days), they completed an online test of temporal order memory for photographs of the target exhibit items. Estimates of item and associative memory processes were derived using the process dissociation procedure. Contrary to the classic finding of disproportionate associative memory decline but spared item memory with advancing age on lab-based tasks, we found an age-related reduction in both item and associative components of temporal order memory when controlling for remoteness. Age was selectively associated with decreased temporal order memory for long versus short lag item pairs. These findings suggest that, relative to lab-based stimuli, there may be greater overlap in the neurocognitive processes recruited by item and associative measures of memory for intrinsically context-bound real-world experiences.

E108

MULTIVOXEL PATTERN SIMILARITY PREDICTS SUBSEQUENT RECOLLECTION FOR SCENES REPEATED ACROSS DIFFERENT ENCODING CONTEXTS

Jong-rok Do[1], Sunyoung Park[1], Yoonjung Lee[1], Kyeongjin Tark[1], Minjeong Jeon[2], Do-Joon Yi[1]; [1]Yonsei University, [2]Ohio State University — The previous studies demonstrated that the similarity, not variability, of multivoxel patterns for repeated items is associated with durable memory retention (Xue et al., 2010; Ward et al., 2013). The current study attempted to replicate the previous findings with important modifications to the methods: items were repeated across different encoding contexts and subsequently tested for episodic recollection. These modifications might reveal mnemonic benefits of neural variability in repeated learning (Wirebring et al., 2015). In the scanner, 22 participants incidentally learned a number of scenes while judging the easiness of drawing each scene in a painting ('painter task') or evaluating the composition of each scene as a photo ('photographer task'). Eighty critical scenes appeared in both tasks while the other scenes appeared once in either task. In the surprise post-test outside the scanner, participants decided if the scene presented in each trial had appeared during both tasks, either one task, or neither of the two tasks. A sequential linear mixed effect modeling was used to analyze the relationship between the pattern similarity for the repeated scenes in 20 encoding-related regions. As results, we found in most regions of interest that the repeated scenes subsequently endorsed to both tasks produced

greater pattern similarity than those endorsed to a single task (i.e., partially forgotten). The latter also produced greater pattern similarity than those endorsed to neither tasks (i.e., completely forgotten). These findings suggest that repeated learning could strengthen memory representations through reactivation regardless of context variability of learning episodes.

E109

DISSOCIATING THE EFFECTS OF PRE-EXPERIMENTAL VS. INTRA-EXPERIMENTAL FAMILIARITY ON SOURCE MEMORY: AN FMRI STUDY

Sunyoung Park[1], Jong-rok Do[1], Hongmi Lee[2], Kyeongjin Tark[1], Kyungmi Kim[3], Minjeong Jeon[4], Do-Joon Yi[1]; [1]Yonsei University, [2]New York University, [3]Wesleyan University, [4]Ohio State University — Objects and events that we experience everyday have different degrees of familiarity. How does such difference in familiarity influence memory? Previous studies have reported inconsistent results; familiarity enhances source memory in some cases, but impairs it in other cases (Kim et al., 2011; Poppenk et al., 2010). Our own previous study suggested that the type of familiarity matters. Specifically, intra-experimental familiarity (i.e., repetition) is beneficial for the source memory of pre-experimentally unfamiliar (i.e., unknown) faces, whereas it is detrimental for that of pre-experimentally familiar (i.e., famous) ones (Lee et. al., 2010). Here, we replicated and extended our findings using fMRI. Twenty-four participants performed a three-phase experiment. The first phase presented a set of famous or unknown faces 10 times to increase their intra-experimental familiarity. In the second phase, the repeated face set and a new set of famous and unknown faces were randomly presented in one of four screen quadrants. The last phase tested if participants correctly remembered in which quadrant each face appeared during the second phase. The source memory performance replicated our previous results. In addition, a generalized linear mixed effect modeling revealed that the activity in encoding-related regions such as hippocampus, amygdala, ventral temporal and frontal cortices significantly increases the goodness of fit of a model that predicts subsequent source memory performance. Together, our results suggest that pre-experimental familiarity can be a potential modulator of intra-experimental familiarity effects on source memory.

E110

NEURAL CORRELATES OF SUCCESSFUL MEMORY ENCODING AND RECOGNITION: DIFFERENT ROLES FOR ERP SIMILARITY ACROSS MULTIPLE STIMULUS PRESENTATIONS IN N400 AND LPC

Carolin Sievers[1], Patrick Davidson[2], Levente Orban[3], Vincent Calcagno[4], Paniz Tavakoli[2], Kenneth Campbell[2], Morris Moscovitch[5,6], Brian Levine[5,6], Louis Renoult[1]; [1]University of East Anglia, UK, [2]University of Ottawa, Ontario, Canada, [3]Kwantlen Polytechnic University, Richmond, British Columbia, Canada, [4]French Institute for Agricultural Research (INRA), Sophia Antipolis, France, [5]Rotman Research Institute, Baycrest, Toronto, Ontario, Canada, [6]University of Toronto, Ontario, Canada — The present study employed the subsequent memory paradigm and representational similarity analysis (RSA) to investigate ERP similarity patterns across 1) multiple encoding episodes and 2) between encoding and correct recognition. Nineteen adult participants performed a categorization task in which each stimulus was presented four times, followed by a recognition memory task. We hypothesized that the N400 component, associated with retrieval from semantic memory, would show more similar amplitudes across the 4 encoding presentations (encoding pattern similarity) for subsequently remembered than forgotten stimuli. On the other hand, we predicted that for the late positive component (LPC), associated with episodic recollection, ERP amplitudes would be less similar across presentations compared to N400 similarity (encoding pattern distinctiveness). We also predicted higher similarity between encoding and correct recognition (i.e., hits) for LPC than N400, consistent with reinstatement of initial encoding patterns. In line with these hypotheses, neural similarity among the 4 encoding presentations was higher for the N400 than for the LPC. Moreover, when comparing similarity between each of the encoding conditions with each other (encoding similarity) and between each with recognition (encoding-recognition similarity), it was found that the degree of similarity in LPC amplitudes was higher between encoding and recognition than across the 4 encoding presentations, while the opposite pattern was observed for the N400. This finding illustrates that semantic memory is biased towards pattern similarity during encoding, while episodic memory is biased towards pattern distinctiveness. In contrast, encoding-recognition similarity is higher for episodic than semantic memory, consistent with the processes of reinstatement.

E111

SCHEMA-CONSISTENCY MODULATES POST-ENCODING NEURAL CONNECTIVITY IN THE HIPPOCAMPUS AND CORTICAL REGIONS

Niv Reggev[1], Alexa Tompary[2], Amnon Yacoby[1], Oded Bein[2], Lila Davachi[2], Anat Maril[1]; [1]Hebrew University, Jerusalem, [2]NYU — Schemas play a pivotal role in memory by promoting the processing of to-be-remembered schema-consistent events. Here we address for the first time the role a schema plays at the time period immediately following the presentation of schema-consistent or inconsistent events. While much recent evidence suggests that processes taking place during post-encoding offline periods play a major role in mnemonic performance, previous schema studies focused on online processing. These studies showed that schema supported (or unsupported) information was associated with neural activity in the Hippocampus (HC), medial prefrontal cortex (mPFC) and left inferior frontal cortex (LIFC) was functionally relevant to the processing of schema supported or unsupported information. To address the contribution of offline processing to schema-dependent memory, participants incidentally encoded verbal stimuli displayed in a schema-consistent or inconsistent context while being scanned; of interest were the post-encoding rest periods which followed each encoding block. Memory was assessed by item-recognition and cued-recall tests. Results indicate the existence of two global patterns: while connectivity within lateral cortical regions is enhanced at offline periods following the processing of schema-consistent information, the offline connectivity between these regions and the mPFC and HC is enhanced following the processing of schema-inconsistent information. Moreover, mPFC-HC connectivity was associated with across-participants subsequent memory, such that the more correlation these regions displayed following schema-inconsistent information, the more schema-inconsistent information was remembered. These results show that post-encoding offline neural operations provide a unique contribution to understanding the processing and subsequent memory of schema-related information.

E112

COGNITIVE ENDOPHENOTYPES INFORM GENOME-WIDE EXPRESSION PROFILING IN SCHIZOPHRENIA

Amanda Zheutlin[1], Rachael W Viehman[2], Rebecca Fortgang[1], Jacqueline Borg[3], Desmond J Smith[2], Jaana Suvisaari[4], Sebastian Therman[4], Christina M Hultman[3], Tyrone D Cannon[1]; [1]Yale University, [2]University of California Los Angeles, [3]Karolinska Institutet, [4]National Institute for Health and Welfare, Helsinki, Finland — OBJECTIVE: Genes affecting schizophrenia, a highly genetic disorder, likely confer risk via affecting systems underlying cognitive processes, accounting for the profound cognitive impairment characteristic of the disease. We performed a whole-genome expression study to clarify the nature of the biological processes mediating between inherited genetic variations and verbal memory dysfunction in schizophrenia. METHOD: Gene expression was assayed from peripheral blood mononuclear cells using Illumina Human WG6 v3.0 chips in twins discordant for schizophrenia or bipolar disorder and control twins. After quality control, expression levels of 18,559 genes were screened for association with California Verbal Learning Test (CVLT) performance, and any memory-related probes were then evaluated for variation by diagnostic status in the discovery sample (N=190), and in an independent replication sample (N=73). Heritability of gene expression using the twin design was also assessed. RESULTS: After Bonferroni correction ($p < 2.69$ x 10-6), CVLT performance was significantly related to expression levels for 76 genes, 43 of which were differentially expressed in schizophrenia patients, with comparable effect sizes in the same direction in the replication sample. For 41 of these 43 transcripts, expression levels were heritable. Nearly all identified genes contain common or de novo mutations associated with schizophrenia in prior studies. CONCLUSION: Genes increasing risk for schizophrenia appear to do so in part via effects on signaling cascades influencing memory. The genes implicated in these processes are enriched for those related to RNA processing and DNA replication and include genes influencing G-protein coupled signal transduction, cytokine signaling, and oligodendrocyte function.

E113

ESTROGEN EFFECTS ON HIPPOCAMPAL MEMORY IN WOMEN

Soniya Assudani Patel[1], Emily Errante[1], Rachel Niezrecki[1], Lauren Masayda[1], Stephen Friedland[1], Franchesca Kuhney[1], Ambica Mehndiratta[1], Adriana Racki[1], Karyn M. Frick[2], Paul Newhouse[3], Robert Astur[1]; [1]University of Connecticut, [2]University of Wisconsin-Milwaukee, [3]Vanderbilt University School of Medicine

— Estrogen is generally associated with female sexual development and reproduction, but it also has a critical role in neuronal function and learning and memory. Low levels of estrogen have been associated with dementia, anxiety, and depression (Contreras et al., 2000; Maki, 2001; Young et al., 2001). Additionally, studies have shown that women with high estrogen levels outperform women who have low levels on various memory tasks (Graham & Milad, 2013; Hampson & Morley, 2013). Hormonal contraceptives (HCs) work by decreasing estrogen levels, thereby inhibiting ovulation. Whereas HCs work well for birth control, it is unclear how this artificial lowering of estrogen affects memory relative to naturally cycling (NC) females. A total of 120 women completed a virtual Morris water task (MWT) and radial arm maze (RAM) over two consecutive days. These tasks are known to be sensitive to hippocampus function. Saliva samples were collected for estrogen assays. Performance on the MWT indicated that on day 2, the HC group showed worse spatial memory than the NC group by having significantly longer distances to the goal platform and less of a preference for the platform quadrant during a no-platform probe trial. Additionally, the HC group made significantly more errors than the NC groups on day 2 of the RAM. Overall, the results indicate that women on HCs perform worse than NC women on hippocampal sensitive tasks. Comparisons between low and high estrogen NC women are also presented. These experiments provide insight into the role of estrogen in memory function.

E114

THE NEURAL CORRELATES OF RELATED LURE INTERFERENCE ON CORRECT RECOGNITION AND FALSE MEMORY SUPPRESSION

Shalome Sine[1], Caitlin Bowman[1,2], Nancy Dennis[1]; [1]Pennsylvania State University, [2]University of Oregon

— Successful memory retrieval requires one to distinguish between old and new information. This is often difficult when new information is closely related to old information and thus causes interference at the time of the retrieval decision. In order to investigate the neural basis of these interference effects, we presented individuals with a retrieval test in which lures were perceptually similar to targets and counterbalanced the order in which the target and corresponding related lure were presented. Results showed that when the related lure came first (as opposed to when the related lure was preceded by the target), the lure caused interference not only on that trial, also on the following target presentation. Specifically, when the related lure was presented prior to the target, increased activity was observed in frontal and parietal regions (reflecting increased evaluation) as well as inferior and middle occipital gyri and fusiform gyrus (reflecting increased visual inspection necessary to resolve interference) for both items. When the target preceded the lure, results revealed a much more limited neural network for both target acceptance and lure rejection. These results suggest that the presentation of a related lure generates interference that then requires heightened attentional processing and evaluation of item details for both the current and future memory decisions. In contrast, when the target is presented first, and interference from the related lure is diminished, correct recognition and correct rejection processing operates much more efficiently.

E115

CAN EVENT-RELATED POTENTIALS AT ENCODING PREDICT WHETHER SUBSEQUENT RECOGNITION IS BASED ON FAMILIARITY OR RECOLLECTION?

Michael Weigl[1], Aline Ehritt[1], Axel Mecklinger[1], Timm Rosburg[1,2]; [1]Saarland University, [2]University Psychiatric Clinics Basel

— The isolation (von Restorff) effect refers to the phenomenon that memory is enhanced for events that are physically or semantically isolated in their study context. Isolated events typically elicit a P300 in the event-related potential (ERP) and semantic isolates additionally elicit an N400. Memory studies with free recall generally report that P300, but not N400, amplitude predicts subsequent memory performance. However, some recent evidence indicates that N400 amplitude at study co-varies with familiarity-based recognition. Thus, we hypothesized that N400 is related to familiarity-based recognition and that P300 is linked to recollection-based recognition, which shares some similarities with free recall. We recorded ERPs to physical and semantic isolates and control items at encoding and tested whether these items were later recognized on the basis of recollection or familiarity using the remember/know procedure. At encoding, physical and semantic isolates elicited, as expected, a P300 and semantic isolates elicited an N400. Whereas the P300 amplitude at encoding was significantly larger for remembered than for known and forgotten items, N400 did not differ between items subsequently remembered, known or forgotten. Unexpectedly, memory for physical and semantic isolates was not enhanced relative to control items. However, high overall memory performance might explain the absence of an isolation effect. The ERP results support the view that P300 activity at encoding is linked to subsequent recollection-based recognition, whereas the hypothesis that N400 at encoding is related to familiarity-based recognition was not supported. Thus, recollection, but not familiarity, seems to depend crucially on the encoding context.

E116

CURIOSITY SWITCHES THE RELATIONSHIP BETWEEN HIPPOCAMPUS ACTIVATION AND MEMORY SUCCESS

Mai-Anh Vu[1], Jessica Stanek[1], Laura Lerebours[1], Tobias Egner[1], R Alison Adcock[1]; [1]Duke University

— High levels of curiosity, like high reward, facilitate increased memory encoding success. Cues predicting high-curiosity outcomes elicit activation in mesolimbic dopamine circuitry supporting memory. Specifically, in the hippocampus, it has been shown that activation at cue predicts subsequent memory success for high- but not low-curiosity information. However, engagement of mesolimbic circuitry is highly dynamic with distinct responses to reward cue, anticipation, and outcome events. Thus, we were interested in investigating whether the relationship between hippocampus activation and memory success is similarly dynamic, and how this relationship is modulated by curiosity. To this end, we designed an fMRI study in which we used trivia questions to manipulate cue-evoked curiosity, presented participants with an anticipatory delay period, and then delivered the trivia answer at outcome. We examined how hippocampus activation over time predicted memory for the answer in either a high- or low-curiosity state. Analyses dissociated event-related hippocampus activation in response to the cue and outcome, as well as the background activation during anticipation. Our findings replicated previous work at cue, showing that the hippocampus only predicted memory success for high-curiosity information. This relationship also held at outcome, such that the hippocampus again predicted memory success for high-curiosity information. However, in the absence of high-curiosity information, both during anticipation and during low-curiosity outcomes, hippocampus activation instead predicted memory failure. Thus, we found that high- versus low-curiosity states inverted the relationship between hippocampus activation and memory encoding success.

E117

INTEGRATION REDUCES INTERFERENCE BETWEEN OVERLAPPING MEMORIES

Avi J H Chanales[1], Franziska R Richter[2], Brice A Kuhl[3]; [1]New York University, [2]University of Cambridge, [3]University of Oregon

— Memories for past events will often share overlapping features. This overlap can lead to interference during memory retrieval, which has long been established as a powerful contributor to forgetting. Here, we tested whether behavioral and neural factors that promote across-event 'integration' during encoding actively reduce interference during subsequent retrieval. To this end, we first developed a behavioral paradigm to measure the degree to which overlapping events interfere with one another during memory retrieval. In our paradigm, participants initially learned to associate words with pictures (A-B learning). During a subsequent learning phase (A-C learning), all of the previously learned words (A) were paired with new pictures (C). Memory for the new associations (A-C) was then tested in the presence or absence of an explicit reminder of the B image. We found that reminding participants of the B image (i.e., an overlapping memory) interferes with retrieval of the C associate as reflected by reduced recall accuracy and longer reaction times, relative to control conditions. We then ran a modified version of the paradigm to test whether reminding subjects of the A-B association during A-C learning would influence interference effects at retrieval. Indeed, this manipulation, which putatively increased integra-

tion during encoding, eliminated the interference cost associated with presenting the B item during A-C retrieval. Finally, we ran an fMRI study and found that trial-level neural estimates of integrative processing during A-C learning predicted whether subsequent reminders of the old associations would interfere with retrieval of the new associations.

METHODS: Electrophysiology

E118

THE ELECTROPHYSIOLOGY OF LANGUAGE COMPREHENSION: A NEUROCOMPUTATIONAL MODEL

Harm Brouwer[1], Noortje Venhuizen[1], Matthew Crocker[1]; [1]Saarland University — We present a neurocomputational model of the electrophysiology of language processing. Our model is explicit about its architecture and the computational principles and representations involved. It is effectively a recurrent neural network (of the 'Elman'-type; [1]) that constructs a situation model of the state-of-the-affairs described by a sentence on a word-by-word basis. Each word leads to a processing cycle centred around two core operations. First, the meaning of an incoming word is retrieved/activated, the ease of which is reflected in N400 amplitude. Next, this retrieved word meaning is integrated with the current situation model into an updated situation model, which provides a context for both the retrieval and integration of the next word. The effort involved in situation model updating is indexed by P600 amplitude. We demonstrate how the model accounts for patterns of N400 and P600 modulations observed for a range of signature processing phenomena, including semantic anomaly, semantic expectancy (on nouns and articles), syntactic violations, and garden-paths. Crucially, the model also captures the much debated 'semantic P600'-phenomenon [see 2,4,5]. The implications of our model will be outlined, and we will argue that explicit computational models and quantitative simulations are generally superior to verbal 'box-and-arrow' accounts, and necessary for settling theoretical debates, such as the one concerning the 'semantic P600'-phenomenon. [1] Elman (1990); [2] Brouwer et al. (2012); [4] Kuperberg (2007); [5] Bornkessel-Schlesewsky and Schlesewsky (2008)

E119

COMBINING TIME-FREQUENCY ANALYSIS AND INVERSE SOLUTIONS TO ASSESS FOR PRESERVED COGNITIVE PROCESSING IN CRITICALLY ILL PATIENTS

Adianes Herrera-Díaz[1], Valia Rodriguez[1], Adonisbel Valero[1]; [1]Cuban Neuroscience Center — Deciding whether a patient with a disorder of consciousness -DOC- is in a vegetative or a minimal conscious state is challenging. Lack of sensitive and objective diagnostic techniques determines that about 40% of cases are misdiagnosed. The situation is more complicated in intensive care environment where a wrong diagnosis could affect the quality of treatment. In this study as part of a protocol that aim to standardize the cognitive assessment of critically ill patients we carried out combined time-frequency -TF- and inverse solution -IS- analyses to explore differences between patients with and without DOC in intensive care unit -ICU. The patient's own name uttered by a familiar -ONF- and unfamiliar -ONUF- voice and the ON played in reverse were used as deviants and standard stimuli respectively in an oddball paradigm during passive listening. The results showed that ONF and ONUF in conscious patients and in a patient with locked-in-syndrome elicited similar event-related potentials with a MMN and a P300 components that were characterized by a synchronization in theta range between 300-700 ms in the time-frequency analysis. IS modeled with LORETA evinced neural generators with maxima in bilateral anterior frontal regions as well as in parietoccipital and temporal areas. However patients in minimal conscious state and in vegetative state differed in the absence of theta synchronization and of bilateral frontal and parietooccipital involvement. Even when our results are preliminary they suggest that TF and IS applied to ERP data could have enough sensitivity to detect preserved cognitive processing in ICU.

E120

ELECTROPHYSIOLOGICAL TOPOGRAPHY OF THE SUBTHALAMIC NUCLEUS IN PARKINSON'S DISEASE

McKenzie Winter[1], Aviva Abosch[1], John Thompson[1]; [1]University of Colorado School of Medicine — We used electrophysiological data from Deep Brain Stimulation (DBS) targeting the Subthalamic Nucleus (STN) of Parkinson's Disease (PD) patients to create an anatomical map of neurons, enabling identification of the STN during surgery as well as contributing to our ever-expanding knowledge of neuroanatomy. In this study, we examined the anonymized single unit recordings from 20 PD subjects collected during the standard-of-care intraoperative, electrophysiological mapping during DBS lead placement. To ensure accurate identification of single neurons, we clustered spike waveform features (e.g., valley, peak, energy, PC1 and PC2) with the program Offline Sorter (Plexon) using a combination of automated clustering algorithms (e.g., k-means, valley-search) and subjective refinement with inspection of waveforms in Matlab (Mathworks). Putative single neurons were rejected based on cluster quality metrics and interspike interval (ISI) violations. Well-isolated single STN neurons were analyzed for firing rate, bursting and tremor-related activity. Anatomically, the electrode positions were derived from the postoperative MRI in conjunction with recording depths collected from the microelectrodes during DBS surgery. Calculated neuronal locations were then transposed onto pre-operative 3T T2 MRI scans (used for targeting). MRI scans were analyzed using the anatomical programs, ITK-Snap and Mango. For our study we sought to characterize whether the dorsal and ventral borders of STN could be differentiated by firing properties of single units, including firing rate and bursting activity. Transposing these electrophysiology recordings to MRI scans of DBS patients will enhance understanding of DBS and the treatment of PD via STN stimulation by creating an anatomical map of neuron waveforms.

E121

THE IMPACT OF LATENCY JITTER ON THE USE OF P300 IN THE ASSESSMENT OF COGNITIVE FUNCTION

Xiaoqian Yu[1], Chad Dube[1], Jordy Roque[1], Emanuel Donchin[1]; [1]University of South Florida — Verleger et al (2014) reported that the amplitude of the P300 is reduced when the task requires the subject to choose among responses. This is considered supportive of a model of the P300 that emphasizes the decision requirements. However, an examination of its waveforms suggests that the P300 amplitude is reduced because in that particular condition the P300 is subject to considerable latency jitter. That is, the latency of the P300 varies substantially across trials due to the difficult judgements required on different trials. As has been shown by Kutas et al (1977) such variance in amplitude can be eliminated by applying latency jitter adjustment to the P300. The current study replicated experiment 1 in Verleger et al (2014) to explore latency jitter issue. In the oddball task, ancillary stimuli were added to frequent and rare targets, either X or U is framed by a blue or yellow rectangle. In a simple condition, subjects evaluate either letter or color to respond; in the hard condition, both letter and color have to be evaluated in order to respond correctly. With latency jitter correction (woody filter) in the data from 16 subjects, we observed an increased P300 in hard condition, suggesting that the reduced P300 is due to latency jitter. This supports the stimulus evaluation hypothesis that response difficulty does not impact P300 amplitude.

OTHER

E122

ARE POSITIVE OR NEGATIVE REINFORCERS MORE EFFECTIVE IN EEG-NEUROFEEDBACK APPLIED TO LEARNING DISABLED (LD) CHILDREN WITH EEG MATURATIONAL LAG?

Thalia Fernandez[1], Maria del Carmen Rodriguez[2], Fabiola Garcia[2], Judith Becerra[2], Maria Isabel Caballero[2], Thalia Harmony[1], Gloria Otero[3]; [1]Instituto de Neurobiologla, Universidad Nacional Autonoma de Mexico, [2]Facultad de Psicologia, Universidad Autonoma de Queretaro, [3]Facultad de Medicina, Universidad Autonoma del Estado de Mexico — EEG-Neurofeedback (NFB) is an operant conditioning procedure, whereby an individual can learn to modify the electrical activity of his/her own brain. Frequently, the EEG of LD children is characterized by excess of theta and deficit of alpha activity. NFB reinforcement decreases the theta/alpha quotient by using a positive auditory reinforce, which is a useful tool to treat LD children. Aim: To optimize the procedure by exploring positive and negative reinforcers. Sixteen LD children with abnormally higher theta/alpha ratio were randomly assigned to an R+ group where a positive reward was given when the value of theta/alpha ratio was reduced or an R- group where a punishment was delivered when the value increased. Positive or negative reward was a tone of 500 Hz. The reduction of theta/

alpha ratio supports the theory of faster learning in the R- group. NFB treatment was not compatible with extinction for either group. IQs improved in both groups, showing more improvement in R- than in R+, with higher differences between groups as time went by; also ADHD score from TOVA and writing improved in both groups, without differences between groups. Both groups showed EEG changes compatible with EEG maturation. In conclusion, NFB applied with either positive or negative reinforcement is useful for the treatment of LD children; however, NFB applied with a negative reward induces a greater and quicker improvement in behavior and EEG values than NFB applied with positive reward, that was not extinguished in either group. Acknowledgements: Héctor Belmont, Susana Castro-Chavira, and PAPIIT (IN204613).

METHODS: Electrophysiology

E123

THE CORTEX DISPLAYS REGIONAL INTRINSIC FREQUENCY BIASES

Monika Mellem[1], Sophie Wohltjen[1], Avniel Ghuman[2], Alex Martin[1]; [1]National Institute of Mental Health, National Institutes of Health, [2]University of Pittsburgh Medical Center — Recent findings in monkeys suggest that intrinsic periodic spiking activity in selective cortical areas occurs at timescales mirroring the anatomical hierarchy: activity in sensory areas is faster while activity in higher-order areas is slower. It is not yet known if a similar timescale hierarchy is present in humans. Additionally, these measures in the monkey studies have not addressed the fact that periodic activity within a brain area can occur at multiple frequencies. We wanted to investigate in humans if regions may be biased towards particular frequencies of intrinsic activity, and if a full cortical mapping still reveals an organization that follows the anatomical hierarchy. We examined the spectral power in multiple frequency bands from task-independent data using magnetoencephalography (MEG). Neuromagnetic responses were recorded from 13 subjects at 600 Hz using a 275 channel whole-head MEG system while subjects fixated for five minutes. Structural MRIs were collected for each subject, dense cortical grids were created with Freesurfer, and the MEG signal was source localized using the minimum norm estimate inverse solution. The Destrieux atlas parcellation was used to calculate spectral power estimates within each gyral/sulcal region over 1-50Hz, and a novel frequency bias index was used to calculate the dominant frequency band for a given region. Results demonstrated biases towards higher frequencies (alpha/beta) in some sensory regions, but a mix of lower and higher frequencies in higher-order regions. Thus they suggest a more complex organization across the cortex that does not simply follow the anatomical hierarchy.

E124

BIPHASIC ERP RESPONSES ARE NOT JUST FILTER ARTIFACTS

Phillip M. Alday[1], Sabine Frenzel[2], Matthias Schlesewsky[1], Ina Bornkessel-Schlesewsky[1]; [1]University of South Australia, [2]University of Marburg — Filtering remains a poorly understood preprocessing step in studying event-related potentials (ERPs). Several recent papers have highlighted the distortions that filtering can introduce into ERP timecourses. Disconcertingly, Tanner et al. (2015) have demonstrated that high-pass filtering can introduce spurious components before a real effect, e.g. an N400 before a P600. Given that filtering traditions vary between workgroups, this raises the question whether the different component patterns observed across languages for the same manipulation are an artifact. Here, we sought to examine the stability across filters of the biphasic N400-P600 pattern often observed in German-language data. Reanalyzing data from Roehm et al. (2013), we looked at the impact of bandpass filtering with both infinite impulse-response (IIR) and finite impulse-response (FIR) filters. The upper edge of the passband was held constant (30Hz), while the lower edge was varied across 0.16, 0.2 and 0.3 Hz with a left transition-band width of 0.15 Hz. Using mixed-effects models, we examined the interaction of the experimental manipulation with passband and response type. Across filters, the previously observed biphasic pattern was preserved. Additionally, we observed an effect for both passband and response type. Visually, the later components seemed to influence earlier components more with the IIR vs the FIR filter. The biphasic pattern is not an artifact of the choice of passband. Moreover, the choice of filter involves much more than the selection of the passband. Filter selection involves many tradeoffs and there is no one universal filter applicable to all (EEG) data.

E125

INFLUENCE OF TRANSCRANIAL ALTERNATING CURRENT STIMULATION ON BRAIN OSCILLATIONS:AN EEG BASED STUDY

Davide Cappon[1], Anahita Goljahani[1], Patrizia Bisiacchi[1]; [1]University of Padova — Recently transcranial alternating current stimulation (tACS) has emerged as a new technique of non-invasive brain stimulation able to interact with neuronal oscillations. A growing number of studies showing the effectiveness of tACS activity in modulating sensory, motor and even higher cognitive processing. However, the neurophysiological mechanisms of tACS are still poorly understood . Given the known electroencephalographic (EEG) correlations with clinical conditions , motor processes, cognitive performance , processing of stimuli , etc.,this study aims to investigate the interactions between tACS and rhythmic EEG activities by measuring the frequencies involved, changes of power and of their location on the scalp. Based on our prior study, stimulation was delivered at alpha (10 Hz) and beta (20 Hz) frequency over the area of the scalp corresponding to the electrodes Fz , F2 , FCZ , FC2 and C3 , C5 , CP5 , CP3. Immediately before and after the stimulation EEG data were collected by 52 active electrodes. EEG data were analyzed by recent approach Channel Reactivity Based (CRB) and established techniques of quantification of changes in power , eg , the Event - Realated Synchronization / desynchronization (ERS / ERD). Preliminary results revealed, significant, frequency-dependent changes of power: 10 Hz stimulation specifically increases alpha power $t(51)=27{,}47, p<0.001$ but no significant changes in beta and theta power. 20Hz stimulation specifically increases beta power $t(51)=2.89, p=0.005$,decreases alpha power $t(51)=-2.22, p=0.03$ no significant changes in theta power. Examination in terms of spatial diffusion is forthcoming.The results provide information on the spectrum of action of the specific stimulation frequencies used.

E126

AFFECTIVE STARTLE MODULATION FOLLOWING A COGNITIVE TRAINING INTERVENTION FOR MOOD AND ANXIETY DISORDERS

Divya J. Duraiswami[1], Jessica S. Ellis[1], Matthew Bachman[1], Lisa M. McTeague[2], Brad Schmidt[3], Edward M. Bernat[1]; [1]University of Maryland, Collge Park, Department of Psychology, Clinical and Cognitive Neuroscience Laboratory, [2]The Medical University of South Carolina, Department of Psychiatry and Behavioral Sciences, [3]Florida State University, Department of Psychology, Anxiety and Behavioral Health Clinic — Startle reflex modulation during aversive picture viewing has been a reliable index of defense activation and affective dysregulation in anxiety and depressive disorders. However, there is little treatment data on pre/post changes in peripheral startle modulation. The current study assessed changes in startle reflex magnitude before and after a cognitive training treatment intervention. Subjects (N=22) participated in a 4-week long intervention designed to assess the neurophysiological modulation of anxiety and depression symptoms. The treatment condition (N=12) combined top-down and bottom-up cognitive bias interventions including Cognitive Anxiety Sensitivity Treatment (CAST) and Cognitive Bias Modification- Interpretation (CBM-I). Subjects in the control condition (N=10) had repeated contact with an experimenter, but did not undergo any treatment. All subjects completed an emotion regulation task that included viewing pleasant, unpleasant, and neutral IAPS images. The magnitude of startle reflex to acoustic startle probes administered during picture viewing was scored from the ongoing orbicularis oculi electromyography and analyzed for pre/post treatment differences in peak amplitude. As a function of intervention condition (active versus control), subjects showed different patterns of startle modulation over time (condition*time, $F=5.66$, $p=0.027$). Those patients in the control condition maintained their level of fear potentiation to aversive relative to neutral pictures ($t=0.76$, ns). In contrast, the treatment group demonstrated a significant reduction in fear potentiation from pre- to post-treatment ($t=2.69$, $p=.014$). These results provide additional evidence for modulation of fear responding after a cognitive intervention, and new evidence that startle reflex can be sensitive to such changes.

E127

DECOMPOSING ERPS FROM 3 HZ AFFECTIVE PICTURE PRESENTATIONS

Stephen Semick[1], Matthew Bachman[1], Edward Bernat[1]; [1]University of Maryland, College Park — Fast picture presentation tasks with ERP measures have provided important information about affective and visual processing (e.g. Junghofer, et al. 2003). The goal of the current study was to apply time-frequency (TF) analysis, a more comprehensive measurement approach, to separate multiple overlapping activations occurring due to the rapid presentations. A primary aim was to assess the late positive potential (LPP) component during the fast picture presentations. The second aim was to characterize regional brain activity using TF amplitude and intertrial phase-synchrony (ITPS). The third aim was to assess functional connectivity using TF interchannel phase-synchrony (ICPS) measures, focused on the occipital areas driven by the fast presentations. Participants (N=120) completed a fast picture viewing task in which the entire IAPS picture set was presented at 3 Hz (3 per second), 819 pictures, in randomized order. First, the time-domain LPP was extracted, which replicated previous work showing an increase for pleasant and unpleasant stimuli relative to neutral 400-700 ms post-stimulus. Next, TF-PCA was used to extract an occipital 3 Hz steady-state principal component (PC) that reflected the rate of stimuli presentation. This PC was found to be sensitive to affective conditions (pleasant and unpleasant) relative to neutral, with significant effects in both amplitude and ITPS. Significant dynamic functional connectivity was found between occipital and other areas, including right temporal-parietal regions. The present findings support the view that multiple overlapping processes are sensitive to affective processing during fast picture viewing, and suggests that TF approach are useful for separating and indexing such processes.

PERCEPTION & ACTION: Other

E128

DIFFERENT TIMING OF FACILITATORY AND INHIBITORY CONTEXTUAL EFFECTS ON MOTOR RESONANCE: A TMS STUDY

Lucia Amoruso[1], Alessandra Finisguerra[1], Cosimo Urgesi[1,2,3]; [1]Laboratory of Cognitive Neuroscience, University of Udine, [2]Scientific Institute (IRCCS) Eugenio Medea, [3]School of Psychology, Bangor University — Converging neuroimaging evidence indicates that inferring the intentions and goals underlying other people's actions is a context-sensitive process. However, little is known about the possible role of context in shaping lower-levels of action coding such as reading action kinematics and simulating muscular activity. Furthermore, evidence regarding the time-course and the neural mechanisms subserving this modulation is still sparse. Here, we combined single-pulse TMS and motor-evoked potentials (MEPs) recording to: i) explore whether top-down contextual information is capable of modulating low-level motor representations and, ii) track changes in MEPs amplitude over time. We recorded MEPs from forearm and hand muscles while participants watched videos about everyday actions embedded in congruent, incongruent or ambiguous contexts. In addition, we delivered TMS pulses at different delays: 80ms, 240ms and 400ms after action onset. Videos were interrupted before action ending, and participants were requested to predict the unfolding of the action. We found that top-down contextual information modulated lower-level aspects of motor resonance with a different engagement of M1 at early (facilitation ~240ms) and later phases (inhibition ~400ms) of action processing, depending on the (in)congruency of the information among hierarchical levels. The different time-course of these effects suggests that they stem from partially independent mechanisms. The early facilitatory effect may directly involve M1, while the later inhibitory one is likely to be mediated by high-level structures that modulate motor representation.

E129

THE TEMPORAL PROCESSING OF GUSTATORY QUALITY, INTENSITY AND HEDONICITY

Moon Wilton[1], Andrej Stancak[1], Patricia Bulsing[2], Alexis Makin[1], Timo Giesbrecht[3], Anna Thomas[3], Tim Kirkham[1]; [1]University of Liverpool, [2]The Hague University of Applied Sciences, [3]Unilever R&D Vlaardingen — The perception of taste is instrumental in food selection and information about the quality, intensity and hedonicity of tastants aids ingestive decisions. To investigate the differential temporal processing of these separate characteristics of taste, we used an automated gustometer apparatus to control the presentation of taste stimuli, and evaluated EEG responses to salt, bitter and sweet taste qualities (as well as a distilled water control) varying in intensity and pleasantness. Using a 64 channel BIOSEMI EEG system, we found that intensity was represented in earlier processing stages (around 100 ms and 300 ms) across right parietal and frontal regions, whereby water (and near isotonic) solutions evoked minimal cortical responses compared to other tastes. Quality was encoded slightly later (around 500 ms) in parietal regions, with salt, bitter and water tastes showing differences in amplitude. Hedonicity was coded fronto-centrally in later stages (around 1250 ms) with water showing weaker amplitude compared with both hedonically positive and negative solutions. The results suggest that the brain encodes distinct tastes similarly over time, and that the profile of activity observed primarily reflects greater neural engagement when a tastant is discernibly different from water.

E130

DECEPTIVE INTENTION AND KINEMATIC ALTERATION OF AN OBSERVED ACTION AFFECT THE MOTOR SYSTEM VIA DISSOCIABLE PROCESSES

Alessandra Finisguerra[1], Lucia Amoruso[1], Stegios Makris[2], Cosimo Urgesi[1,3]; [1]University of Udine, Italy, [2]Edge Hill University, United Kingdom, [3]Bangor University, United Kingdom — Social interaction often requires reading others' intentions by observing their movements. Previous work showed that action simulation is crucial in detecting others' deceptive intent: the observation of deceptive actions facilitates the observers' motor activity more than seeing him acting truthfully, suggesting that motor resonance is sensitive to deceptive intentions. However, an alternative explanation is that this facilitation mirrors the kinematic alteration necessary to attain deceptive vs. truthful actions. Here, we tested these alternative hypotheses by using transcranial magnetic stimulation to measure corticospinal excitability (CSE) from hand and forearm muscles. Participants watched videos of an actor lifting a cube and judged whether the cube was heavy or light. The videos were taken in three conditions where the actor was asked to lift the cube after receiving truthful information on the object weight and being asked to provide either i) truthful (true condition) or ii) deceptive (deceptive condition) cues to the observers or iii) after receiving fooling information and being asked to provide truthful cues to the observer (deceived condition). Thus, we independently manipulated actor's intention and kinematics alterations. According to previous studies, CSE increased during the observation of deceptive actions; however, a decrease of CSE occurred in the deceived vs. the true and deceptive conditions. Importantly, while deceptive actions enhanced CSE for both muscles, perceiving kinematic alterations affected CSE in a muscle-specific manner. This suggests that deceptive intention is actually coded by the observer's motor system and different hierarchical levels of action representation may modulate its activity via dissociable processes.

E131

CEREBELLAR TDCS DURING SPEECH PERCEPTUAL LEARNING DISSOCIATES THE TIMING OF PERCEPTUAL DECISIONS FROM PERCEPTUAL CHANGE

Daniel Lametti[1,3], Leonie Oostwoud Wijdenes[2], James Bonaiuto[3], Sven Bestmann[3], John Rothwell[3]; [1]Department of Experimental Psychology, The University of Oxford, [2]Donders Institute for Brain, Cognition and Behaviour, Radbound University, [3]Sobell Department of Motor Neuroscience and Movement Disorders, University College London — Speech perception is remarkably malleable yet there have been few causal investigations of the brain regions involved in speech perceptual learning. Recent neuroimaging studies suggest that the cerebellum might play a role in non-motor functions, including perception and perceptual learning. Here we test this idea directly using transcranial direct current stimulation (tDCS) in combination with a speech perceptual learning task. In the experiments, participants experienced a series of speech perceptual tests designed to measure and then manipulate their perception of the phonetic contrast between the words "head" and "had". One group received tDCS to the cerebellum during speech perceptual learning and a different group received "sham" tDCS during the same task. Both groups showed similar learning-related changes in speech perception; these changes transferred to a different phonetic contrast ("head-to-"hid") and lasted for up to a week. For both trained and untrained speech sounds, cerebellar tDCS significantly increased the

time it took participants to indicate their perceptual decisions with a button press. By analyzing perceptual responses indicated using both hands, we suggest that cerebellar tDCS disrupted processes related to the timing of speech perceptual decisions. The experiments provide initial evidence that the cerebellum critically contributes to the timing of perceptual behaviour, a result that mirrors one of its known roles in the motor domain.

E132

THE POLYMODAL ROLE OF CONSCIOUSNESS IN ADAPTIVE ACTION SELECTION: A PARADIGM FOR NEUROIMAGING

Donish Cushing[1], Ezequiel Morsella[1,2]; [1]Department of Psychology, San Francisco State University, [2]Department of Neurology, University of California, San Francisco — Recent developments have led to the proposal that the primary function of conscious processing is to render adaptive what in everyday life is called "voluntary" action, a complex form of action involving skeletal muscle. From this standpoint, the conscious field permits otherwise independent outputs engendered by "encapsulated," modularized systems (e.g., color perception versus olfactory perception) to influence (skeletomotor) action selection collectively. This occurs in "integrated actions" (e.g., holding one's breath while underwater). The outputs, which come from a wide variety of systems including low-level systems (e.g., smoke detection) and high-level systems (e.g., subvocalization), could be memory-based or perception-based, or be intentional or unintentional. We designed a task that allows one to investigate this polymodal, multifaceted phenomenon in a manner amenable to neuroimaging technologies. Participants (n = 9) were presented with visual objects and instructed to not think of the names of these objects. If an unintentional subvocalization of the object name arose (which occurred on 88.7% of the trials), participants were instructed to make a special button press if the subvocalization rhymed with a word held in prospective memory and if there was a visual "go" cue onscreen. Despite the many contingencies and modalities involved, participants were accurate in carrying out this special button press: Accuracy was 83.1%, which is higher than what would be expected by chance, $t(8) = 12.11$, $p < .001$. Coupled with neuroimaging technologies, this paradigm could illuminate the neural bases of the polymodal role of conscious states in action selection.

E133

THE NEURAL RESPONSE TO SOMATOSENSORY STIMULATION IN SENSORY PROCESSING DISORDER (SPD): A HIGH DENSITY ELECTROPHYSIOLOGY STUDY

Sydney Jacobs[1], John J. Foxe[1,2], Gregory Peters[1], Sophie Molholm[1]; [1]Albert Einstein College of Medicine, [2]University of Rochester Medical Center — Atypical and maladaptive responses to the sensory environment are seen in many neurodevelopmental disorders (NDD). The neural basis of these aberrant reactions, however, remains largely unknown. When sensory reactivity is severe enough to impact everyday functioning and observed in the absence of an NDD such as autism or attention deficit disorder, the individual may be given a diagnosis of Sensory Processing Disorder (SPD). Here we examined brain responses of children with an SPD, autism, or neurotypical development to somatosensory inputs. We sought to determine whether differences in the initial registration and processing of sensory inputs might account, in part, for aberrant reactions to the sensory environment. 13 children with SPD (5.3 - 15.2 years), children with autism, and neurotypical controls were presented with vibrotactile stimulation over the median nerve region of the right wrist at five different presentation rates (ISIs: 150ms, 250ms, 350ms, 550ms, and 1050ms), while high-density EEG was recorded. Somatosensory evoked potentials (SEPs) were robust and highly similar in their temporal and spatial properties across the groups. Clear differences in SEP amplitude as a function of stimulation rate were observed exclusively for the SPD group. Response amplitude as a function of ISI suggested a steeper slope for the SPD group, due to greater increase in response amplitude with increasing ISI, a difference that was most apparent during later sensory processing (130-195ms). These findings suggest a potential neural mechanism, with possible clinical group specificity, underlying the increased reactivity to environmental stimulation in SPD.

E134

NON-BAYESIAN WEIGHTING OF IMPLICIT AND EXPLICIT INFORMATION IN A MOTION DISCRIMINATION TASK

Andrea Alamia[1], Etienne Olivier[1], Alexandre Zénon[1]; [1]Université catholique de Louvain, Bruxelles, Belgium — Alongside conscious decision making, unconscious factors also drive our behavior. In the current study we investigated how unconscious associative learning affects decision making in a motion discrimination task. We replicated an experimental design used in a previous study and that leads to robust unconscious learning of supraliminal stimuli association. Two groups of subjects participated in the experiment. The first group (implicit group, n=20) was unaware of the color-motion association while the second one (explicit group, n=20) was fully aware of it. In the first part of the experiment, participants had to report the motion direction of a patch of dots of three possible colors. Unbeknownst to the participants, two colors were always associated with the same direction/response, while the other color was uninformative. In the second part of the experiment, participants had to perform the same task, while the motion coherence varied between trials. Drift diffusion models (DDM) were used to fit the data. Preliminary results suggest that the explicit group weights the sensory information in accordance with Bayesian cue integration: they used the color information more when the motion signal strength was lower. In contrast, in the implicit group, the participants seemed to give constant weight to the color information, irrespective of the motion coherence. Interestingly, the DDM analysis suggested that the color information biased both the strength of the motion signal and the response choice. These findings suggest that the combination of unconscious and conscious information for decision making does not follow Bayesian principles of optimal cue integration.

E135

RESPONSE SELECTION IN TOOL ACTION AND COMMON COMPETITION TASKS DRAWS UPON SHARED AND DISTINCT BRAIN REGIONS

Louisa L. Smith[1], Christine E. Watson[1], Laurel J. Buxbaum[1]; [1]Moss Rehabilitation Research Institute — The need to select between competing responses according to task goals is a fundamental challenge across many cognitive domains. Recently, we identified a left hemisphere network including the supramarginal gyrus (SMG), inferior frontal gyrus (IFG)/anterior insula, and superior longitudinal fasciculus (SLF) as critical for selecting actions during tool use in the face of competition from task-inappropriate actions. Here, we assessed whether tool action selection depends upon the same neuroanatomic network as other well-studied measures of response competition and selection. We administered a competition-inducing Tool Action task as well as spatial Stroop and Flanker tasks to 35 chronic left-hemisphere stroke patients. In each task, competition was indexed by the reaction time cost for high-conflict versus low-conflict stimuli. Voxel-based lesion symptom mapping and tractographic overlap analyses revealed distinct and shared brain regions critical for performance across tasks. Lesioned voxels in IFG and insula were associated with poor performance on both the Stroop and Tool Action tasks, while lesioned voxels in SMG and superior parietal lobule/posterior intraparietal sulcus were associated with specific impairments in the Tool Action and Flanker tasks, respectively. Additionally, lesioned voxels associated with poor performance across all three tasks overlapped with the known location of a portion of the external capsule undercutting the IFG as well as the putamen. Our results suggest that tool action selection is supported by a distributed network comprising an anterior parietal region unique to tool actions as well as prefrontal, insular, and subcortical components that mediate competition irrespective of cognitive domain.

E136

EXPERIENCE TRANSFORMS THE CONJUNCTIVE REPRESENTATIONS OF OBJECT FEATURES IN THE VENTRAL VISUAL STREAM

Jackson Liang[1], Jonathan Erez[1], Felicia Zhang[2], Rhodri Cusack[3], Morgan Barense[1]; [1]University of Toronto, [2]Princeton University, [3]University of Western Ontario — The perception of a discrete object critically relies upon the integration of that object's individual features into a coherent whole. Yet, how the visual system accomplishes this transformation is still unknown. The representational hierarchical model predicts that perirhinal cortex (PRC), which sits at the apex of the object processing stream, should be sensitive to specific conjunctions of features but not the component features themselves. To test

this possibility, we recently conducted an fMRI experiment in which participants were scanned while viewing various features and feature conjunctions. Activity in PRC and lateral occipital cortex (LOC) was shown to code object feature conjunctions that were distinct from the summed activations to the individual features themselves. Here, we extended these findings along two lines of investigation. First, how do the representations of individual features and feature conjunctions change with experience? Second, do conjunctive representations promote the reactivation of individual features – or vice versa – through connectivity between ventral visual stream (VVS) structures? Following the initial experiment, participants returned and were extensively trained to distinguish the individual features of each object. They were scanned a second time to measure their brain responses to conjunctions of trained and novel features. Univariate analyses revealed increased engagement of V1 and LOC during the presentation of trained features compared to novel features. Moreover, patterns of activity in posterior VVS consistently coded the unique conjunctions of trained features but not conjunctions of novel features. These results point to complementary roles for anterior and posterior VVS before and after learning respectively.

E137

BIASES IN TACTILE LOCALIZATION SUBSEQUENT TO CORTICAL DAMAGE

Michael Grzenda[1], Jared Medina[1]; [1]University of Delaware — Damage in primary somatosensory cortex (S1) can result in hemianaesthesia, or plastic changes resulting in the re-emergence of the damaged representations in neighboring cortical areas. Although the topography of these reorganized maps has been studied in non-human primates, little is known about the relationship between cortical damage and tactile localization. To examine the relationship between impaired tactile detection and error patterns in tactile localization, we examined tactile performance in over 50 brain-damaged individuals. Tactile detection thresholds were assessed using an adaptive staircase procedure with Semmes-Weinstein monofilaments. Tactile localization was assessed by asking participants to localize (via pointing movements) suprathreshold stimuli presented to 22 locations on the dorsal surface of their hand (Rapp, Hendel & Medina, 2002). We used linear mixed models to examine the relationship between detection thresholds and spatial patterns in tactile localization bias. We found a significant relationship between higher detection thresholds and shifts in tactile localization towards the center of the hand. We discuss two possible interpretations of the data. First, consistent distortions in mapping from reorganized S1 representations to higher-order representations of body size and shape necessary for tactile localization may result in the observed error patterns. A second explanation is that general biases toward the center of a categorical space (prototype) when stimulus location is uncertain results in the observed pattern of performance.

PERCEPTION & ACTION: Vision

E138

SCENE SELECTIVITY AND RETINOTOPY IN MEDIAL PARIETAL CORTEX

Edward Silson[1], Adam Steel[1,2], Chris Baker; [1]1. Laboratory of Brain & Cognition, National institute of Mental Health, Bethesda, Maryland, 20892, USA, [2]2. Physiological Imaging Group, FMRIB Centre, John Radcliffe Hospital, Headington, Oxford OX3 9DU, UK — Functional imaging studies in human reliably identify a trio of scene-selective regions, one on each of the lateral (occipital place area, OPA), ventral (parahippocampal place araea, PPA) and medial (commonly referred to as retrosplenial complex, RSC) cortical surfaces. Recently, we demonstrated differential retinotopic biases for the contralateral lower and upper visual fields within TOS and PPA, respectively. Here, using fMRI, we combine detailed mapping of both population receptive fields (pRF) and category-selectivity, with independently acquired resting-state functional connectivity, to examine retinotopic sensitivity within medial scene-selective cortex across a large number of participants (n=16). Consistent with previous work, we identify the medial scene-selective area, which was largely contained within the posterior bank of the parieto-occipital sulcus (POS) and did not extend into restrosplenial cortex, suggesting the use of RSC as a label for this region is potentially misleading. Interestingly, this same region was identifiable solely on the basis of responses to our retinotopic mapping stimuli with a striking degree of spatial consistency. Our analyses not only demonstrate a high degree of retinotopic sensitivity, but also highlight a significant contralateral visual field bias coupled with very large pRF sizes within this region. Unlike, its scene-selective counterparts TOS and PPA, this medial scene-selective region did not show a consistent bias to either the contralateral lower or upper visual fields. This retinotopy was also evident in fMRI patterns acquired during rest. Taken together the retinotopic profile of medial scene-selective cortex suggests a prominent role in mediating scene related visual information between TOS and PPA.

E139

PHASE DEPENDENT TARGET DETECTION DURING RHYTHMIC VISUAL 10HZ STIMULATION REVEALS ENTRAINMENT

Annika Notbohm[1], Christoph Herrmann[1,2]; [1]Experimental Psychology Lab, Department of Psychology, European Medical School, Carl von Ossietzky Universität, Oldenburg, Germany, [2]Research Center Neurosensory Science, University of Oldenburg — The perception of brief visual stimuli has been shown to correlate with the phase of the intrinsic alpha oscillations in parieto-occipital areas. To investigate whether these correlative observations reflect a causal relationship, modulation of alpha oscillations is broadly applied via rhythmic sensory stimulation (i.e. entrainment). It is, however, subject of open debate whether the thereby produced steady-state visual evoked potential (SSVEP) can be explained by entrainment or rather reflects a sequence of independent ERPs (event-related potentials). In this experiment, we presented a brief light flash of various brightnesses at two opposite phase angles of an ongoing visual stimulation train with 10 entrainer- flashes per second to healthy young adults. We hypothesized, that detection thresholds for the two phase conditions would differ during a rhythmic but not during an arrhythmic stimulation train. The SSVEP was recorded via EEG. Our results show that the ratio of the detection thresholds at opposite phase angles during rhythmic ongoing visual stimulation is significantly increased as compared to the arrhythmic condition (t-test, $p<0.05$), which shows ratios closer to 1. In conclusion, we could demonstrate that a rhythmic visual stimulation can alter detection thresholds in a phase dependent manner, suggesting intrinsic oscillations to be synchronized with the external, rhythmic stimulation. If, on the contrary, rhythmic stimulation would cause a series of independent ERPs, the ratios would be expected to be independent of rhythmicity. This finding paves the way for further applications of entrainment as a means to investigate the causal relation between brain oscillations and brain functions.

E140

NEURAL CORRELATES OF GRADED VISUAL AWARENESS: AN ERP STUDY

Chiara Francesca Tagliabue[1], Chiara Mazzi[1], Chiara Bagattini[2], Silvia Savazzi[1]; [1]University of Verona, Italy, [2]IRCCS Centro San Giovanni di Dio Fatebenefratelli, Brescia, Italy — The debate on consciousness is focused on two major topics: the search for the neural correlates of visual awareness and the graded vs dichotomous nature of conscious experience. This project aims at searching for the possible neural correlates of different grades of visual awareness by investigating the ERPs to reduced contrast visual stimuli. The hypothesis is that different grades of awareness may be reflected by different amplitudes of the components related to conscious perception. The experiment includes two consecutive sessions. The first one is a threshold assessment, to find two individual luminance values (lighter and darker) at which subjects (N=12) are aware of about 50% of the stimuli. In the second stage (EEG experiment) subjects are presented with the same two luminance values and required to judge the brightness of the stimulus (lighter/darker) and then to rate the clarity of their perception on the Perceptual Awareness Scale (no experience, brief glimpse, almost clear experience, clear experience). ERP analyses reveal a left centro-parietal negative deflection peaking at 280-320 ms from stimulus onset, probably related to phenomenal awareness of the stimulus (the actual content), followed by a bilateral positive deflection peaking at 500-600ms over almost all electrodes, probably reflecting access to such content. Interestingly, both deflections show a reliable ($p<0.05$) linear amplitude modulation related to the level of awareness: as visual awareness increases also the amplitude of the components increases. It thus seems that visual conscious experience is characterized by a gradual increase of perceived clarity at both behavioural and neural level.

E141

RECONSTRUCTING TOP-DOWN WORKING MEMORY SIGNALS FROM POPULATION ACTIVITY IN EARLY VISUAL CORTEX

Masih Rahmati[1], Golbarg Saber[1], Clayton E. Curtis[1]; [1]New York University — Top-down signals modulate neural population activity in early sensory areas during working memory. Here, we aim to 1) reconstruct the neural population dynamics and working memory content during a retention interval in early visual areas, 2) isolate the dynamics due to top-down signals, and 3) identify the sources of the top-down signals. Using fMRI, we measured neural activity in retinotopic visual areas while subjects maintained a planned saccade directed to or away from the location of a briefly presented visual target. We developed a forward encoding model to reconstruct the neural population dynamics in visual areas. In the model, we used a linear combination of outputs from a number of information channels to estimate each voxel's response to targets at various positions in the visual field. To validate the model, we successfully reconstructed the locations of targets during visual encoding. We then showed that the model could reconstruct the locations of targets from activity late in the retention interval. Critically, we could reconstruct the saccade goal even on trials in which participants planned anti-saccades to positions in the visual field that were not visually stimulated, and thus, can only be attributed to the effects of a top-down signal. Finally, we searched for brain areas in frontal and parietal cortex whose delay period activity moderated the dynamics captured by our model. By reconstructing the locations of maintained representations, we demonstrated that population activity in early visual areas are sculpted by top-down signals.

E142

EFFECTIVE CONNECTIVITY BETWEEN OFA AND FFA DURING FACE PERCEPTION AND REPETITION: DYNAMIC CASUAL MODELLING OF EVOKED MEG, EEG AND FMRI

Roni Tibon[1], Daniel Wakeman[2], Richard Henson[1]; [1]MRC Cognition and Brain Sciences Unit, [2]Athinoula A. Martinos Center for Biomedical Imaging — Repetition suppression (RS) refers to the reduction in neural activation following repeated presentation of a stimulus, and is frequently used to investigate the role of face-selective regions in human visual cortex. A common assumption is that RS reflects localized, "within-region" changes, such as neuronal fatigue. In contrast, predictive coding theories characterize RS as a consequence of top-down changes in between-region modulation. We applied Bayesian model comparison of families of Dynamic Causal Models (DCM) with different directed graphs between 4 regions of interest (left and right OFA and FFA) to fit evoked responses measured by fMRI and by MEG and EEG, in order to study bottom-up and top-down mechanisms underlying RS effects. Nineteen participants made 2 visits to the lab, during which data were acquired from either a Siemens 3T MRI system or an Elekta Neuroimag MEG system. Participants made left-right symmetry judgments on a random sequence of faces and phase-scrambled faces. After initial presentation, each stimulus was repeated again. Group-level analyses revealed increased activation for Faces versus Scrambled Faces and for Initial versus Repeated presentation in all four ROIs. Preliminary DCM results reveal that driving input of Faces and Scrambled Faces versus baseline enters the network at both the OFA and the FFA. Furthermore, repetition of Faces modulated forward and backword connections between OFA and FFA, as well as self-connections. The results suggest that repetition affects both within-region dynamics and across-region connectivity.

E143

CAPACITY LIMITATIONS OF HUMAN VISUAL SYSTEM REVEALED WITH RESPONSE PRIMING

Bella Matias[1], Marjan Persuh[1]; [1]Borough Manhattan Community College, City University of New York — Most researchers regard visual working memory as a conscious memory system and it is well established that visual working memory is strictly limited in capacity. Similarly, humans are able to track only a few individual items at the time. Some recent evidence suggests that such capacity limitations originate at the encoding stages of processing. We hypothesized that encoding capacity limitations are a general property of the visual system. We tested our prediction using a response priming paradigm. Evidence suggests that response priming requires intact retinogeniculostriate pathway. We hypothesized that priming is also limited by the representation of visual information at the encoding stage. Participants made speeded responses to horizontal and vertical bars displayed at the center of the display. Prior to target presentation, a prime, horizontal or vertical bar was presented at one of the eight positions around the imaginary circle. We varied the number of items on the screen by presenting a single prime together with distractor bars of a different orientation. Priming effects were the strongest for a single prime, presented in isolation. As the number of distractors increased, priming effects become progressively weaker and with the set size of six, were completely eliminated. These results suggest that the capacity of visual system to represent individual objects for priming is similar to restrictions previously demonstrated for working memory. Furthermore, because response priming is independent of visual awareness, our results indicate that capacity limitations of our visual systems are not restricted to conscious vision.

E144

STRONG VISUAL CONTEXTUAL ASSOCIATIONS ENHANCE SEMANTIC PROCESSING: AN EEG INVESTIGATION

Maximilien Chaumon[1,2], Niko, A Busch[1,2]; [1]Humboldt-Universität zu Berlin, Germany, [2]Charité Universitätsmedizin, Germany — Context shapes the way we perceive the world. In the visual domain in particular, it was proposed that context guides perception via associative predictions generated from prior experience of visual objects in context. Recently, it has been shown that the strength with which a given object is associated with its usual context rapidly influences how the object is processed in visual areas. Here, we further explore whether the strength of visual contextual associations also changes semantic processing as indexed by the N400 component of the EEG. In particular, we used the fact that the N400 amplitude is influenced by the semantic relatedness between a stimulus and the context it is presented in. We thus introduce a metric of contextual strength for visual objects and use this metric in a classical N400 paradigm to examine whether the N400 response is affected by the contextual strength of the eliciting stimuli. As expected, we found a classical N400 effect when comparing semantically related and unrelated target objects. Furthermore, we show that the magnitude of the N400 effect was unaffected by the prime objects' contextual strength. By contrast, the N400 effect was enhanced when the target object was contextually strong. We conclude that the strength of contextual associations borne by visual objects readily affects their ability to disturb previously set contextual expectations but seems not to affect their ability to establish new contextual associations.

E145

THE INFLUENCE OF DISTRACTORS ON FAST-REACHING MOVEMENTS

Emily Prentiss[1], Jimena Jaramillo[1], Quanjing Chen[1], Bradford Z. Mahon[1]; [1]University of Rochester — Speeded reaches to a visual target are subject to distortion effects when distractors are presented spatially adjacent to the target. Understanding the spatial and temporal constraints to which visuomotor updating is subject is central for understanding how the dorsal visual pathway functions, as well as the sensitivity of this pathway to certain classes of stimuli. Prior work has tested the effects of introducing a wide array of visual distractors, which act to temporarily displace the target location during the reach. There is some discrepancy in prior work, with some studies observing that distractors attract reach trajectories toward the location of the distractor, and other studies finding that distractors repel reach trajectories. Here we systematically varied the location, size, and duration of transient distractors in order to probe the constraints on fast visuomotor updating. Participants were asked to fixate on a target presented in 1 of 5 possible locations (1 center, 4 peripheral). Upon fixation of the target and initiation of the reach, a distractor was presented in an adjacent location for a brief period (< 200 ms). Participants were asked to move as quickly as possible to touch the original target location, resulting in an average total movement time of about 350ms per trial. Overall, we observe that reach trajectories are biased toward the distractor when the task constraints are such that distractors appear at possible target locations. These data elucidate the role of high-level, and potentially consciously available, strategies on how distractors affect rapid target reaches.

E146

NEURAL MECHANISMS UNDERLYING VISUOSPATIAL ABILITIES: AN ADAPTED WECHSLER BLOCK DESIGN TASK

Veronique D.Therien[1], David Luck[2], Isabelle Soulières[1]; [1]University of Quebec at Montreal, [2]University of Montreal — Block design tasks, such as the one included in the Wechsler intelligence scales, assess visual problem solving and reasoning. The tasks traditionally require assembling a larger target figure with small blocks. Increasing the perceptual cohesiveness of the figure to be reproduced is detrimental to accuracy and response times in such tasks. Important individual differences in visuospatial abilities may be associated with underlying differences in neural mechanisms. Aims: Our goal was to uncover the neural network involved in visuospatial abilities and expertise, and more specifically in the Block Design Task. Methods: In an adaptation of the original Block Design Task suitable for presentation in the MRI scanner, the participants' task was to identify which type of block would go in a given position in the target design shown. Perceptual cohesiveness of the target design was parametrically varied across the 90 trials. Participants also completed the Raven's Progressive Matrices and a mental rotation task. Results and discussion: Increasing perceptual cohesiveness significantly reduced accuracy and increased response times. Performance in the adapted Block Design task also correlated significantly with performance on the Raven's Matrices and the mental rotation task, confirming the validity of our task to assess visuospatial abilities. At the cerebral level, contrasting high versus low perceptual coherence trials revealed specific activity mainly in bilateral inferior parietal lobule and in the right superior and middle frontal gyrus. Increasing visuospatial task difficulty is associated with increased activity in this fronto-parietal network, and with performance in visuospatial reasoning.

E147

THE ROLE OF RIGHT EXECUTIVE MOTOR CONTROL REGIONS IN MENTAL ROTATION

Levan Bokeria[1], Kyle F. Shattuck[1], John W. VanMeter[1]; [1]Georgetown University — The specific roles of parietal and motor cortices in mental rotation tasks have been long debated in the literature. A meta-analysis of neuroimaging studies suggests that brain activation patterns depend on the particular experimental setup, use of different baseline conditions, and possible use of different strategies by the subjects during the task. However, another factor that may impact results is the degree to which inherent visuospatial abilities influence the regions recruited. In the current fMRI study, 42 right-handed subjects performed a 3D Rotation task adapted from the Harvard Geospatial Battery of tests developed by Stephen Kosslyn. A novel control condition was used to test the specificity of brain activation during mental rotation. Subjects' visual perceptual ability and visual abstract processing were assessed using the Wechsler Abbreviated Scale of Intelligence Performance IQ (PIQ) measure, which was entered as a covariate of interest in a regression analysis with task-related BOLD signal increase. After controlling for accuracy and reaction time, the following areas showed increased activity during task performance: bilateral precuneuous, right superior parietal lobule, left superior frontal gyrus, and bilateral precentral gyrus. After controlling for sex, a positive correlation between PIQ and task-related activation was found in the right precentral gyrus as well as the right inferior orbito-frontal gyrus. These findings provide evidence that a right hemispheric cortical network is recruited to a greater extent by individuals with greater visuospatial ability during mental rotation.

E148

PHYSICAL SIZE AND SPATIOTOPIC CUES MODULATE INVERTED FACE REPRESENTATION

James Brown[1], Anthony Cate[1]; [1]Virginia Tech — Recent neuroimaging findings indicate that the real-world size of objects is spatially represented along the ventral temporal lobe of the brain. Additionally, behavioral studies involving mental rotation and spatial navigation tasks performed on screens of varying size suggest that task performance is improved when viewers perform the task on a large visual display compared to a small visual display even when visual angle is held constant. Given these findings, the present study investigated the interaction between real-world size and perceived size on holistic processing using fMRI. Subjects were shown images of upright faces and inverted faces, as well contours whose forms were comprised of local and globally aligned elements or global only aligned elements. These stimuli were chosen because of their known differences in holistic representation. In order to manipulate perceived size, subjects were shown small and large images that were either near or far to the scanner and during perceived size conditions retinal image size was held constant. It was hypothesized that cortical activations elicited in response to the face and contour stimuli would change as a function of their perceived sizes. Further, changes would represent alterations in the representations of the face and contour stimuli in way related to their holism. GLM analysis from 17 young, healthy participants indicated significant effects in the left and right anterior calcarine sulcus and left fusiform gyrus. Interestingly, these effects were significantly less present for smaller real-world size images of inverted faces, which suggests an effect of perceived size.

THINKING: Decision making

E149

PROBABILITY CONTEXTS MODULATE MEDIOFRONTAL PREDICTION ERROR SIGNALS IN RESPONSE TO GAINS AND LOSSES

Pablo Morales[1], Atsushi Kikumoto[1], Jason Hubbard[1], Ulrich Mayr[1]; [1]University of Oregon — Previous research has interpreted electrophysiological indices related to unexpected negative outcomes such as the feedback-related negativity (FRN) as a reflection of a midbrain-generated prediction error, not necessarily of a negative event per se. Recent research has additionally demonstrated that the FRN may also be sensitive to unexpected positive outcomes. What remains unknown is how the degree of outcome expectancy may differentially modulate responses to positive and negative events. To better understand the role of outcome expectancies in generating these electrophysiological signals, the current work employed a two-armed bandit task where probabilities of monetary gains and losses were manipulated and explicitly cued on a trial-by-trial basis between 30% and 70%. Participant behavior was sensitive to the probability manipulation, showing betting choices that scaled with the degree of outcome expectancy. Overall FRNs were significantly larger following losses when compared to gains, and the probability manipulation did not affect the amplitude of these signals overall. However, loss-gain difference waves scaled nearly linearly with outcome expectancy where more unexpected outcomes were characterized by smaller differences between losses and gains, and expected outcomes showed the opposite pattern. Spectral power of low frequency oscillations in the delta (1-3 Hz) and theta (4-7 Hz) bands was also modulated following gains and losses. These results suggest that electrophysiological signals such as the FRN may not be uniquely sensitive to expectancy alone, and may instead reflect the combination of both outcome expectancy and valence.

E150

STRIATAL DOPAMINE AND EXTERNALIZING BEHAVIOR: EFFECTS ON REWARD WANTING, LEARNING, AND HABIT FORMATION

Kaileigh Byrne[1], Christopher J. Patrick[2], Bo Pang[1], Darrell A. Worthy[1]; [1]Texas A&M University, [2]Florida State University — The dopaminergic system plays a critical role in the neural circuitry underlying reward wanting, learning, and habit formation. Furthermore, externalizing behavior has been linked to impairments in reward processing and decision-making. Given the relationship between the dopaminergic system and externalizing behavior, we examined whether striatal dopamine moderates the impact of externalizing proneness on reward-based decision-making. In Study 1 (N=93), participants completed disinhibition and substance abuse subscales of the brief form Externalizing Spectrum Inventory, and then performed a delay discounting task to assess preference for immediate rewards along with a dynamic decision-making task that assessed long-term reward learning. Striatal tonic dopamine levels were operationalized using spontaneous eyeblink rate. Regression analyses revealed that high disinhibition predicted greater delay discounting among participants with lower levels of striatal dopamine only, while substance abuse was associated with poorer long-term learning among individuals with lower levels of striatal dopamine, but better long-term learning in those with higher levels of striatal dopamine. In Study 2 (N=67), we extended this procedure to a two-stage devaluation task to assess reward-based habit formation. Results demonstrated that substance use predicted less devaluation sensitivity and thus

more habit-based behavior, but this relationship was not moderated by striatal dopamine. These results suggest that disinhibition is more strongly associated with the wanting component of reward-based decision-making, whereas substance abuse behavior is associated more with learning of long-term action-reward contingencies and reward-based habit formation.

E151

DUAL SYSTEMS OF CATEGORY LEARNING: EFFECTS OF TRANSCRANIAL INFRARED LASER STIMULATION

Nathaniel Blanco[1], Francisco Gonzalez-Lima[1], Todd Maddox[1]; [1]University of Texas at Austin — Transcranial infrared laser stimulation involves using infrared light to enhance neurobiological functions. It is a new non-invasive form of low-level light therapy (LLLT) that shows promise for wide-ranging experimental and clinical applications. LLLT has been shown to enhance cellular respiration and energy metabolism (ATP production) through photobiomodulation of the enzyme cytochrome oxidase. Applications of LLLT in humans in vivo are novel, but preliminary research indicates it may have a broad range of uses. Previous research suggests that LLLT aimed at the prefrontal cortex can improve sustained attention and short-term memory. We recently showed that LLLT enhances performance on the Wisconsin Card Sorting Task, the gold standard of executive function in neuropsychology. Here we directly investigated the influence of transcranial laser stimulation on two neurobiologically dissociable systems of category learning: a frontal cortex mediated hypothesis-testing system that learns categories using explicit, verbalizable rules and a striatally mediated procedural learning system that learns categories through gradual dopamine-driven reinforcement learning. Participants received either active or placebo transcranial laser stimulation targeted at lateral prefrontal cortex, and then learned one of two category structures—a rule-based (RB) structure optimally learned by the frontal system, or an information-integration (II) structure optimally learned by the striatal system. We found enhanced RB and II learning after active laser stimulation. Computational modeling results indicate that RB learning is enhanced by accelerating the switch from simple to more complex verbal rules whereas II learning is enhanced by accelerating the switch from rule use to adopting the optimal, implicit strategy.

E152

NEURAL MECHANISMS UNDERLYING SATISFICING DECISION MAKING UNDER TIME PRESSURE

Hanna Oh[1], Jefferey Beck[1], Silvia Ferrari[2], Marc Sommer[1], Tobias Egner[1]; [1]Duke University, [2]Cornell University — Real-life decision making is often beset by difficulties due to the uncertain nature of decision-relevant information, and the limited time and cognitive resources available to analyze that information. It is thought that humans overcome these challenges through satisficing, heuristic decision making that prioritizes some sources of information while ignoring others, thereby providing solutions that are not necessarily optimal but fast and "good-enough". However, how we adopt decision making under uncertainty and time pressure remains poorly understood. Here, we used functional magnetic resonance imaging (fMRI) to examine how people solve a multi-cue probabilistic classification task under changing time pressure. On each trial, participants were presented with two compound stimuli composed of four different visual features (cues) associated with fixed outcome probabilities (weights) that had to be learned via probabilistic feedback. Following an initial learning period, participants were scanned while performing two successive post-learning task phases, a low and a high time pressure phase (1500ms vs. 500ms response window). We employed variational Bayesian inference to derive subjects' decision strategies, revealing that under high time pressure, subjects dropped the weakest cue from their decision making process. We then used uni- and multi-variate fMRI analyses to characterize neural cue processing during the different task phases. Results show that decision difficulty consistently scaled with activity in orbitofrontal and parietal cortices, regardless of task phase. By contrast, changes in decision strategies under high time pressure were characterized by differential multivoxel pattern signatures in the dorsolateral frontal, parietal and visual cortices.

E154

A BRIEF INTERVENTION ALTERS THE USE OF MODEL-BASED VS. MODEL-FREE DECISION STRATEGIES

Maria K. Eckstein[1,2], Silvia A. Bunge[1], Klaus Wunderlich[2]; [1]UC Berkeley, [2]Ludwig-Maximilians-Universitaet, Munich — In this study, we sought to test whether we could alter participants' decision-making towards model-based or model-free decision strategies on a task that has been shown to elicit a mixture of these two strategies (2-step task), by manipulating the type of tasks presented beforehand. In model-based decision-making, an internal representation of the problem structure is used to select actions; model-based decision-making has been linked to prefrontal-dorsal striatum systems. Model-free decision-making involves habitual learning of action-outcome associations, and has been linked to the ventral striatum. We hypothesized that completing brief tasks involving planning or associative learning immediately prior to performing the two-step task would lead to a higher proportion of model-based and model-free judgments, respectively. 32 adults performed the planning tasks in one session and the associative-learning tasks in a second session two weeks later, or vice versa. We fit a hybrid reinforcement-learning model to each participant's data, computing several parameters including the relative weight between model-based and model-free strategy use w. We found a significant group-by-session interaction in w ($\chi 2(7)=7.9$, $p=0.005$), wherein participants who had performed the planning tasks in session 1 increased their use of a model-based strategy in session 2 ($t(14)=1.9$, $p=0.04$), whereas those who had performed the association tasks in session 1 increased their use of a model-free strategy ($t(16)=2.2$, $p=0.02$). This study shows that even a brief intervention can lead individuals to base their decisions either on a representation of task structure or on more rapid but less flexible associative learning.

OTHER

E155

BRIDGES AND COMMUNITIES: THE IMPACT OF SHARED CONCEPTS IN COGNITIVE NEUROSCIENCE

Jonathan Morgan[1], Natasha Sakraney[1], James Moody[1], Scott Huettel[1], Achim Edelmann[1], Greg Appelbaum[1]; [1]Duke University — Cognitive neuroscience is a multidisciplinary field aimed at understanding how neural structures and processes shape behavior. Functional magnetic resonance imaging is a key measurement approach used in this effort and has been the source of empirical data in thousands of published articles. In this research, we take these articles as our data in order to understand how the structure of cognitive neuroscience influences the dissemination and recognition of new knowledge in the discipline. Using a combination of text and social network analysis techniques, we capture the effects both of an article's Scientometric characteristics (e.g., length, publication year, number of authors and references) and of its content (e.g., concepts and brain regions studied) upon its subsequent impact. Analyzing 2,365 articles from five of the discipline's most prominent journals for the years 2004-2010, we map connections between the articles through the psychological concepts and neuroanatomical terms that they share in their abstracts and titles. We identify communities of articles defined by common ideas, and show through a set of regression models that articles that bridge communities are more influential, leading to greater subsequent citations. For example, our analysis indicates that articles connecting work in visual processing, social neuroscience, emotion management, and facial recognition made significant contributions during this period, leading to an increasing emphasis on emotion management and spectrum disorders later in the period. We believe this approach offers a general platform to explore questions concerning the evolution of sub-disciplinary boundaries, and the role of collaboration in the generation of new knowledge.

THINKING: Other

E156

LARGE-SCALE RESTING-STATE NETWORK CORRELATIONS PREDICT MIND WANDERING TENDENCIES

Christine A. Godwin[1], Michael A. Hunter[2], Matthew A. Bezdek[1], Gregory Lieberman[2], Katie Witkiewitz[2], Vincent P. Clark[2], Eric H. Schumacher[1]; [1]Georgia Institute of Technology, [2]University of New

Mexico — Mind wandering (MW) is frequently associated with increased activation in default mode network (DMN; Andrews-Hanna et al., 2010). Most fMRI studies use experience sampling or post-study questionnaires to measure MW during a scan. Here we build on this research by examining the extent that trait mind wandering is related to the functional connectivity (FC) between the DMN and an intrinsic task positive network (TPN) during rest. Resting-state fMRI scans (5.5 min) from 112 participants were decomposed into seven components using group independent component analysis (ICA). Each participant completed the Mind Wandering Questionnaire (MWQ; Mrazek et al., 2013) to measure levels of task-unrelated thought tendencies. ICA was used to define the DMN and TPN, and the average DMN and TPN signals were extracted for each individual. Each participant's DMN and TPN signal were correlated to obtain a measure of the DMN/TPN static FC, which was compared to MWQ scores using Pearson correlation. We found a statistically significant positive correlation between DMN/TPN FC and tendency to mind wander, $r(110) = .25$, $p = .008$. Previous research has demonstrated that increased coactivation of the DMN and TPN is detrimental to task performance, and increased anti-correlation is associated with more efficient behavioral performance (e.g., Thompson et al., 2013). The positive correlation between MW and FC supports and extends these findings. A stability between these networks can be observed in resting state as well, and may be related to a general tendency to experience task-unrelated thoughts.

E157

THE EFFECTS OF NICOTINE ON CONDITIONING, EXTINCTION, AND REINSTATEMENT

Alexandra Palmisano[1], Eleanor Hudd[1], Courtney McQuade[1], Dr. Harriet de Wit[2], Dr. Robert Astur[1]; [1]The University of Connecticut, [2]The University of Chicago — One view in addiction research is that nicotine dependence develops due to the reinforcing properties of nicotine, related to euphoria or anxiety relief. Another recent view, derived from animal models, suggests that nicotine can also enhance the reinforcing, motivating functions of non-nicotine related rewards. Few studies have examined the ability of nicotine to enhance reinforcement from stimuli unrelated to smoking in humans. Here, we aimed to determine whether nicotine enhances reinforcement of an M&M food reward in a virtual reality environment using a 2-day conditioned place preference paradigm. On the first day, subjects explored two virtual rooms where they received M&M rewards in one room, and no rewards in the other. On the second day, subjects received no M&Ms in either room to test for extinction. After several sessions, participants received M&Ms in a novel context and were tested for reinstatement. On each day, half the subjects ingested nicotine (4 mg/kg) and half received placebo. Participants who ingested nicotine before training rated the previously-paired M&M room significantly more favorably on Day 1 test day than did subjects in the placebo group ($p < 0.05$). Also, the nicotine-treated group spent significantly more time in the previously-paired M&M room than did the placebo group on Day 2 ($p < 0.05$). Our results indicate that nicotine may delay the rate of extinction and promote reinstatement. Thus, these data provide key information for understanding how conditioning paradigms can provide insight into treating addictions.

E158

TASK-SPECIFIC PROCESSING OF ARABIC DIGITS IN THE LEFT ANGULAR GYRUS

Eric Wilkey[1], Gavin R Price[1]; [1]Peabody College, Vanderbilt University — Previous research suggests the left inferior parietal lobe, specifically the left angular gyrus (AG) is preferentially associated with the processing of symbolic numbers (i.e. Arabic digits), relative to nonsymbolic numerical processing (i.e. sets of dots). The present study investigates whether such preferential processing is influenced by task demands by contrasting neural activation during symbolic vs nonsymbolic number processing in two tasks using functional magnetic resonance imaging (fMRI) at 7 Tesla. Using numerosities 2, 4, 6, & 8, presented as Arabic digits or sets of dots, participants were required on one task to indicate whether a presented numerosity was smaller or larger than 5 (i.e. compare), while in the second task they were required to identify the exact numerosity of the presented stimulus (i.e. identify). We conducted a whole-brain analysis of variance testing for a task by format interaction. Results indicated significant interactions in 5 clusters ($p<.001$ uncorrected, $p<.05$ cluster corrected). In the left prefrontal, anterior cingulate, and right insula, this interaction was characterized by greater activation for identify vs compare in the nonsymbolic format only. The posterior cingulate cortex interaction was characterized by greater activation for symbolic vs nonsymbolic in the identify condition only. Finally, the left angular gyrus interaction was characterized by greater activation for symbolic vs nonsymbolic in the identify condition only. These results indicate that the preferential processing of Arabic digits in the left AG is influenced by task demands, suggesting a role for both top-down and stimulus driven processes in the neural processing of numerical symbols.

E159

CLASSIFYING COGNITIVE SUBGROUPS OF PARKINSON'S DISEASE BASED ON RESTING-STATE FUNCTIONAL CONNECTIVITY PATTERNS.

Suhnyoung Jun[1], Na-Young Shin[2], Seung-Koo Lee[3], Sanghoon Han[1]; [1]Yonsei University, [2]Ewha University School of Medicine, [3]Yonsei University College of Medicine — Functional connectivity magnetic resonance imaging (fcMRI) studies have reported reliable changes in intrinsic connectivity of human brain over various clinical disorders. To explore the potential of fcMRI data to classify cognitive subgroups of Parkinson's disease patients (PD) with various level of cognitive status such as subjective cognitive impairment (PD-SCI), mild cognitive impairment (PD-MCI), and dementia (PDD), and to elucidate the relation between resting-state networks and inter-regional connectivity patterns leading to decent classification performance, 44 patients with PD-SCI, 125 patients with PD-MCI and 44 patients with PDD were recruited. The present study show that the use of 16,110 connectivity features, composed by cross-correlating the first and second eigenvector resting signals from principal component analysis of every 90 Automated Anatomical Labeling regions, allowed prediction of Parkinson's disease cognitive status using linear support vector machine-based multivariate pattern analysis. Features were ranked according to F-score and included accumulatively during the analysis. The resultant accuracy curve showed that using approximately 100 features was sufficient enough to discriminate the cognitive subgroups of PD with more than 80% of accuracy. We further found several resting-state networks playing a major role in group discrimination: visuospatial network including bilateral superior frontal gyrus, executive control network including bilateral middle and inferior frontal gyrus, dorsla default mode network and anterior salience network. These findings suggest that inter-functional-connectivity patterns of brain regions can be used to classify subjects with PDD, PD-MCI, and PD-SCI and that the key features which yielded high accuracy were mostly within core resting-state networks.

E160

SPONTANEOUS INTEGRATION BETWEEN THE REPRESENTATION OF NON-SYMBOLIC AND SYMBOLIC NUMBERS

Ruizhe Liu[1,2,3], Allison Liu[1,2], Christian Schunn[1,2], Julie Fiez[1,2,3], Melissa Libertus[1,2,3]; [1]University of Pittsburgh, [2]Learning Research and Development Center, University of Pittsburgh, [3]Center for the Neural Basis of Cognition, Pittsburgh, Pennsylvania, USA — Educated adults are able to represent numerical information in a non-symbolic and a symbolic format and flexibly switch between the two. Yet, it is unclear how these formats are integrated in the human brain. Previous studies have shown that a positive event-related potential (ERP) component peaking around 200 ms over posterior scalp sites, also called the P2p, is sensitive to ratio differences in both numerical formats. Here, we examined adults' neural activity (N=25), measured via ERPs, when they were passively viewing non-symbolic and symbolic numbers simultaneously. Each stimulus consisted of an Arabic numeral overlaid on a cloud of dots. The dot quantity either matched or mismatched with the Arabic numeral. Comparing ERPs to matched and mismatched trials yielded no differences on the P2p. However, we also asked each participant to explicitly estimate dot quantities in a separate behavioral task and observed that participants tended to significantly underestimate the actual dot quantities that were shown. After adjusting the dot quantities in the EEG experiment for this underestimation bias, participants showed greater P2p amplitudes in the adjusted mismatch condition than in the adjusted match condition. These findings support the notion that adults spontaneously integrate non-symbolic and symbolic number formats, but that such integration is only visible when the perceived quantity is considered.

E161

DOUBLE DISSOCIATION OF VALENCE AND VIVIDNESS DURING IMAGINATION

Trishala Parthasarathi[1], Joseph W. Kable[1]; [1]University of Pennsylvania — Recent work has shown that the default mode network (DMN) is activated when imagining the future. However, it is unknown whether different aspects of imagination engage different nodes of the DMN. Here, we test how the vividness, valence, and temporal distance of an imagined event differentially modulates BOLD activity. Twenty-four people were scanned using fMRI while imagining scenarios manipulated for vividness, valence, and temporal distance. Subjects rated each scenario for vividness and valence. We analyzed our neuroimaging data using the general linear model; during the imagination period, we included separate regressors for comparing scenarios that were high versus low in vividness, high versus low in valence, and high versus low in temporal distance. A region-of-interest analysis was also conducted using ventromedial prefrontal cortex (vmPFC) and ventral striatum (VS) masks obtained from a previous meta-analysis, as well as anatomically defined Left and Right hippocampus. At the whole brain level, we found increased BOLD activity in the vmPFC, VS, and medial temporal regions when participants were imagining. Precuneus and hippocampus had increased activity for more vivid scenarios compared to less vivid scenarios, and greater activity was seen in the vmPFC and VS for positive scenarios compared to negative scenarios. ROI results confirmed that valence modulates activity in the vmPFC and VS, but not hippocampus, while vividness modulates activity in the hippocampus, but not vmPFC or VS. These results show that different aspects of imagination differentially modulate separate nodes of the default mode network.

OTHER

E162

THE SEMANTICS OF COGNITIVE NEUROSCIENCE: MAPPING STRUCTURE AND EVOLUTION

Natasha J Sakraney[1], Jonathan H. Morgan[1], Scott Huettel[1], Jim Moody[1], Achim Edelmann[1], Greg Appelbaum[1]; [1]Duke University — As cognitive neuroscience research continues to proliferate, it generates new knowledge about the linking between brain and behavior. The primary units of such research are peer-reviewed articles that express results of individual experimental studies. In the current project, we apply network analysis techniques to the text of thousands of articles that report findings from fMRI studies of human cognition in order to create, visualize, and quantify the interrelations between anatomical and conceptual terms that constitute the foundation of the discipline of cognitive neuroscience. We compute statistical measures of the average path length, network density, and clustering coefficients to explore the semantic structure of the discipline and the evolution of the topics studied in this literature over time. Two-year sliding window networks between 2004 and 2010 reveal distinct trends wherein the average path length decreased, while density and clustering coefficient increased. These relationships indicate that the network of terms is becoming more connected over time, but that this connectivity is not uniform over all areas of study with greater clustering in some domains, such as social and visual neuroscience, reflecting increased specialization. Additional analysis of the specific shared terms in these clusters at different times indicates that subdisciplines within cognitive neuroscience are becoming differentiated; they are changing from being flexible parts of a larger literature into stabilized and distinct communities. This meta-analysis therefore quantitatively demonstrates how the field of cognitive neuroscience is changing and can identify longitudinal trends and gaps to be filled, while also suggesting profitable directions for future research.

THINKING: Other

E163

THE ASSOCIATION BETWEEN INTROSPECTIVE AWARENESS AND ACTIVITIES OF THE SEMANTIC SYSTEM

Xu Xu[1], Chunyan Kang[2], Kaia Sword[1], Taomei Guo[2]; [1]Penn State University at Harrisburg, [2]Beijing Normal University — The primary goal of the present study was to determine whether an individual's level of introspective awareness, based on self-assessment, relates to activities of the semantic system as evaluated by electrophysiological measures. In addition, the study investigated whether subjective awareness report may demonstrate differential relations with the processing of different semantic categories. Thirty-five university students provided self-assessment on their levels of introspective awareness. Their brain electrophysiological responses were recorded during performance on a lexical decision task. Word stimuli included two different semantic categories: mental verbs, representing mental events and processes, and physical verbs, representing physical actions and movements. Data analysis focused on the N400 time window where individual differences in level of ERP activities are considered representing differences in level of semantic activations. The results revealed close associations between awareness self-ratings and the N400 amplitudes. However, these observed associations did not show substantial differences between mental and physical verb conditions. Furthermore, prominent gender differences emerged in the associations. For men, the associations showed a left hemisphere prominence; for women, the associations displayed a bilateral pattern. These findings indicate that the semantic system plays an important role in the mechanism of higher-order conscious awareness, different domains of semantic knowledge may be equally involved in introspective awareness, and there may be pronounced gender differences in the neurobiological basis of conscious awareness. Further, the observed associations between the self-report and the electrophysiological measures lend support to the validity of subjective awareness and assessment of higher-order mental functioning.

NEUROANATOMY

E164

DEEP GRAY MATTER CHANGES IN MULTIPLE SCLEROSIS

Jonn Kmech[1], Esther Fujiwara[1], Dana Cobzas[1], Gregg Blevins[1], Hongfu Sun[1], Alan Wilman[1]; [1]University of Alberta, Edmonton, Canada — In addition to inflammatory and demyelinating processes, elevated iron levels in deep gray matter structures (basal ganglia, thalamus) are increasingly recognized in multiple sclerosis (MS). The functional significance of subcortical iron accumulation vis-à-vis known MS-related atrophic changes remains to be determined. We investigated sub-cortical changes (iron accumulation, atrophy) in MS-patients using quantitative MRI measures at very high field, and to relate these to disease characteristics (disability, disease duration), demographics (age, gender), and cognitive performance. A total of 41 MS-patients (16 relapsing-remitting, 15 secondary progressive, 10 primary progressive) and 29 non-MS controls were assessed with 4.7 T magnetic resonance imaging (MRI) and the Brief Repeatable Battery of Neuropsychological Tests (BRB-N). Regional volumes, transverse relaxation rates (R2*), and quantitative susceptibility mapping (QSM) were assessed for four basal ganglia nuclei and thalamus. Parameters in MS-patients were compared to those in controls and correlated with clinical, demographic and cognitive scores. Subcortical volumes were reduced in MS patients, with largest differences in the thalamus of progressive MS patients. Iron accumulation measures (R2*/QSM) showed more selective effects, limited to the putamen in progressive MS-patients. In the BRB-N, patients showed typical reductions in memory and processing speed. Age and disability (EDSS) were negatively correlated to subcortical volumes, and positively correlated to iron measures. In MS-patients, especially in those with the progressive subtype of MS, cognition was related to thalamus volumes; thalamic and globus pallidus iron related to cognition, esp. delayed memory. In addition to atrophy, iron changes in MS patients' deep gray matter structures are functionally relevant.

E165

DIFFERENTIAL AGING AND BLOOD PRESSURE EFFECTS ACROSS CORPUS CALLOSUM SUBREGIONS: A LIFESPAN DTI STUDY

Stephanie Matijevic[1], David Hoagey[1], Karen Rodrigue[1], Kristen Kennedy[1]; [1]University of Texas at Dallas — Previous research indicates that callosal microstructural integrity is negatively impacted by aging in even healthy adults. However, the regional specificity of those effects is less clear. The corpus callosum is composed of several functionally distinct subregions, varying in axonal composition and cortical projections, which may show differential selectivity to aging. Elevated blood pressure may exert further detrimental effects on white matter health and may influence estimates of aging effects on brain structure. Thus, in the present study we used diffusion tensor

imaging to examine the effects of aging and pulse pressure across regional callosal microstructure in 179 healthy individuals across the adult lifespan (20–94 years of age). Region-of-interest guided deterministic tractography was utilized to estimate fractional anisotropy (FA), radial diffusivity (RD) and axial diffusivity (AD) within five callosal subregions: genu, anterior midbody, posterior midbody, isthmus, and splenium. We found an Age x Subregion interaction on FA, RD, and AD, where significant detrimental effects of age were found on all regions (for FA, RD, and all but splenium for AD); however aging effects were regionally differential, exhibiting an anterior-to-posterior gradient of aging. Additionally, we found Age x Pulse Pressure interactions on RD and AD, with higher pulse pressure associated with poorer RD and AD in all callosal subregions, without regional specificity. These results suggest that callosal microstructure ages differentially in an anterior-to-posterior gradient and that elevated blood pressure may have a more global negative effect across all the subregions, eliminating the relative preservation of posterior areas. Support: NIA grants AG-36848, AG-36818

E166

DECREASES IN WHITE MATTER INTEGRITY LINKED TO PTSD IN MILD TRAUMATIC BRAIN INJURY

Theresa Teslovich[1], Ping-Hong Yeh[1], Priya Santhanam[1], Mark Varvaris[1], Terry R Oakes[1], Gerard Riedy[1,2], Lindell K Weaver[3,4]; [1]National Intrepid Center of Excellence (NICoE), Bethesda, MD, USA, [2]Uniformed Services University of the Health Sciences, Bethesda, MD, USA, [3]Intermountain LDS Hospital and Intermountain Medical Center, Salt Lake City, UT, USA, [4]University of Utah, Salt Lake City, UT, USA — Posttraumatic stress disorder (PTSD) is a disabling psychiatric condition affecting roughly 6.8% of adults in the US. Among service members, rates of PTSD have been estimated at up to 12-18%; often this risk is increased in the presence of traumatic brain injury (TBI). This study investigates the relationship between white matter (WM) integrity and PTSD in male service members and veterans with mild TBI (mTBI). The group was subdivided into those with (n=34, mean age=35.7(6.6)) and without (n=35, mean age=30.7(7.1)) a diagnosis of PTSD. Global probabilistic tractography of diffusion tensor imaging (DTI) was performed using TRACULA to reconstruct the neural WM tracts. Preprocessing included intra-subject registration of individual diffusion-weighted images to the structural T1w image and then a common template space, creation of cortical and WM masks from FreeSurfer reconstructions, and extraction of standard DTI metrics. Group analyses were conducted using a linear mixed model to investigate the role of PTSD and age within each tensor-based measure. A significant group effect was seen in the right uncinate fasciculus ($t(65)=3.31$, corrected $p=0.027$), with decreased fractional anisotropy (FA) in the comorbid PTSD mTBI group, relative to the non-PTSD mTBI group. This decrease in FA was paired with an increase in radial diffusivity ($t(65)=-3.00$, uncorrected $p=0.004$), indicative of regional de-myelination. These findings suggest the right uncinate fasciculus plays an important role in the pathogenesis of PTSD in mTBI. Abnormalities in this tract could result in the disruption of prefrontal modulation of the limbic system (i.e. amygdala, hippocampus), potentially manifesting as symptoms of PTSD.

E167

FOCAL TEMPORAL POLE ATROPHY AND NETWORK DEGENERATION IN SEMANTIC VARIANT PRIMARY PROGRESSIVE APHASIA

Jessica Collins[1,2], Victor Montal[3], Bradford Dickerson[1,2]; [1]Massachusetts General Hospital, [2]Harvard Medical School, [3]Sant Pau-Hospital — The Semantic Variant of Primary Progressive Aphasia (svPPA) is a devastating neurodegenerative disease characterized by the progressive loss of semantic memory. Despite a wealth of neuroimaging research that has associated svPPA with a distributed pattern of cortical atrophy that is most prominent in the left anterior temporal pole, there is little consensus regarding which region within this heterogeneous structure is most damaged, which may indicate the putative origin of neurodegeneration. In this study, we localized the most consistent region of atrophy in svPPA using cortical thickness analysis and surface-based inter-subject registration in two independent patient samples. Across both samples the point of maximal cortical atrophy was located in same region of the left dorsolateral temporal pole. Individual subject analyses localized the point of maximal atrophy for 100% of patients in both svPPA samples to the same temporopolar region. Using resting state functional connectivity (rs-fcMRI) we showed that the focal atrophy point anchored a large-scale network in healthy young adults that closely resembled the distributed atrophy pattern in svPPA and included several brain regions that are commonly implicated in semantic memory. In both patient samples, the magnitude of atrophy within a brain region was predicted by that region's strength of functional connectivity to the focal atrophy point in healthy adults. These findings suggest that cortical atrophy in svPPA may follow connectional pathways within a large-scale semantic network that converges on the temporal pole.

E168

FRONTAL CORTICAL THICKNESS ASYMMETRY DIFFERENCES IN AUTISM SPECTRUM DISORDER

Hakeem Brooks[1], Tracey A. Knaus[2], Helen Tager-Flusberg[3], Jeremy D. Cohen[1]; [1]Xavier University of Louisiana, [2]Brain and Behavior Program at Children's Hospital, Louisiana State University Health Sciences Center, [3]Boston University School of Medicine — Autism Spectrum Disorder (ASD) is a neurodevelopmental disorder characterized by verbal and nonverbal communication deficits and repetitive behaviors. Numerous studies have used voxel-based morphometry (VBM), a coordinate-based methodology, to assess localized neuroanatomical differences in ASD. Previous studies noted differences in brain regions implicated with social cognition and behavior (medial orbitofrontal region, fusiform gyrus, and frontal pole), language and communication (pars opercularis), and repetitive behaviors (medial orbitofrontal region and anterior cingulate cortex). Surface-based morphometry (SBM), however, provides measurements of surface area, cortical thickness, curvature, and cortical folding. The current study investigated cortical thickness differences in males ASD (N=19) compared to controls (N=20) using FreeSurfer, a semi-automated image processing application that provides SBM measures. Based on previous anatomical findings, it was hypothesized that cortical thickness would be different in the pars triangularis, pars opercularis, medial orbitofrontal cortex, and frontal pole between ASD and controls. After controlling for total brain volume (TBV), no significant differences in cortical thickness were found in any region-of-interest (ROI) between the two groups. However, significant interactions were found among left-right asymmetry, group and TBV for cortical thickness in the frontal pole and pars opercularis. There was also a significant asymmetry by group by age interaction for cortical thickness in pars opercularis. Connected brain networks function efficiently when each connected region has the appropriate proportionality with the rest of the brain. Therefore, the significant group differences in cortical thickness asymmetry that vary with TBV suggest that there are broad network-based changes of brain organizational structure in children with ASD.

E169

META-ANALYSIS OF PET IMAGING STUDIES OF ADULT AGE DIFFERENCES IN THE DOPAMINE SYSTEM

Teresa Karrer[1,2], Anika Josef[3], Rui Mata[4], Evan Morris[1], Gregory Samanez-Larkin[1]; [1]Yale University, [2]Technische Universitaet Dresden, [3]Max Planck Institute for Human Development, Berlin, [4]University of Basel — Selective, qualitative summaries of the Positron Emission Tomography (PET) literature have described a strong negative relationship between age and dopamine function overall, but there are often overlooked inconsistencies in the size of the effects. The goal of this study was to perform a systematic meta-analysis of PET studies examining adult age differences in dopamine synthesis capacity, receptors, and transporters to yield quantitative measures of average effect sizes as well as examination of variation in effects across studies. We identified candidate studies by first (1) searching PubMed on the basis of defined MeSH terms (combinations of "aging", "PET", and dopamine markers) and then by (2) searching the references within the papers from the PubMed search that met our inclusion criteria. We included studies with healthy subjects and a minimum adult age range of 30 years. We converted all reported main effects of age to correlation coefficients and then used these values in a random-effects model to quantify the mean size of the age effect on dopamine synthesis capacity, receptors (D1-like, D2-like), and transporters across studies. Our meta-analytic results yielded moderate to large, negative mean correlations between age and both striatal and frontal cortical dopamine receptors and striatal dopamine transporters. In contrast, there was much smaller (close to zero) effect of age on synthesis capacity. This study more precisely quantifies

prior claims of reduced dopamine functionality in age while also exploring the factors that account for variance in effects sizes – especially for D2 receptors (e.g., scanner resolution, ligands, study sample characteristics).

E170

SPECIFICITY IN LOCATION OF FACE- AND FOOD- SELECTIVE ORBITOFRONTAL CORTEX VALUE SIGNALS AND THEIR RELATIONSHIP TO INDIVIDUALIZED SULCOGYRAL ANATOMY

Marisa Patti[1,2], Carly Hyde[1,2], Kayleigh Adamson[2], Hyden Zhang[3], Sara Deitrick[2], Vanessa Troiani[2]; [1]Bucknell University, [2]Geisinger Autism and Developmental Medicine Institute, [3]Temple University — The orbitofrontal cortex (OFC) has an important function in codifying individual motivational behaviors. Here we characterized two types of motivational brain responses, food and social. First, we identified the location of value signals in OFC for each individual in our college student sample (N=28). Value signals were determined for each individual by contrasting faces or food with all other objects using a variant of a standard fMRI face localizer task that included faces, food, scenes, and objects. Based on previous literature, we anticipated value signals for faces to be medial and value signals for food to be lateral. Consistent with our hypothesis, we found that medial value signals were more often associated with faces (27/28 subjects), while only 14 subjects had medial food value signals. Lateral value signals were found for both faces and food (27/28 for food; 26/28 for faces). While lateral value signals were consistently present for both faces and food, these were found in distinct sulcogyral locations within lateral OFC. In a second analysis, we characterized the OFC sulcogyral pattern type bilaterally and found that individuals with the Type II pattern (known to increase risk for schizophrenia; Lavoie et al. 2014) were more likely to have atypical value signal locations. Atypical organization of the OFC architecture has been linked to psychiatric disorders and more recently with quantitative traits that are associated with subclinical manifestations of psychiatric illness. This suggests a possible link between abnormal locations of value signals, uncommon sulcogyral anatomy, and social and motivational behavior.

E171

SEROTONIN NEURONS EXPRESSING VESICULAR GLUTAMATE TRANSPORTER-3 IN THE CAUDAL DORSAL RAPHE NUCLEUS SHOW ENHANCED ACTIVITY IN DEPRESSIVE-LIKE BEHAVIOR

Jarret Williams[1], Maria A. Mucci[1], Martine M. Mirrione[1]; [1]Quinnipiac University — Previous studies have shown there is increased serotonergic neuronal activity and serotonin (5-HT) release in the caudal dorsal raphe nucleus (DRN) when animals are exposed to uncontrollable stress. Potentiated caudal DRN 5-HT release appears necessary for the development of depressive-like behavior in the learned helplessness (LH) model, though the cellular mechanisms driving this release remains unclear. Vesicular glutamate transporter 3 (VGlut3) co-expression in serotoninergic neurons has been shown to enhance 5-HT vesicular packaging. Therefore in this study, we tested whether activation of neurons with co-expression of VGlut3 and 5-HT correlated with depressive-like behavior. Quantitative immunofluorescence of c-fos expressing 5-HT/VGlut3 neurons in the caudal DRN revealed a statistically significant increase in activation of these co-expressing neurons in LH compared to resilience ($p<0.05$), specifically driven by neurons in the far-caudal raphe region (-9.12 mm from bregma). Interestingly, the percentage of activated 5-HT non-VGlut3 neurons in the caudal DRN was not significantly different between LH and resilience. Reduced GABAergic regulation onto 5-HT/VGlut3 neurons during stress may promote vulnerability to behavioral helplessness and suggests blockade of VGlut3 in the dorsal raphe may attenuate the overactive stress response leading to depressive behavior.

Poster Session F

ATTENTION: Other

F1

THE FUNCTION OF IGNORING A DISTRACTOR UNDER STRESS Ritsuko Nishimura[1]; [1]Aichi Shukutoku University — Stress in daily life is negative experience and impairs cognitive performance (Staal, 2004). The present study examined the function of ignoring a distractor under a stressful condition, using the Flanker task. This task requires participants to identify a target while ignoring peripheral distractors. If they can ignore distractors efficiently, the error rate will be same for the compatible and incompatible conditions. However, if they cannot, the error rate will be higher in the incompatible condition than the compatible condition. Half of in the participants were assigned to the stress group where they were instructed that they had to speak for 3 minutes front of an audience and video camera after the Flanker task. Participants in the non-stress were instructed they had to perform a verbal frequency task without an audience and camera after the Flanker task. Results showed that only the stress group showed a higher error rate in the incompatible condition ($F(1, 25) = 7.83$, $p = .009$). That is, the function of ignoring a distractor can be impaired by stress. This function is known to be related to executive resources (Lavie, 2010). These resources are depleted by anxiety and threatening situations (Johns et al., 2008). Accordingly, an interpretation of the present results is that in stressful situations, executive resources are depleted because of anxiety, and this leads to impairments in our ability to focus on the main task while ignoring distractors.

F2

FOOD TYPE AND ERPS TO DIFFERENT KINDS OF FOODS: EVIDENCE FOR DISSOCIATION OF THE N2 AND P3 COMPONENTS IN A GO/NO-GO TASK Frank DePalma[1], Natalie Ceballos[1], Rebecca Lopas[1], Andrew Vasquez[1], Roger Samson[1], Allison Zborowski[1], Reiko Graham[1]; [1]Texas State University — Behavioral inhibition has been linked to impulsivity, which is associated with negative health behaviors such as over-eating. Event-related potential studies examining neural responses to foods vs. nonfoods have demonstrated larger N2 and P3 components to foods. The current study examined whether food type and/or preferences play a role in these effects, as well as the role of variables such as body mass index (BMI) or hunger. Nineteen healthy females (mean age = 23.2 years) completed go/no-go tasks with either high calorie sweet or high calorie savory foods as targets (counterbalanced). Self-reported BMI, food preferences, hunger, restrained eating, and state/trait cravings were also assessed. Behavioral analyses revealed greater accuracy for go relative to no-go trials, with no differences for sweet or savory foods. N2 amplitudes over frontocentral areas were largest for sweet foods, regardless of preferences; the N2 was not sensitive to inhibitory processes. In contrast, P3 amplitudes were sensitive to go/no-go status but not to food type, being larger for no-go trials especially over frontocentral areas. Correlational analyses of peak amplitudes and self-report variables revealed that amplitudes were not related to self-report variables, with the exception of trait craving, which was negatively associated with P3 amplitudes. Overall, results suggest that the N2 and P3 elicited by food stimuli in a go/no-go task index separate processes. The N2 was enhanced to sweet foods, converging with eye-tracking studies showing that females orient most quickly to sweet foods, regardless of preferences. In contrast, the P3 was sensitive to processes associated with behavioral inhibition.

F3

VALENCE OR SALIENCE? DIFFERENCES IN THE NEURAL SIGNATURE OF REWARD AND PUNISHMENT IN VISUAL ENCODING Ludwig Barbaro[1], Marius Peelen[1], Clayton Hickey[1]; [1]University of Trento, Italy — Humans preferentially select reward-associated visual stimuli. However, it is unclear whether this reflects a low-level bias toward reward cues or a broader strategic propensity toward objects providing outcome-predictive information. Here we test these valence and salience hypotheses. Participants were cued to detect examples of object categories – cars, trees, houses, people – presented in scenes. For each category, detection resulted in either cash reward, monetary loss, or neutral outcome. Importantly, errors in critical conditions had a static cost (ie. +150 vs. +50 in positive condition, -50 vs. -150 in negative condition). As such, participants were always motivated to respond correctly. We had two expectations: if selection is driven by the value of prior outcome, participants should preferentially select and encode reward-associated stimuli (valence model). However, if resources are deployed to stimuli that are motivationally relevant, reward-predictive and loss-predictive stimuli should be equally salient (salience model). In a behavioural experiment performance closely followed the valence model: accuracy was high when targets predicted positive outcome and low when targets predicted negative outcome. Moreover, reward-predictive stimuli disrupted search when they acted as distractors but loss-predictive stimuli were easy to ignore. In a second fMRI experiment we found the same pattern in the encoding of stimuli representations in ventral visual cortex, revealed using multivoxel pattern analysis. Moreover, stimulus-evoked activity in the dopaminergic midbrain predicted the quality of these representations. The association of reward to a category of stimuli thus appears to have a unique effect on selection that is independent of the drive to seek information.

F4

THE EXISTENCE OF A PARTNER MODULATES COGNITIVE CONTROL Yumi Kimura[1], Kazuhito Yoshizaki[1]; [1]Aichi Shukutoku University — The congruency effect observed in a stimulus-response compatibility paradigm is modulated by the proportion of the congruent trials in a given block, which is termed the proportion congruency (PC) effect. The present study examined the effect of task relevancy in the social context, on the PC effect, using a go/no-go Flanker task. The participants completed a go/no-go Flanker task, in which they were assigned two of four targets and required to identify the two targets. In Experiment 1, we manipulated the PC for assigned targets and no-go targets. The results showed the PC effect depending on the PC of assigned targets. Experiment 2 demonstrated that the PC effect did not appear when participants were informed that no-go targets were assigned to another partner. Experiment 3 was conducted that while the PC of targets assigned to participants was constant, the PC of no-go targets assigned to a partner was manipulated by high and low PC. The results showed the congruency effect was modulated by the PC of the no-go targets. Experiment 4 was identical to Experiment 3, except that participants were not informed of the existence of a partner assigned to the no-go targets. The results showed that the congruency effect was not modulated by the PC of the no-go targets. Taken together, when the task relevancy of no-go targets is enhanced, visual selectivity inferred from congruency effect is modulated by the PC of a partner assigned to no-go targets as well as the PC of his/her own targets.

F5

THE DE-CAFF STUDY: THE AFFECT OF CAFFEINE ON ATTENTION Kanchan Sharma[1], Scott Ankrett[1], Thomas Davis[1], Elizabeth Coulthard[1]; [1]University of Bristol, England — Caffeine is the most frequently consumed stimulant worldwide. However its potential to ameliorate attention impairment in healthy ageing and conditions such as Dementia with Lewy Bodies is unknown. We used a blinded, placebo-controlled, cross-over design to explore whether caffeinated, compared to decaffeinated coffee, would improve performance on experimental and real-world tasks of attention in healthy older people. We assessed three broad areas of attention: alerting (simple, choice and cognitive reaction times), orienting (rapid serial visual presentation (RSVP) paradigm) and the executive network (Stroop task). Digit span and walking while talking (WWT) tasks represented functional measures of attention. 20 healthy older participants performed tests over a nine day period with baseline testing on day 1 followed by caffeine abstinence. On Day 8 participants were provided with a caffeinated or de-caffeinated drink 1 hour prior to testing. On Day 9 the alternate drink was received. The full paradigm was performed at both 62 and 100 mg caffeine doses. Data from twenty healthy elderly participants demonstrates that at

low dose in fact caffeine only reduces (impairs) reliable digit span (p=0.04) whereas at higher doses caffeine improves cognitive reaction time (p=0.01). There was no difference on RSVP, Stroop task, digit span or WWT. This suggests the effects of caffeine are dose dependent, benefits require a higher dose and are specific to the alerting network. Future work will use this paradigm to establish any potential for caffeine to provide meaningful improvement in quality of life in neurological illnesses including Dementia with Lewy Bodies.

EMOTION & SOCIAL: Person perception

F6

SAME/OTHER SEX ATTRACTIVENESS IN FEMALE HETEROSEXUALS: AN EYE-TRACKING STUDY

Tisha Dudley[1], Judith Easton[1], Natalie Ceballos[1], Nina Rodriguez[1], Roger Samson[1], John Treffalls[1], Reiko Graham[1]; [1]Department of Psychology, Texas State University

— Research suggests that female judgments of male attractiveness involve attention to body regions that provide biologically-relevant information about mate fitness, which vary depending on body composition (e.g., musculature, body fat). Less is known about how women make judgments about other women. The current study used eye-tracking to examine gaze patterns (e.g., duration to first fixation, total fixation duration) while heterosexual women (N = 25, Mage = 21.7 years) made attractiveness judgments about muscular, lean, overweight, and normal weight male (M) and female (F) bodies. Ratings varied as a function of body type and sex, with normal weight bodies rated highest (M = F), followed by muscular bodies (M > F), lean bodies (M < F), and overweight bodies (M < F). Comparison of gaze metrics across body types revealed that eye movements also varied as a function of body type and sex, especially fixation patterns across body regions. Exploratory correlations between ratings and metrics for the different body types revealed that eye movements to male bodies (except heavier bodies) were more likely to be correlated with attractiveness. In comparison, participant body mass was more likely to be related to ratings of female bodies (except lean and muscular bodies). Overall, results suggest that appraisals of attractiveness differ depending on the sex of the object; male attractiveness is associated to attention to specific body areas, while female attractiveness is more self-referential. Results are discussed in the context of evolutionary theories of attraction/competition.

ATTENTION: Other

F7

A WANDERING MIND DOESN'T LEARN

Judy Xu[1], Janet Metcalfe[1], David Friedman[1,2]; [1]Columbia University, [2]New York State Psychiatric Institute

— Previous studies with event-related potentials (ERPs) have shown that mind wandering is associated with attenuated sensory and cognitive processing. Mind wandering has also been associated with poorer learning. However, to date investigators have not assessed the relation between mind wandering and learning-related processing. In our experiment, while recording ERPs, we randomly probed participants for their attentional state ('on task' or 'mind wandering') while they studied a series of English-Spanish word pairs. At the end, participants were tested on their learning. There was no difference in early sensory ERP components between on-task and mind wandering states at parietal-occipital sites. However, there was a significant difference in a late slow wave from 300-650ms, such that, relative to on-task trials, mind wandering was associated with attenuated processing. Further, processing during mind wandering was not significantly different from baseline (or 0). When we categorized the same events by final test accuracy, a very similar pattern emerged: ERPs to incorrect, relative to correct, items showed a significantly attenuated slow wave. This suggests that the slow wave might index of encoding-relating processing. As the mind wandering ERPs were very similar to those for inaccurate word pairs, these data identify a potential mechanism for why learning suffers when the mind goes offline: namely that there is no substantive encoding-related processing, which would then result in poorer performance.

F8

FOOD PREFERENCES AND GAZE PATTERNS TO COMPLEX FOOD IMAGES

Allison Zborowski[1], Oleg Komogortsev[2], Natalie Ceballos[1], John Traffalls[1], Reiko Graham[1]; [1]Department of Psychology, Texas State University, [2]Department of Computer Science, Texas State University

— Research has shown that in females, attentional biases to foods vary as a function of body mass index (BMI) and food type. The current study examined eye gaze to different foods when multiple images competed for attention. Gaze patterns were monitored while women (N = 58) viewed 2 x 3 arrays of different food images (high calorie sweet, high calorie savory, and low calorie foods) and ranked them in terms of preferences. Estimates of attentional orienting (duration to first fixation) and maintenance (total fixation duration) to the different image types were derived, as well as BMI, hunger, cravings, and restrained eating. Preferences for savory foods were higher than those for sweet and low calorie foods; however, with respect to attentional capture, they were looked at last. In contrast, total fixation durations were more similar to preferences: women looked longer at savory foods, followed by sweet, then low calorie foods. Follow-up correlational analyses confirmed that preferences were highly related to fixation times across all food groups; higher preferences were associated with longer fixations to those foods, while duration to first fixation was unrelated to preferences. Finer grained analyses of most preferred foods across the arrays confirmed that most preferred foods were looked at longer than other foods, with heavier participants fixating longer on savory foods relative to their lighter counterparts. Overall, results suggest that the ability of a certain food to initially capture attention is less important in predicting preferences than its ability to maintain attention over time.

F9

A COMPARISON OF ELECTROPHYSIOLOGICAL MECHANISMS IN WORKING MEMORY-GUIDED ATTENTION, EXOGENOUS ATTENTION, AND ENDOGENOUS ATTENTION

Caiqi Chen[1], Guifang Fu[2], Tian Hong[1]; [1]South China Normal University, [2]Guangdong University of Foreign Studies

— Using a spatial cuing paradigm, with abstract symmetrical image stimuli, the present study conducted two experiments examining the differences between electrophysiological mechanisms of working memory-guided attention (WMA), exogenous attention, and endogenous attention. Experiment 1 investigated the relationship between WMA and exogenous attention in four conditions: 1) a WMA condition, in which the target was cued only by working memory content without peripheral cuing; 2) a peripheral cuing condition, where the target was cued solely by a peripheral cue; 3) a WMA+ peripheral cuing condition, in which the target was preceded by both cues in order to examine a possible coordination effect; and a 4) WMA/ peripheral cuing condition, where two target locations were cued by WMA and peripheral cuing respectively to examine competition between cues. Experiment 2 was identical to experiment 1, except that the peripheral cue was replaced with a central cue. Behavioral data showed typical cuing effects for the three attentional orienting categories as well as a competitive effect, but no coordinating effect. ERP results for the WMA condition showed a robust P2 component at anterior scalp sites, a less positive P300 compared to exogenous attention conditions, and a more positive P300 compared to endogenous attention at posterior electrodes. These results suggest that WMA involves electrophysiological mechanisms distinct from exogenous and endogenous attention, supporting the selection history accounts of attention, which emphasize that priority is determined by more than just goal and stimulus-driven selection, suggesting that a top-down versus bottom-up dichotomy is an inadequate taxonomy of attentional control.

ATTENTION: Spatial

F10

WHITE MATTER DAMAGE AND VISUOSPATIAL IMPAIRMENT AFTER TRAUMATIC BRAIN INJURY.

Meghan D. Caulfield[1], Kimberly Hreha[1,2,3], Peii Chen[1]; [1]Kessler Foundation, West Orange NJ, USA, [2]Kessler Institute for Rehabilitation, West Orange NJ, USA, [3]Teachers College Columbia University, New York NY, USA

— Cognitive deficits, including visuospatial

impairment, occur after traumatic brain injury (TBI). However, one particular disorder of spatial attention has been under-investigated in TBI. This disorder, called spatial neglect, is characterized by a failure or slowness to respond, orient, or initiate action towards one side of space. Spatial neglect often occurs after unilateral stroke. Recently, we found it is also common following TBI in inpatient rehabilitation. This study explores whether the neural networks critical for neglect in stroke are also critical for neglect in TBI. We examined 4 individuals with TBI (2 male, 2 female; M=67 years; 2 with neglect) in an inpatient rehabilitation facility, using behavioral measures of spatial neglect and diffusion MRI. Given that lesions involving the superior temporal gyrus (STG) and superior longitudinal fasciculus (SLF) are critical for spatial neglect after stroke, we seeded in the STG (10 mm radius), along the SLF to examine this tract. In the TBI patients with neglect symptoms, the SLF was disconnected between the temporal lobe and the parietal lobe. This tract remained intact in the other two patients who showed no neglect-related deficits. We also compared fractional anisotropy (FA) of the STG using a ratio of right to left STG. The non-neglect patients had similar FA in both hemispheres (1.00) while the neglect patients had reduced FA in the right compared to left STG (0.77). These results suggest there are similar underlying neural mechanisms for spatial neglect after TBI as previously reported after stroke.

F11

CAUSAL REGIONAL CONTRIBUTIONS IN VISUOSPATIAL NEGLECT DERIVED FROM GAME-THEORETICAL LESION INFERENCE

Monica N. Toba[1,2], Melissa Zavaglia[3,4], Federica Rastelli[1], Pascale Pradat-Diehl[5], Antoni Valero-Cabre[1], Claus C. Hilgetag[3]; [1]Cerebral Dynamics, Plasticity and Rehabilitation Group, Frontlab, Brain and Spine Institute, Paris, France, ICM, CNRS UMR7225, Inserm U1127 - UPMC-P6 UMR S 1127 , [2]Laboratory of Functional Neurosciences (EA 4559), University Hospital of Amiens and University of Picardy Jules Verne, [3]Department of Computational Neuroscience, University Medical Center Hamburg-Eppendorf, Hamburg, Germany, [4]School of Engineering and Science, Jacobs University Bremen, Germany, [5]Service de Rééducation et Medicine Physique, Hôpital de la Pitié-Salpêtrière, APHP — Right brain damaged patients with visuospatial neglect fail to orient and respond to stimuli situated on the left side of space. Anatomical correlates of this clinical condition are debated with recent studies showing the role of a complex fronto-parietal network. In the present study, we used a game-theoretical lesion analysis approach in order to investigate causal regional contributions and interactions between nodes of the attentional orienting networks in 25 patients presenting neglect as assessed with a task battery including line bisection, bells and letter cancellation. We selected several regions of interest (ROIs) identified in studies investigating attentional orienting: frontal eye fields (FEF), intraparietal sulcus (IPS), inferior frontal gyrus (IFG), temporo-parietal junction (TPJ) and the inferior occipital gyrus. For each ROI in each patient, we quantified the number of lesioned voxels. For each behavioural task, functional contributions were computed with a multi-perturbation Shapley value Analysis (MSA) (Keinan et al. 2004), which allows to infer causal regional contributions from behavioural performance after multiple lesions, treating brain regions as players in a coalition game. The highest causal contributions were observed for the IPS and TPJ. Functional interactions derived from MSA revealed synergisms between IPS and TPJ (for bells cancellation and line bisection) and between TPJ and IFG (for bells and letter cancellation). By using a game-theory-based method, we could infer causal contributions and functional interactions of specific anatomical regions in neglect. The present findings may aid the design of rehabilitation programmes.

F12

SPATIAL AND TEMPORAL FEATURES OF THE FORMATION OF LONG-TERM MEMORY BIASES AND THE EFFECTS ON SUBSEQUENT PERCEPTION

Andrew Quinn[1], Eva Zita Patai[1], Kate Watkins[2], Mark Woolrich[1], Anna Christina Nobre[1]; [1]Oxford Centre for Human Brain Activity, University of Oxford, United Kingdom, [2]Department of Experimental Psychology, University of Oxford, United Kingdom — Spatial and contextual associations in long-term memory are known to guide attention through top-down biasing of sensory processing. The underlying neural network is thought to be centered around the hippocampus, and theta-band activity has been implicated in the integration of information across brain areas. We were interested in how the encoding of spatial locations of objects in complex scenes would develop across learning, and how this would relate to deployment of attention to those spatial locations in a subsequent memory-guided attention paradigm. In this study, we used magnetoencephalography (MEG) and complementary functional magnetic resonance imaging (fMRI) in order to reveal the spatial and temporal dynamics of the brain areas involved during the incremental learning of spatial contextual associations, and how this relates to neural and behavioural signatures of memory-based perceptual facilitation. We found increases of activation in the network of brain regions implicated in forming spatial contextual memories, involving hippocampus, prefrontal cortex, and precuneus, as well as intraparietal sulcus and frontal eye-fields. Cross-frequency coupling of theta phase and gamma power was found to increase with contextual learning across this network. Brain activity in the theta band implicated in learning correlated with behavioral benefits of memory-guided attention in a subsequent attention-orienting task. Our results reveal co-activation of traditionally segregated memory and attention networks within different frequency bands, which interact during encoding, as well as predict the strength of memory-based attentional bias.

F13

MAPPING HUMAN FRONTAL AND PARIETAL CORTEX FOR ATTENTION, SACCADES, AND HAND MOVEMENTS USING 7 TESLA FMRI

Trenton Jerde[1], Philip Burton[2], Malin Björnsdotter[3], James Hedges[1]; [1]New York University, [2]University of Minnesota, [3]Linköping University, Sweden — Frontoparietal cortex contains topographic maps that prioritize goal-relevant information in space. We tested the hypothesis that priority maps selectively communicate a goal state to the different effector systems. To identify brain regions for saccades, subjects made saccades to targets in one of 12 locations around a central fixation. To identify maps of covert attention, subjects systematically shifted their covert attention around 12 locations in the visual periphery. These brain areas were then investigated further in two event-related fMRI studies with the following three epochs in which: (i) an effector-free directional cue appeared in one of the four visual quadrants, prioritizing that location in space; (ii) a centrally presented 'e' or 'h' prioritized an eye or hand movement on a trial; and (iii) a perceptual decision task was followed by an immediate movement. The latter two tasks differed in that the direction of movement may or may not have been known before the third epoch. Saccades and fixation were quantified by eye tracking in the scanner, and hand movements were measured using a joystick. Images were collected using 7 Tesla multiband EPI of the whole brain with a 1.6 mm voxel resolution. We found activation in frontoparietal cortex that was saccade-dominant, attention-dominant, or overlapping. We also found subregions selective for the direction of an upcoming eye or hand movement. These results show that the prioritization of eye and hand movements differs in frontoparietal cortex, and that its subregions are differentially involved in the transient dynamics of attention and action.

F14

HOME-BASED ON-LINE WORKING MEMORY TRAINING AND ATTENTION TRAINING FOLLOWING STROKE. SPECIFIC COGNITIVE EFFECTS AND GENERALIZED BENEFITS.

Tom Manly[1], Polly Peers[1], John Duncan[1], Adam Hampshire[2], Duncan Astle[1]; [1]Medical Research Council Cognition and Brain Sciences Unit, Cambridge, [2]Imperial College, London — Cognitive impairments are common following stroke and associated with poor outcomes. Here we describe a study in which 20 stroke survivors were allocated to home-based progressive Working Memory Training (Cogmed) or a similar, novel on-line training battery that emphasised attention to onscreen information rather than retention of a sequence. Participants completed approximately 20 minutes training a day over 2-weeks. Performance on the training tasks improved steadily in both conditions and, compared with a no-treatment, both were associated with significant gains in participants' self-reported cognition and mood function. Training was also associated with gains on untrained outcome measures. Attention training was followed by significant reductions in spatial bias and increased capacity to take in information at a glance. In contrast, Working Memory Training gains were greatest on untrained spatial recall tasks. Crucially, most participants were able to self-administer the training effectively, and reported subjectiv- benefits. The results are an encouraging indication that inexpen-

sive home-based computerised training may be well-tolerated and lead to specific and generalised improvements in function and mood following stroke. Further work is required to replicate and examine long-term benefits and dose-related effects.

F15

MODELING AUDITORY SPATIAL ATTENTION WITH AI CONSTRAINT-BASED APPROACHES Maxwell T. Anderson[1], Jaelle Scheuerman[1], Jesse A. Benzell[1], K.B. Venable[1], Edward J. Golob[1]; [1]Tulane University — It is well-established that spatial attention can be allocated as a gradient that diminishes from a central focus. Our recent auditory spatial attention experiments showed that reaction time as a function of distance from the attended location had an inverted u-shaped curve. This pattern of reaction time suggests a more complex gradient that is well-fit by quadratic functions, suggesting two variables. This project modeled reaction time in four experiments (n=83) to inform basic characteristics of a computational model of auditory spatial attention. Our model uses basic ideas of top-down and bottom-up attentional control from verbal models (Baddeley & Hitch, 1974; Cowan, 1988). There are three main components of our computational model: goal map, saliency map, and priority map. Each unidimensional map contains a semicircular vector quantifying attentional bias across the horizontal plane (180°). The priority map is comprised of the goal and saliency maps representing top-down and bottom-up spatial attention. In a subsequent study, differences in saliency map standard deviations, corresponding to breadth of attentional bias, modeled the pattern of reaction times with excellent (-90° r2=.93; 0° r2=.98) or good (+90°, r2=.48) fits. It was observed that obtaining good fit required the peak bias for the saliency map to be less than half that of the goal map. AI methods were used to further refine this fit. Overfitting was avoided by constraining model parameters with values from previous experiments. Beyond predicting results, changes in the maps made by AI constraints provided insights into general attentional dynamics.

F16

ATTENTION EFFECTS IN EARLY VISUAL CORTEX RELATED TO CONFLICT ADAPTATION Rebecca Waugh[1], Jennifer Barredo[1,2], Kerstin Unger[1], Michael Worden[1]; [1]Brown University, [2]Providence VA Medical Center — Behavioral responses to visual stimuli become slower and less accurate when they are presented amongst incompatible stimuli. This stimulus compatibility effect is reduced when the previous trial was incompatible. This observation, termed the congruency sequence effect (CSE), is thought to emerge from adjustments in selective attention in response to previous incompatibility. However, the specific attentional mechanisms underlying the CSE and the stages of perceptual processing involved are unclear. Some evidence indicates that conflict adaptation is limited to excitatory attentional modulations (enhancement of task-relevant features) later in visual processing, while other evidence suggests the involvement of early visual mechanisms. We investigated whether conflict-driven spatial attention alters processing in early visual regions and whether such modulations include both enhancement of task-relevant signals and suppression of task-irrelevant signals. In an fMRI experiment, participants performed a spatial flanker task in which we manipulated levels of prior conflict. For each participant, we defined regions of interest within primary visual cortex corresponding to the spatial locations of the central target and peripheral distractors. Behavioral results showed that the stimulus compatibility effect was smaller after incompatible than compatible trials. Imaging data suggest that modulation associated with conflict adaptation occurred in central target but not peripheral distractor regions. The target response was amplified following incompatible trials but diminished after compatible trials. The effects depended on the number of compatible/incompatible trials preceding the current trial. These preliminary findings are consistent with earlier work suggesting that conflict-induced spatial attention mechanisms modulate processing as early as in primary visual cortex.

F17

MEMORY AND ATTENTION FIELDS IN THE HUMAN VISUAL SYSTEM Anne Martin[1], Liang Wang[1,2], Yuri Saalmann[1,3], Avgusta Shestyuk[4], Nathan Crone[5], Josef Parvisi[6], Robert Knight[4], Sabine Kastner[1]; [1]Princeton University, [2]Chinese Academy of Sciences, [3]University of Wisconsin, Madison, [4]University of California, Berkeley, [5]The Johns Hopkins Hospital, [6]Stanford University — Visual processing has traditionally been thought to occur along a ventral "what" and a dorsal "where" pathway. However, human functional brain imaging studies suggest that the ventral stream carries spatial information in addition to coding for objects, and the dorsal stream serves not only spatial cognition but also object vision. Detailed electrophysiological data on spatial selectivity across the visual hierarchy have not been reported thus far. Here, we analyzed ECoG signals from 6 epilepsy patients performing an Eriksen flanker task variant. Following a spatial cue and variable delay interval, subjects differentiated between two shapes at the cued location in an array of distracters. Using our probabilistic atlas of the human visual system we found that about half of the electrodes located in visual areas had spatially selective cue-elicited activity, or "response fields". High frequency broadband enhancement and alpha suppression continued to signal the location of the up-coming target during the cue-target delay when no visual stimulation was present, a "memory field" maintaining an internal representation of space. Attention-related, spatially specific modulation persisted in response to the target in the form of an "attention field". Memory and attention fields were found throughout the dorsal and ventral visual pathways, with strongest signals in the areas most closely associated with object and shape processing, i.e. posterior-parietal cortex and the lateral occipital complex. The representation of space across the visual hierarchy in both low and high frequency bands suggests a parallel functionality of processing that may integrate information transfer across these disparate cortical areas.

EMOTION & SOCIAL: Development & aging

F18

MOTIVATION AND LEARNING SYSTEMS IN THE ADOLESCENT BRAIN Samantha DePasque[1], Adriana Galvan[1]; [1]University of California, Los Angeles — Adolescents exhibit a peak in reward sensitivity relative to children and adults. This phenomenon is due to a developmental imbalance between the more rapidly developing affective systems (e.g., the striatum and amygdala) versus the relatively immature cognitive control systems (e.g., prefrontal cortex) of the adolescent brain. This hyper-sensitivity to rewards is thought to drive adolescents' heightened propensity for risk- and reward-seeking; however, the same network that is responsible for this heightened reward sensitivity is also known to be heavily implicated in feedback-based learning. The present study sought to determine whether ontogenetic changes in this system may also influence adolescents' ability to learn from performance-related feedback. Early- to mid-adolescents and adults completed a learning task to assess developmental differences in feedback-based learning. Adolescents and adults both exhibited an ability to learn from feedback, and feedback engaged a similar network in both age groups, encompassing the dorsal and ventral striatum, medial prefrontal cortex, and posterior cingulate cortex. Consistent with the observation of heightened striatal sensitivity during adolescence, we found evidence of exaggerated responses to feedback valence in the adolescent striatum. Furthermore, in the amygdala, the threat of evaluation more strongly influenced feedback responses for adolescents than for adults, suggesting that developmental factors may also render adolescents more susceptible to the effects of motivational context on learning.

F19

INTEROCEPTIVE SENSITIVITY FACILITATES EMOTION REGULATION AMONG OLDER ADULTS Kameko Halfmann[1], Marcus Haustein[2], Natalie Denburg[2]; [1]Saint Norbert College, [2]University of Iowa — Although awareness of bodily feedback (i.e., interoceptive sensitivity) declines with natural aging, a growing body of research suggests that emotional functions are preserved, and may even improve with age. However, most research focuses on emotional experience and well-being rather than the successful use of emotions to promote adaptive behavior. Successful emotion regulation is vital for emotions to be an asset to social and cognitive functions, rather than a detriment. We aimed to examine the relationship between interoceptive awareness (i.e., awareness of one's visceral and bodily states) and emotion regulation among older adults. We show that individual differences in interoceptive sensitivity (IS) relate to successful emotion regula-

tion. We used a heartbeat detection task to measure IS and had three central results. First, older adults with higher IS reported greater use of regulation strategies, such as emotion suppression and cognitive reappraisal. Second, older adults with higher IS were more successful at reducing negative emotions using cognitive reappraisal. Third, older adults with higher IS were more likely to engage the dorsolateral prefrontal cortex, a cognitive control region, when using cognitive reappraisal. Taken together, these results suggest that IS facilitates emotion regulation among older adults. IS may serve as a marker of successful emotional aging. Also, training older adults to develop IS may improve emotion regulation and cognitive functions that rely on emotion regulation, such as decision-making.

F20

THE NOISY, SOCIAL BRAIN: MULTIVARIATE PATTERNS OF BOLD VARIANCE PREDICT AUTISTIC SPECTRUM PHENOTYPES AND EPIGENETIC VARIABILITY ON THE OXYTOCIN RECEPTOR GENE

Tyler Santander[1], Jessica J. Connelly[1], James P. Morris[1]; [1]University of Virginia — The human brain is a complex, hierarchical dynamical system whose micro- and macroscale components interact to produce myriad mental states. In this study, we sought to model spatially-distributed cortical networks related to social perception in addition to biochemical markers—namely, DNA methylation on the oxytocin receptor gene (OXTR)—thought to mediate social behavior. Toward that end, healthy young adults underwent resting-state fMRI and provided blood samples for epigenotyping. They additionally completed the Autism-Spectrum Quotient (AQ) to determine how these macroscale-neural and microscale-molecular factors relate to the broad autism phenotype (BAP). Resting fMRI data were extensively processed to correct for head motion; we then computed both temporal and spectral measures of BOLD variability for each individual in a voxelwise fashion. Finally, using Bayesian relevance vector regression, we attempted to decode BAP and OXTR methylation levels from multivariate patterns of BOLD variability in the anterior salience network (aSN) and dorsal default mode network (dDMN). Results show that temporal and spectral BOLD variance in the aSN significantly predict individual differences in both OXTR methylation and BAP-related traits; however, BOLD variability in the dorsal DMN is only predictive of OXTR methylation, suggesting that DMN function may be regulated by these molecular factors without directly contributing to behavioral outcomes. Together, these findings may provide support for "noisy brain" hypotheses of autistic spectrum phenotypes. Moreover, they bolster recent hypotheses regarding the role of oxytocin in autistic spectrum behaviors, suggesting that these traits result from deficits in oxytocin's ability to modulate the salience of social information.

F21

TOWARD A HEDONIC THEORY OF EXERCISE BEHAVIORS: ACUTE EXERCISE SELECTIVELY INCREASES THE FUNCTIONAL CONNECTIVITY OF REWARD AND AFFECTIVE BRAIN SYSTEMS IN OLDER ADULTS

Timothy B. Weng[1], Gary L. Pierce[1], Warren G. Darling[1], Derik Falk[1], Vincent A. Magnotta[1], Michelle W. Voss[1]; [1]The University of Iowa, Iowa City, IA — Older adults represent the highest proportion of sedentary adults, despite their knowledge of the health benefits associated with physical activity and exercise or their intentions to engage in such behaviors. Recent evidence suggests that self-reported affective responses during exercise are important predictors of future exercise initiation and maintenance. How are these affective signals represented in the brain? In the current study, we tested the hypothesis that an acute exercise session selectively targets a network of brain regions that are involved in reward-based decision making and affect processing. We assessed functional changes among these regions by collecting resting-state fMRI before and immediately after 13 older participants completed two within-subjects exercise conditions during separate counter-balanced sessions. During the active condition, participants cycled at a moderate intensity, and during the passive condition, their legs were moved by motorized pedals on the same machine and at the same pedal rate as in the active condition. We found that active exercise increased the functional connectivity (FC) within the reward and affective network ($p<0.01$), whereas passive exercise by the same subjects yielded no significant changes. In comparison, neither condition produced changes in FC among a network of primary sensory regions. We interpret these findings as evidence that active exercise can elicit an affective brain representation that may serve to bias behavioral actions when individuals are later faced with the decision to exercise. This suggests that the acute brain response to exercise may help to prospectively predict changes in future physical activity and exercise behaviors.

EMOTION & SOCIAL: Emotion-cognition interactions

F22

NEGATIVE AFFECT ENHANCES COGNITIVE CONTROL

Andrea A Mueller[1], James F Cavanagh[1]; [1]University of New Mexico — Pavlovian biases affect learning and behavior due to an innate pairing of reward seeking with action invigoration and punishment avoidance with action suppression. We sought to explain how emotional events affect Pavlovian biases, and how cognitive control can be used to overcome them. Our task presented negative and positive emotion-inducing pictures prior to imperative cues with orthogonalized action / outcome pairings. We defined Pavlovian congruent conditions as action- outcome congruence (go-to-win, nogo-to-avoid) whereas Pavlovian conflict conditions were those in which action and outcome contrast (go-to-avoid, nogo-to-win). Prior work has indicated that good performance in conflict conditions is associated with the application of cognitive control (defined by frontal midline theta power in the EEG). Behavioral results revealed that negative images boosted cognitive control, as measured by better accuracy in conflict conditions. Time-frequency analyses indicated that stimuli primed by negative images were associated with a stronger correlation between mid-frontal theta power and behavioral accuracy in avoidance conditions (go-to-avoid, nogo-to-avoid). These findings suggest that negative emotions may incidentally induce top-down control. Collectively, these findings bolster claims of domain general operations of midcingulate cortex which is thought to integrate both negative affect and control.

F23

REWARD DISTRACTERS AND WORKING MEMORY FILTERING

Tara Miskovich[1], Kenneth Bennett[1], Daniel Stout[1], Christine Larson[1]; [1]University of Wisconsin-Milwaukee — Reward stimuli capture attention involuntarily, much like other motivationally relevant or salient stimuli (e.g., threat), even when they are task-irrelevant (Anderson et al., 2011). Moreover, affective distracters have preferential access to working memory (WM; Stout et al., 2013). The current study assessed the ability to efficiently filter reward-distracters from WM using an event related component, contralateral delay activity (CDA), which indexes items held in WM (Vogel & Machizawa, 2004). Participants completed a WM change detection task with distracters that were previously associated, but no longer associated with monetary reward. Although we predicted participants would demonstrate greater CDA amplitude when distracters were of high versus low reward, results indicate that previously high-rewarded distracters did not impact filtering efficiency compared to low-rewarded ($p > 0.9$) and neutral distracters ($p > 0.9$), keeping with a previous report (Gong et al., 2014). In early trials of the change detection task, we found evidence that WM capacity was impaired compared to the no distracter condition when previously rewarded distracters were present ($ps < 0.03$), an effect not seen with neutral distracters present. However, there was no difference between reward distracters (high and low), suggesting this may be due to contingent capture from previously studied targets. Results may indicate that attentional capture by irrelevant reward has a limited impact on WM compared to emotionally-neutral distracters.

F24

EEG B ENHANCEMENT AND SUPPRESSION REFLECT PERSONAL VERSUS VICARIOUS EMOTIONAL EXPERIENCE

Taylar Grossman[1], Barbera Dylan[1], C. Chad Woodruff[1]; [1]Northern Arizona University — EEG β (14-30Hz) rhythms have been found variously to increase (β enhancement) or decrease (β suppression) in power. β enhancement/suppression may reflect first-person versus vicarious experience of emotion, respectively. Similarly to ų suppression (8-13Hz), β suppression may relate to mirror processing. Given studies that show self-other differences in mu suppression relate to self-reported perspective-taking (PT), we investigated whether self-other differences in the β range relate to self-reported empathy. We presented

participants with videos (motion) and photographs (static) of emotional faces during an emotion judgment task. Half the faces displayed were the participant's face (self) while the other half were faces of strangers (other), displaying one of four emotions: happy, sad, angry, neutral. Participants also completed the Interpersonal Reactivity Index (IRI) and the Empathy Quotient (EQ). A 2 × 2 × 3 RM ANOVA (image type (video, photo), task (self, other), electrode (F3, Fz, F4) revealed significant differences in β power between self and other stimuli in response to static ($p<.05$) but not in response to moving faces (video; $p>.05$). Negative correlations were seen between PT and frontal electrode amplitude (F3, Fz) in the other task. Additionally, a positive correlation obtained between PT and self-other differences in F3 power response to static stimuli. Additional correlations between power and various subscales of the IRI (e.g personal distress and empathic concern) also obtained. These data replicate previous research demonstrating dissociations between β enhancement and suppression and they further characterize the relationship between the EEG β-range and empathy.

F25

NEURAL MECHANISMS UNDERLYING REWARD CIRCUITRY IN POSTTRAUMATIC STRESS DISORDER

Sarah Boukezzi[1], Pierre-François Rousseau[1], Bruno Nazarian[1], Valérie Guyon[2], Zendjidjian Xavier[2], Hialaveran Paul[3], Florian Nicolas[4], Christelle Baunez[1], Eric Guedj[1], Stéphanie Khalfa[1]; [1]Institut de Neurosciences de la Timone, CNRS-UMR 7289, Marseille, France, [2]APHM, Conception, CUMP, Marseille, France, [3]Service de psychiatrie de l'Hôpital d'Instruction des Armées, Alphonse Lavéran, Marseille, France, [4]Service de psychiatrie de l'Hôpital d'Instruction des Armées, Sainte Anne, Marseille, France

— Posttraumatic Stress Disorder (PTSD) is an anxiety disorder that can develop after experiencing or witnessing a traumatic event. Anhedonia, or diminished interest in, and inability to experience pleasure are a key feature of PTSD. It has been recently suggested that this may result from deficits in reward mechanisms. However, the question of whether PTSD is associated with a dysfunctional reward processing remains largely unexplored and little is known regarding the underlying neural networks. The present study aimed at investigating the expectancy and outcome phases of reward processing in PTSD patients. Participants with PTSD and healthy matched controls underwent functional magnetic resonance imaging while performing a monetary incentive delay task. During the task, participants were cued to anticipate and to respond to a rapidly presented target to gain or avoid losing varying amounts of money. The preliminary results indicated that during the anticipation and the gain outcomes phases, PTSD participants showed a reduced activation in the basal ganglia relative to healthy matched controls. Conversely, that was not the case during the loss anticipation phase, in which the PTSD participants showed an increased activation in the basal ganglia relative to healthy matched controls. These findings suggest that dysfunctional reward-related activations may be associated with dysfunctions in the reward pathway on PTSD patients. Specifically, and in agreement with the persistence of anhedonia in PTSD, these preliminary findings imply that PTSD symptoms may promote the inhibition of brain areas involved in the processing of positive cues.

F26

BODY POSTURE AND THE REPRESENTATION OF "ABSTRACT" CONCEPTS

Gitte Joergensen[1], Rebecca Welles[1], Kagnica Seng[1], Julia Ryan[1], Patrick Orvis[1], Eiling Yee[1]; [1]University of Connecticut

— Sensorimotor-based ("embodied") theories of semantic memory posit that brain regions that are active when an object is perceived and/or interacted with are the same regions that represent that object. While such accounts make clear predictions about how we represent object concepts, e.g., "dog", it is not obvious how they can accommodate concepts for which there is no obvious external sensory input, such as "joy" or "power". There is evidence that the representations of affect-related concepts are based in emotional states (Vigliocco et al., 2009). If true, body posture (due to its association with emotional state) may also be involved in the representations of such concepts. We examined whether body posture affects processing for words related to affect and/or dominance. Participants were randomly assigned to hold expansive or contractive postures (cf. "power posing") under the guise that this would affect their heart rate. Subsequently, they completed a semantic categorization task that included words that varied in valence and dominance. Next, they completed free recall and old/new recognition tasks for the previously categorized words. There were no reliable relationships between posture and performance on semantic categorization or free recall. However, there was a significant interaction between posture and RTs in old/new recognition: Participants who had held the expansive, but not the contractive postures responded to positive valence and high dominance words faster than to negative valence and low dominance words. These findings suggest that, like for object concepts, bodily experience plays a role in the representation of affective and dominance-related concepts.

F27

DANCE EXPERTISE INCREASES AFFECTIVE SENSITIVITY

Julia F Christensen[1,2], Sebastian B. Gaigg[2], Antoni Gomila[3], Beatriz Calvo-Merino[1]; [1]Cognitive Neuroscience Research Unit, Department of Psychology, City University London, UK, [2]Autism Research Group, Department of Psychology, City University London, UK, [3]Department of Psychology, University of the Balearic Islands, Spain

— The present study shows how motor expertise increases sensitivity to affective body movement at the behavioural and physiological level. Nineteen affective movement experts (professional ballet dancers) and twenty-four controls watched 96 video clips of emotionally expressive body movements while they performed an affect rating task (subjective response) and their galvanic skin response was recorded (psychophysiological response). The movements in the clips were either sad or happy, and in half of the trials movements were played in the order in which they are learned (forward presentation), and in the other half, backwards (control condition). Results showed that motor expertise in affective body movement specifically modulated both behavioural and physiological sensitivity to others' affective body movement, and that this sensitivity is particularly strong when movements are shown in the way they are learnt (forward presentation). The evidence is discussed within current theories of proprioceptive arousal feedback and motor simulation accounts.

F28

DISTINCT PATTERNS OF INTRINSIC FUNCTIONAL CONNECTIVITY ARE ASSOCIATED WITH DISPOSITIONAL AGGRESSION AND EXPERIENCED ANGER

Raluca Petrican[1], Saman Sarraf[1], Cheryl Grady[1,2]; [1]Rotman Research Institute, [2]University of Toronto

— Despite their importance for optimal functioning, the distinct neural mechanisms underlying a chronic behavioral inclination versus a present inner readiness to act aggressively are still poorly understood. To address this question, we capitalized on existing evidence that dispositional aggression is linked to heightened threat reactivity and impaired executive control-based regulation of responses to stressors. Anger, as one affective response to an immediate threat, increases readiness to aggress by heightening the internal accessibility of relevant thoughts and motor behaviors. To test the implications of these proposals with respect to the underlying neural mechanisms, we used resting state fMRI data from 279 (117 males) younger adults from the Human Connectome Project. We measured the functional interactions between the periaqueductal gray [PAG], the core neural region underlying reactively aggressive responses to environmental stressors (Gregg & Siegel, 2001; Panksepp, 1998), and networks involved in behavioral control versus internal thinking. Dispositional aggression was linked to greater connectivity between the PAG and networks involved in environmentally, rather than internally, driven control of behavior. Complementarily, particularly among males, currently experienced anger was linked to stronger connectivity between the PAG and networks involved in present-, rather than past- or future-, oriented self-referential thinking, which implied greater self-referential focus on aggression-related behaviors in the context of the here-and-now. These findings provide evidence on the dissociable neural signature of a chronic tendency versus a present readiness to aggress and, as such, have the potential to aid in the design of interventions targeting external versus internal contributors to malign interpersonal dynamics.

F29

THE EFFECTS OF ACUTE STRESS ON MOTIVATED AND TASK-BASED ATTENTION

Natalie Hansen[1], Molly O'Hagan[1], Chris Caracciolo[1], Vladimir Miskovic[1]; [1]SUNY Binghamton

— Acute stress exerts a strong influence over the brain's attentional systems by prioritizing the processing of cues rich in motivational significance. A rapid functional consequence of

stress involves a shift in the balance of neural activity away from a task-directed prefrontal cortex (PFC) mode to a sensory-vigilance mode. Here, we used event-related potentials to examine the consequences of acute stress induction on the cortical processing of affective images, both with and without the presence of a cognitive load manipulation. Half of the images were viewed freely in the absence of a task, while the other half required the solution of a time constrained mathematical equation superimposed upon the image. We hypothesized that the stress group would exhibit a strong motivated attention bias that would persist even in situations where the affective images served as distractors in the context of completing a competing cognitive task. The stress group performed a cold pressor hand immersion challenge that raised both systolic and diastolic blood pressure (ps < 0.01), while the control group immersed their hands in room temperature water. Contrary to our expectations, the findings demonstrated a suppression of motivated attention allocation (as indexed by decreased late positive potential [LPP] amplitudes) in the immediate aftermath of acute stress as compared to the control condition. Moreover, the cognitive load manipulation further diminished LPP amplitude evoked by the arousing images to a greater extent in the stress than in the control group. These findings suggest that the cold pressor challenge attenuates visual processing in general.

F30

NEUROPLASTICITY IN AN EXTENDED AMYGDALA NETWORK AS THE MECHANISM UNDERLYING ATTENTION BIAS MODIFICATION TRAINING: A VOXEL-BASED MORPHOMETRY PILOT STUDY

Jacob Aday[1], Josh Carlson[1]; [1]Northern Michigan University — Increased attentional bias to threat has been identified as a causal mechanism in the development of anxiety. As such, attention bias modification was conceived as a treatment option where anxiety is alleviated through a computerized cognitive training regimen that reduces an individual's attentional bias to threat. After more than a decade of research on attention bias modification, there is meta-analytic support for attention bias modification in reducing attentional bias and anxious symptoms. Although attention bias modification appears to be a very promising treatment option for anxiety, the mechanism of action by which attention bias modification is effective is unknown. Existing neuroimaging evidence suggests attentional bias to visual threat is associated with a network of brain regions including the amygdala, anterior cingulate cortex, and visual cortex. The participants in our study received 6 weeks of at-home attention bias modification training. Pre-training and post-training measures of T1-wieghted structural MRI, attentional bias (dot-probe), and trait anxiety were collected. Results from voxel-based morphometry analyses provide initial evidence that attention bias modification results in reduced gray matter volume in the extended amygdala (substantia innominate/bed nucleus of the stria terminalis) and anterior cingulate cortex at a group-level. At the individual-level, we found that greater reductions in gray matter volume correspond to greater reductions in attentional bias and anxiety. These results provide initial evidence that the mechanism underlying effective attention bias modification training is a reduction of gray matter volume in an extended amygdala network. Neuroplasticity in this network may be an important target for anxiety treatment.

F31

MODULATION OF VISUAL SENSORY PROCESSING BY ASSOCIATED VALENCE – EVIDENCE FROM EVENT-RELATED BRAIN POTENTIALS

Annekathrin Schacht[1], Annika Grass[1], Anna Grimm[1], Mareike Bayer[1]; [1]University of Goettingen — Stimuli of emotional content are preferentially processed because of their high intrinsic salience for the organism. This processing advantage has been shown already for initial stimulus analyses at a sensory level much before conscious recognition or elaborate appraisal, as reliably indicated by modulations of event-related brain potentials (ERPs) at short latencies. Interestingly, such early effects are not restricted to the processing of evolutionary or socially relevant stimuli but occur even for symbolic and arbitrary stimuli like written words of emotional content. While sometimes interpreted as an indicator of extremely fast access to inherent meaning, recent research suggested that these effects might instead origin from associative learning mechanisms, particularly in the verbal domain. In three ERP studies this assumption was directly examined by employing reinforcement-learning paradigms. These studies provide evidence that newly acquired valence can effectively boost sensory processing of symbolic stimuli at different sub-stages, depending on whether or not they convey inherent meaning. Importantly, these effects do not occur under cross-modality learning conditions, indicating the relevance of the sensory percept in the acquisition of new valence. Taken together, these findings strongly suggest associative learning as a potential source of early emotion effects in visual stimulus processing.

F32

READING CROWD EMOTION: THE ROLES OF HEMISPHERIC SPECIALIZATION, TASK GOAL, ANXIETY, AND FACIAL IDENTITY

Hee Yeon Im[1], Daniel Albohn[2], Reginald Adams[2], Kestutis Kveraga[1]; [1]Harvard Medical School / Massachusetts General Hospital, [2]The Pennsylvania State University — The ability to read the collective mood of a crowd of faces is a critical social skill that guides our interactions with groups. Despite its important implications for behavior in real life situations (e.g., deciding whether a crowd is safe to approach or best avoided), the factors modulating crowd emotion perception remain largely unexplored. Methods: In four studies, we examined how crowd emotion perception is influenced by intrinsic factors (observers' intent to approach or avoid, anxiety level) and extrinsic factors (visual field of presentation and gender of crowds). We simultaneously presented two crowds of faces morphed along an emotion continuum in the left and right visual fields for 1 second and asked observers to rapidly report which crowd they would approach or avoid. Results: While right hemisphere dominance for negative stimuli, and left hemisphere preference for positive stimuli, have been reported, we found that lateralization effects are actually goal-dependent: both happier crowds and angrier crowds were perceived significantly more accurately in the left visual field/right hemisphere when observers sought to approach happier crowds and to avoid angrier crowds. We also found that happy female crowds and angry male crowds were perceived significantly more accurately, as in single face perception. Moreover, observers' anxiety level significantly modulated crowd emotion perception such that high-anxiety participants were faster overall and less accurate in perceiving happier, but not angrier, crowds. Conclusion: Perception of crowd emotion shows task-driven dominance of the right hemisphere, and is strongly modulated by crowd gender and observers' anxiety level.

EMOTION & SOCIAL: Emotional responding

F33

AN EEG STUDY OF E-CIGARETTE RELATED ADDICTION AND AFFECTIVE PROCESSES

Aishwariya Chandrasekar[1], Matthew Bachman[1], Neva Gakavian[1], Anne Tootell[1], Adreanna Massey[1], Jessica Ellis[1], Debra Bernat[1], Edward Bernat[1]; [1]University of Maryland, College Park — While event-related potentials (ERPs) have been studied in relation to nicotine addiction with various delivery systems (Versace et al., 2011), research regarding nicotine use with e-cigarettes is limited. The current study utilizes ERPs to assess e-cigarette users' reactivity towards e-cigarette cues, as well as differences between states of nicotine withdrawal and satiation. Seventeen daily e-cigarette users completed an affect regulation task in which they were instructed to either increase or decrease their reactions to picture stimuli, or simply view them. The picture stimuli included e-cigarette, unpleasant, pleasant, and neutral cues. The task was completed first in a state of withdrawal, and then again after vaping to satiation. ERP components were assessed for the different picture cues, regulatory instructions, and nicotine states. Components included earlier P2, N2, and P3 components, and the late positive potential (LPP). An increased LPP was observed for pleasant, unpleasant, and e-cigarette cues relative to neutral during withdrawal. After satiation, an LPP decrease was observed to e-cigarette cues, but no change was observed for pleasant or unpleasant. Instruction effects were also observed in earlier P2, N2, and P3 components. Results indicate that e-cigarette users' responses to e-cigarette cues are similar to those evoked by more intrinsic high arousal cues, when in withdrawal. When sated, e-cigarette cue reactivity was significantly decreased, indicating modulation by nicotine state. These results parallel effects previously found in cigarette users, suggesting a similar addictive pattern.

OTHER

F34

CAPTURING YOUR BEST SIDE: THE INFLUENCE OF FACIAL ATTRACTIVENESS ON POSING BIASES

Victoria Harms[1], Nicole Bolt[1], Lorin Elias[1]; [1]University of Saskatchewan — When examining the posing orientation in portraits, individuals tend to post with their left cheek forward. However, individuals also show an awareness of asymmetries in facial expressivity, showing a greater tendency to pose with the more expressive left cheek forward in loving family portraits and the less expressive right cheek forward when posing for stoic scientific portraits. Further research has provided some evidence that the right side of the face is perceived as more attractive compared to the left side. We examined posing bias in modeling headshots to assess whether this attractiveness asymmetry influences posing direction in portraits specifically highlighting the attractiveness of the subject. Despite an emphasis on individual attractiveness, we observed an overall leftward posing bias for the modeling images rather than the predicted rightward bias. Consistent with the typical left-cheek bias observed in portraiture, this observed leftward bias suggests that either the rightward bias for facial attractiveness does not influence posing behaviour, or it is less dominant than other factors such as asymmetries in emotional expressivity.

EMOTION & SOCIAL: Self perception

F35

SELF-PERCEPTION AS ITS OWN REWARD: BRAIN BASIS OF NARCISSISTIC SELF-VALUATION IN PERSON PERCEPTION AND SOCIAL COGNITION

Noam Zerubavel[1], Kevin Ochsner; [1]Columbia University, [2]Columbia University — What compelled Narcissus to fixate on his reflection instead of others? Could the underlying neural mechanisms also explain narcissists' excessively self-centered cognitions? We hypothesized that narcissistic self-absorption—both in person perception and social cognition processes—relates to disproportionate reward value elicited by focusing on oneself relative to others. Specifically, we tested the hypothesis that individual differences in subclinical narcissism (Narcissistic Personality Inventory; NPI-16) would correlate with activity in core valuation regions—ventromedial prefrontal cortex (vmPFC) and ventral striatum (VS)—evoked by images of oneself (relative to group members) and making trait judgments about oneself (relative to group members). To test this hypothesis, we recruited groups of well-acquainted participants to complete several tasks in the fMRI scanner: (1) viewing their own and group members' faces while performing a simple cover task; (2) making trait judgments about themselves and group members; and (3) an independent functional localizer (Monetary Incentive Delay task) to identify vmPFC and VS regions of interest (ROIs) active during anticipation and receipt of monetary rewards. We found that individual differences in subclinical narcissism were predicted by heightened neural activation in both vmPFC and VS ROIs while (1) viewing images of oneself (relative to group members) as well as (2) making trait judgments about oneself (relative to group members). In addition, these neural indices of narcissistic self-perception explained more variance in behavioral self-enhancement effects in the trait judgment task relative to the NPI-16. More broadly, the naturalistic paradigm we advance here can be used to investigate the neurocognitive mechanisms implicated in various personality disorders.

F36

SEX DIFFERENCES IN CO-RUMINATION ARE RELATED TO DISTINCT PATTERNS OF MEDIAL PREFRONTAL CORTEX RESTING STATE FUNCTIONAL CONNECTIVITY

Gabriela Alarcon[1], Bonnie J. Nagel[1]; [1]Oregon Health & Science University — Co-rumination, or repetitive, problem-focused talk in a dyadic relationship, has been shown to predict the onset of depression and mediate gender differences in risk for adolescent depression. Sex differences in co-rumination have been reported previously in healthy adolescents; however, the mechanisms supporting these sex differences have not been determined. We examined how the interaction of co-rumination and sex relates to resting state functional connectivity magnetic resonance imaging (rs-fcMRI) of the medial prefrontal cortex (mPFC), a node of the default mode network involved in self-reflection and implicated in major depression. Thirty-six adolescents (15-18 years) were included in the rs-fcMRI analysis of bilateral mPFC seed regions. Partial correlations assessed whether the interaction of sex and co-rumination (Co-Rumination Questionnaire) was related to bilateral mPFC rs-fcMRI. Girls reported higher co-rumination scores than boys ($t=2.92$, $p=.006$), which were related to stronger connectivity between left mPFC and frontal lobe regions implicated in major depression, self-awareness, and risk aversion, as well as the supramarginal gyrus, important for empathy. In contrast, boys showed negative associations between co-rumination and rs-fcMRI of the same regions. However, higher co-rumination scores in boys were positively related to stronger rs-fcMRI between right mPFC and right frontopolar cortex, a region important for executive functioning, while a negative association was present in girls. These findings may indicate that heightened rs-fcMRI between mPFC and socio-affective and fronto-parietal networks in girls and boys, respectively, explain sex differences in co-rumination. More research is needed to determine if these sex differences potentiate subsequent onset of major depression.

F37

IN THE FACE OF CHANGE: WHICH COPING STRATEGIES PREDICT BETTER OUTCOMES AFTER A FACE TRANSPLANT SURGERY?

Marie-Christine Nizzi[1], Megan Oser[2,3], Jenny Zinser[2]; [1]Harvard University, [2]Brigham and Women's Hospital, [3]Harvard Medical School — Objectives: Face transplantation is an innovative surgical procedure aiming to restore appearance and function in patients with a history of severe facial trauma. Since the first case in 2005, more than 20 patients have received full or partial face transplants worldwide. However, little is known about the cognitive, emotional and psychological impact of such a transformative surgery on the patients' sense of self. Methods: In this longitudinal study, we used the Brief COPE (Carver, 1997) to investigate how different coping strategies prior to transplantation relate to post-transplantation outcomes such as self-esteem (Rosenberg's Self Esteem Scale, Rosenberg, 1965), depression (CES-D, Lewisohn et al., 1997) and quality of life (QoL) (EQ-5D, EuroQuol Group, 1998). We monitored 6 patients up to 48 months after their surgery. Results: Correlations between coping patterns were higher in patients with more negative outcomes on self-esteem, depression, and QoL compared to patients with more positive outcomes. This may suggest that there are several ways of being resilient but one sure way of facing change that leads to poor outcome. Additionally, we categorized coping strategies into active and avoidant coping (following Amoyal et al., 2011). We found that active strategies foster better post-surgery outcomes in all three measures and that avoidant coping foster more negative quality of life. Conclusions: The coping profile of candidates might have predictive utility in patients' post-surgery subjective experience. Practice implications: as pre-surgery education programs are being developed for face transplantation candidates, training in the relevant coping strategies could be integrated to improve post-surgery resilience.

F38

GENERAL AND SPECIFIC SELVES: DIFFERENTIAL FUNCTIONAL BRAIN NETWORK CONNECTIVITY

Rui Nouchi[1], Motoaki Sugiura[1], Shinichi Mizokami[2], Yuki Yamamoto[1], Kelssy Hitomi dos Santos Kawata[1], Kohei Sakaki[1], Joseph Hsun-Cheng Lee[1], Shohei Yamazaki[1], Tetsuya Kageyama[1], Ryuta Kawashima[1]; [1]Tohoku University, [2]Kyoto University — Self-concepts are composed of multiple self-aspects (Marsh et al. 2006). People may have different attitudes to general and specific selves. For example, self-esteem for the specific self (the most important aspect of the self) was higher than that for general self (Mizokami, 2013). The purpose of this study was to investigate the differences of neural correlates between the general and specific selves. Before fMRI (functional magnetic resonance imaging) scan, 25 participants were interviewed to select the specific self, general other, and specific other. During block-designed MRI scan, all participants rated 30 sentences which are related to self-concepts from the positions of general self (GS), specific self (SS), general other (GO), and specific other (SO). Additionally, participants rated number of wrong phrases in the 30 sentences as a control task (C). A 2 (target: self, other) by 2 (aspect: general, specific) factorial design analysis using [GS vs C], [SS vs C], [GO vs C], and [GS vs C] contrasts was performed in Statistical Parametric Mapping (SPM8). The functional connectivity (FC) analyses using the mPFC and precuneus related to the

self process as a seed were conducted by CONN tool box. Results showed that SS had a higher FC between the mPFC as a seed and the right superior frontal gyrus areas compared to GS. On the other hand, GS had a higher FC between the precuneus as a seed and the bilateral vmPFC compared to SS. These results firstly showed the neural correlate's differences between the general and specific selves.

EMOTION & SOCIAL: Other

F39

FURTHER DATA FOR A POTENTIAL CAUSE FOR THE SIMILARITY OF PERCEPTS ASSUMED ACROSS INDIVIDUALS

Maud Haffar[1], Hugo Pantecouteau[2], Sheila Bouten[1], J. Bruno Debruille[1]; [1]McGill University, [2]École Normale Supérieure de Lyon — Looking for an account of the similarity of perceptions assumed across individuals, a previous study found that the processing of a stimulus by a person has an impact on the ERPs of a closely related person (partner). The present study was thus aimed at verifying these results and at seeing whether such an impact could be found in strangers. We focused on the mean voltages of event-related potentials (ERPs) in the time-window of the P600 and the N400. These ERPs were elicited by stimuli of the internal affective picture system in 20 pairs of closely related persons. Each member of a pair couldn't see what his/her partner was seeing and faced one half of the same screen. Two stimuli were presented simultaneously, one on each half. The sameness of these stimuli and the participants' belief in that sameness were manipulated. We found a significant effect of consistency (belief and reality were either consistent vs. inconsistent) in the N400 time window and a significant consistency x electrodes interaction at the sagittal electrode subset in the P600 time window. The same experiment was run with 16 pairs of strangers. No such effects were found. However, a "closeness effect" was observed, that is, ERPs were more negative when partners were doing the task than when strangers were doing it. The results of the previous study were therefore replicated and were specific to closely related persons. These findings support the existence of spontaneous brain-to-brain communications.

EMOTION & SOCIAL: Self perception

F40

NEUROCOGNITIVE MECHANISMS UNDERLYING HUMAN KINSHIP PREFERENCE

Mareike Bacha-Trams[1], Enrico Glerean[1], Juha Lahnakoski[2], Vappu Elisa Ryyppö[1], Mikko Sams[1], Iiro P Jääskeläinen[1,3]; [1]School of Science, Aalto University, Espoo Finland, [2]Max-Planck-Institute of Psychiatry, Munich, Germany, [3]Advanced Magnetic Imaging Centre, School of Science, Aalto University, Espoo Finland — Kinship premium effect, previously demonstrated behaviorally, describes enhanced willingness to help kin over others. Here, we studied the underlying neurocognitive mechanisms. During functional magnetic resonance imaging, 30 volunteers engaged in a decision game to either save, in different constellations, their sister, friend, vs. others, from a crisis area. The level to which kinship premium effect was stimulated was varied parametrically from saving sister and four others over a single other to saving sister-only over friend and four others. Further, the subjects viewed four times a re-edited film ("My sister's keeper") depicting a moral dilemma with kinship premium question involving refusal by a healthy sister to donate her kidney to her gravely ill sister. Subjects were asked to adopt, in different runs, the perspective of the to-be-organ-donor vs. recipient sister, and were on different runs given information about genetic vs. adoptive relatedness of the sisters. Our results showed that brain areas in prefrontal cortices, cingulate, insula, and precuneus were activated as a function of increasing involvement of kinship premium dilemma in the decision-making game. Further, similar sets of brain areas were observed to exhibit increased inter-subject correlation of brain hemodynamic responses when subjects were watching the movie and taking the perspective of the to-be-organ-donor sister (i.e., the active agent in the kinship premium dilemma depicted) with a priori knowledge that the sisters were genetically related. Together, our results suggest, based on brain regions activated across the tasks, that kinship premium effect involves moral judgment, emotion regulation, and self-referential thinking.

F41

THE RELATIONSHIP BETWEEN SCHIZOTYPY AND THE PROPENSITY TO ACCEPT EXTRAORDINARY SOCIAL ROLES

Gifty Asare[1,3], Ana L. Fernandez Cruz[4], Ola Mohamed Ali, Ishan Walpolla, Julia Segal[1,3], Bruno Debruille[1,2,3]; [1]Department of Psychiatry, McGill University, Montreal, Qc, Canada, [2]Department of Neurology and Neurosurgery, McGill University, Montreal, QC, Canada, [3]Douglas Mental Health University Institute, Montreal, QC, Canada, [4]McGill University Integrated Program in Neuroscience, Montréal, Canada — Background: Delusions of grandeur are frequent in schizophrenia and psychosis. They also exist to a lesser extent in the general population. They reveal a will to play extraordinary roles (e.g., being a prophet). Given that cognitive and behavioral strategies associated with such a will could conflict with those involved in playing more ordinary roles, one can ask whether this propensity contributes to some symptoms, such as behavioral disorganization. We thus tested if the will to play extraordinary roles in healthy participants could predict some schizophrenia-like traits. Methods: 209 healthy volunteers between the ages of 18 and 30 were recruited to fill out questionnaires assessing schizotypal traits, including the schizotypal personality questionnaire (SPQ). They were then presented with hundreds of names of social roles and asked to decide, for each role, whether or not they would consider playing it at any moment of their lives. Results: Participants accepting a greater percentage of the extraordinary roles, regardless of the favorability of these roles, had higher SPQ scores. This correlation ($r = .401$, $p = 7.17E-09$) was significantly greater than the correlation between the percentages of ordinary roles accepted and the SPQ scores ($r = .145$, $p = .044$) (Fisher Z-transform, $p = .003$). Among the three factors of the SPQ, disorganization was the one best predicted. Conclusions: The correlations found here should prompt further studies to investigate whether the will to play extraordinary roles could be a contributor to the symptoms accompanying psychosis and schizophrenia.

F42

ERP CORRELATES OF THE REPRESENTATIONS OF THE SELF, OF THEIR ACTIVATION AND OF THEIR BINDING WITH THE REPRESENTATIONS OF THE STIMULUS

Monique Mata[3], M Whyte[3,4], R Petrie[3], JB Debruille[1,2,3]; [1]Department of Psychiatry, McGill University, Montreal, Qc, Canada, [2]Department of Neurology and Neurosurgery, McGill University, Montreal, QC, Canada, [3]Douglas Mental Health University Institute, Montreal, QC, Canada, [4]School of Psychology, University of Queensland, QLD, Australia — To study the ERP correlates of the representations of the self, namely, their activations and their integration with the representations activated by the stimulus, we designed a new experiment in which each trial started either with the pronoun 'Me' or with the pronoun 'Him', which referred to an individual who introduced himself in a twelve minute video prior to testing. The second stimulus of each trial was the name of a social role. The task of the participant was then to decide whether or not (s)he would consider playing the role at any moment of his/her life, in the case of 'Me' and whether the other person would play it, in the case of "Him". (S)he thus had to try to bind representation of the self to the representations of the behaviors associated to the role. Fifty three participants were tested, we found larger P3-600s when they had to make the decision for themselves rather than for the other person. We discussed the functional significance of these electrophysiological differences as indexing a greater binding that would occur between the more complex representations of the self and the social role compared to the binding of the social roles to the representations of the other person. We also examined the ERP elicited by the presentation of the pronouns. P2s were larger for the pronoun 'Him/Her' when the pronoun of the preceding trial was 'Me' as compared to the pronoun 'Me' when it was preceeded by 'Him'.

EXECUTIVE PROCESSES: Development & aging

F43

THE INFLUENCE OF MINDSET ON MATH-RELATED POST-ERROR ADJUSTMENTS IN ADOLESCENTS

Nienke van Atteveldt[1], Sandra van Aalderen-Smeets[2], Lydia Krabbendam[1]; [1]VU University Amsterdam, The Netherlands, [2]University of Twente, The Netherlands — Students' implicit beliefs ("mindsets") about the malleability of their abilities have major impact on school motivation and performance. Students with an entity mindset believe that their abilities are fixed and cannot be improved much by effort, those with an incremental mindset believe that they can increase their abilities by working harder. Mindset shapes students' responses to setbacks; an entity mindset often results in adopting maladaptive strategies to cope with, or avoid, failure and negative feedback. Stimulating an incremental mindset is therefore of great importance to improve motivation and school success. We investigated the impact of 15-year-old students' mindset on how they adjust their performance after making mistakes. We assessed default mindset using a questionnaire, and manipulated mindset by presenting information about brain stability vs. plasticity (prime). Next, they performed a set-shifting math task in which they solved equations while the mathematical rule changed occasionally. Students with an incremental mindset were faster and more accurate on the math task. Post-error analysis indicated that students with an entity mindset slowed down after mistakes more, and improved less in accuracy, than those with an incremental mindset. Priming effects were nonsignificant on any task measure. In contrast, the brain plasticity prime produced a significantly stronger incremental self-report mindset score. These results demonstrate that mindset influences how adolescents learn from making mistakes on a math task. The discrepancy between the priming effects on the questionnaire vs. on task performance indicates that knowledge about brain plasticity is not necessarily enough to influence on-line learning behaviour.

F44

PHIBRA - AN AEROBIC EXERCISE INTERVENTION EXAMINING DOPAMINE D2 RECEPTORS AND COGNITION IN THE AGING BRAIN

Lars Jonasson[1], Katrine Riklund[1], Arthur F. Kramer[2], Lars Nyberg[1], Carl-Johan Boraxbekk[1]; [1]Umeå University, Sweden, [2]University of Illinois — In the PHysical Influences on BRain in Aging (PHIBRA) study, 60 sedentary elderly individuals (64-78y) completed a randomized physical activity intervention, contrasting aerobic exercise with a stretching and toning active control condition. For the first time on human subjects, the effects from a physical activity intervention was related to dopamine D2 receptor availability, as measured by [11C]Raclopride. In addition, data from a robust cognitive test battery was collected, as well as a range of magnetic resonance imaging modalities, providing the opportunity to examine the role of dopaminergic transmission on brain functions following physical activity. The intervention was successful as indicated by a clear baseline to follow-up group interaction on VO2, that reflected improved VO2 from aerobic exercise. A group interaction favoring the aerobic exercise group was also found for general cognitive function, indexed by a composite including episodic memory, processing speed, updating, shifting, and complex working-memory tasks. Ongoing analyses focus on intervention effects on the D2 system. To conclude, our preliminary results add to a growing literature suggesting that aerobic exercise has a broad influence on cognitive functioning, which may aid in explaining why studies focusing on a narrower range of functions have sometimes reported mixed results.

F46

WORKING MEMORY TRAINING INCREASES ENGAGEMENT OF FRONTAL REGIONS IN ADOLESCENTS

Gail Rosenbaum[1], Morgan Botdorf[1], Jamie Patrianakos[1], Henry Wilmer[1], Laurence Steinberg[1], Jason Chein[1]; [1]Temple University — Adolescence is a period of heightened risk-taking relative to adulthood or childhood, due in part to peers' increased influence on decision-making (Gardner & Steinberg, 2005). According to the dual-systems model of adolescent decision-making, adolescents' increased risk-taking is driven by heightened reactivity in a socio-emotional system, including ventral striatal and ventromedial prefrontal regions, and a still-maturing cognitive control system, including the lateral prefrontal cortex (lPFC; Steinberg, 2008). Because adolescents' choices have harmful consequences, it is important to investigate interventions that might attenuate risk-taking. Drawing on the dual-systems framework, one way to lower adolescent risk-taking might be to increase cognitive control. Working Memory Training (WMT) has proven effective in increasing adults' cognitive control (Chein & Morrison, 2011), but impacts on adolescent cognitive control have not been explored. Accordingly, we tested whether four weeks of WMT (relative to Trivia Training, TT) would increase cognitive control, and decrease risk-taking in adolescents. We found that adolescents receiving WMT, but not TT, increased the number of locations they could hold in memory. Improvements did not significantly transfer to performance on basic cognitive control measures, but across two risk-taking tasks, WMT adolescents showed suppressed levels of risk taking when observed by an anonymous peer audience, an effect not seen in TT. In a preliminary fMRI study, we find enhanced lPFC activity during a cognitive control task in WMT but not TT participants. These early results suggest that WMT may enhance adolescents' cognitive control and subsequently decrease risk-taking in the context of socio-emotional challenges.

F47

CONTRIBUTIONS OF AGE AND BETA-AMYLOID DEPOSITION TO FRONTO-PARIETAL COGNITIVE CONTROL REGIONS DURING TASK SWITCHING AMONG COGNITIVELY NORMAL ELDERLY

Hwamee Oh[1], Qolamreza Razlighi[1], Christian Habeck[1], Yaakov Stern[1]; [1]Taub Institute, Columbia University — Impairments in cognitive control are one of core components of age-related cognitive decline. Cognitive aging studies have shown age-related functional alterations in fronto-parietal cortices implicated in cognitive control. Although cognitively normal, a relatively large proportion of older adults presents with the accumulation of beta amyloid peptides, a pathological hallmark of Alzheimer's disease (AD). The topography of amyloid deposition largely overlaps with fronto-parietal control (FPC) regions, although little is known about the impact of amyloid deposition on FPC regions. The present study examined independent contributions of age and amyloid deposition to task-evoked FPC activations during task-switching. Using functional magnetic resonance imaging (fMRI), 43 young and 62 cognitively normal older adults underwent an fMRI session during an executive contextual task in which task difficulty varied: Single (either letter case or vowel/consonant judgment task) vs. dual (switching between letter case and vowel/consonant decisions) task. Older subjects additionally completed 18F-Florbetaben positron emission tomography scans to quantify brain amyloid deposition and were grouped into either amyloid-positive or amyloid-negative. Consistent with previous reports, age-related increases in brain activity were found in fronto-parietal control regions that were commonly identified across groups. For both task conditions, amyloid-related increases in brain activity were found in comparison to baseline activity. For higher cognitive control load, however, amyloid-positive elderly showed reduced task-switching activation in the right inferior frontal cortex compared to amyloid-negative elderly. The present results suggest that failure of modulating activations to accommodate enhanced control demand may differentiate functional alterations due to age from AD pathology in cognitively normal elderly.

F48

THE HEALTHY AGING BRAIN'S POTENTIAL TO COMPENSATE FOR AGE-RELATED FUNCTIONAL DECLINE - WHAT CAN WE LEARN BY LOOKING AT THE INTRINSICALLY ACTIVE BASELINE?

Angela Martina Muller[1,2,3], Susan Mérillat[1,2,3], Lutz Jaencke[1,2,3,4]; [1]University Research Priority Program (URPP), Dynamic of Healthy Aging, University of Zurich, Switzerland, [2]International Normal Aging and Plasticity Imaging Center (INAPIC), University of Zurich, Switzerland, [3]Division Neuropsychology, Institute of Psychology, University of Zurich, Switzerland, [4]Center for Integrative Human Physiology (ZIHP), University of Zurich, Switzerland — While differences in fMRI activation patterns between young and old adults have been reliably observed, their meaning is still an open question, with interpretations ranging from successful compensation mechanisms to indicators of age-related functional degradation. As the intrinsic baseline architecture of the brain is the dominant configuration during all brain states, we speculate that the aging brain's intrinsic

functional architecture might be also one of the limiting factors its capacity to compensate for age-related constraints. The aim of our study was to investigate the functional baseline configuration of a large sample of older adults (n = 186, mean age = 70.4) using graph theoretical analyses in order to evaluate its potential to compensate for functional and structural reductions occurring with age. We found a clear anterior-posterior dichotomy, with nodes in the posterior part of the brain showing more age-related loss of functional flexibility than nodes in the anterior regions. Additionally, we found an age-related hemispheric asymmetry in the frontal regions' capacity to potentially compensate for functional degradation. Compared to the right frontal regions, the left frontal cortex might have preserved a higher capacity to compensate for age-related functional degradation. At least, our findings also showed the relevance of the functional intactness of the cerebellum, the thalamus, and the caudate nucleus for preserved cognitive and behavioral performance in age

F49

INTERLEUKIN-6 AND LONGITUDINAL PROCESSING SPEED CHANGE IN OLDER ADULTS

Rowan Saloner[1], Hannah Holt[1], Brianne M Bettcher[1], Shubir Dutt[1], Ryan Fitch[1], John M Neuhas[1], Matthew Wynn[1], Joel H Kramer[1]; [1]University of California, San Francisco — Previous studies link systemic inflammation with worse cognition and white matter changes. These studies have been cross-sectional, however; little is known if baseline inflammation is associated with longitudinal changes in cognition. Our objective was to determine if baseline inflammation predicted steeper cognitive decline longitudinally. Participants were 126 functionally intact, community-dwelling, older adults (mean age=73.1) followed over multiple timepoints over 4-6 years. We measured baseline plasma interleukin-6 (IL-6) using the Mesoscale platform. At each time point, participants were administered a series of computerized reaction time tasks that yielded a single, composite processing speed score. Participants also underwent 3T MRI scans; volumes were obtained using Freesurfer 5.1. The IL-6 values were log transformed, and slope values of the processing speed scores were calculated using linear mixed models. In our first linear regression analysis, higher baseline IL-6 levels predicted greater increases in processing speed slope after controlling for baseline processing speed (beta=.109, p<.01). Follow-up regression analyses entered vascular risk factors (body mass index; diastolic blood pressure) and corpus callosum volumes into the model, but the relationship between IL-6 and change in processing speed remained significant. These findings suggest that higher levels of systemic inflammation at baseline are associated with increased rates of cognitive slowing over time in functionally intact older adults. This associated remained significant even after controlling for baseline processing speed, vascular risk factors, and white matter volumes. These results highlight the importance of inflammation in cognitive aging, and further suggest that the effect of inflammation may be independent of vascular pathways.

EXECUTIVE PROCESSES: Monitoring & inhibitory control

F50

ATTENTIONAL BIAS IN INDIVIDUALS WITH COMORBID CANNABIS USE DISORDERS AND TOBACCO USE

Alina Shevorykin[1,2], Ayman Baig[2], Daniel Robles[2], Naomi Dambreville[2], Lesia Ruglass[2], Robert Melara[2]; [1]Pace University, [2]The City College of New York, CUNY — Cannabis Use Disorder (CUD) is a complex and prevalent condition affecting approximately 4.3 million people in the U.S. (National Survey on Drug Use and Health, 2012). Long-term cannabis use is associated with cognitive impairments within the domains of attention, concentration, inhibition, and impulsivity, among others (Thames, Arbid & Sayegh, 2014; Crane et al., 2013). Research has shown that up to 90% of cannabis users also smoke tobacco, and identified both synergistic and compensatory effects of comorbid tobacco and cannabis use (Rabin & George, 2015). The current study was a preliminary data analysis, as part of a larger study on attentional bias and cannabis cue reactivity, which aimed to examine the cognitive relationship between CUD and tobacco use. Fifty two participants matched on age, race/ethnicity, education level and gender were screened for eligibility, diagnosed using the Structured Clinical Interview for DSM-IV, and assessed using a Modified Flanker Task, which measures inhibitory control. People with CUD and comorbid tobacco dependence were compared to people with CUD without tobacco dependence and controls. Repeated-Measures ANOVA revealed a significant main effect for Condition Type ($p<0.01$), for overall Reaction Time and overall Accuracy variables. As expected, individuals were more accurate and faster in the Baseline condition versus Filtering. Interestingly, results showed a marginal interaction between Group Type and Condition for the Reaction Time variable only. Cannabis users with comorbid tobacco use were slower than controls, but faster than cannabis users who don't smoke. This suggests the possibility of a stimulant effect of tobacco for cannabis users.

F51

MEG CORRELATES OF UNINTENTIONAL VALUE INTEGRATION OF VISUAL FOOD CUES AND ITS DOWN-REGULATION BY HEALTH-GOAL ACTIVATION

Rotem Beit-Arie[1], Abraham Goldstein[1]; [1]Bar-Ilan University — Everyday marketing media bombards us with visual cues of high-energy food in situations that do not require (or do not allow for) decision making or intentional valuation and most times under satiety conditions. Using magnetoencephalography (MEG) we studied the automatic brain responses to visual high-energy food cues under such conditions. Specifically, we tested whether the mechanism of value integration, involving the ventromedial prefrontal cortex (vmPFC), usually found in overt decision making studies, is activated by visual food cues even without deliberate decision-making or judgment, and whether it can be down-regulated by inadvertently activating health goals. Twenty not-hungry lean participants (19<BMI<25) watched pictures of high-energy food, low-energy food, neutral and pleasant images and were engaged in a food-unrelated oddball task, in two sessions, a week apart. MEG was recorded after activating health goals by reading a text regarding the dangers of overeating or after reading a control text on computer overuse, in a counterbalanced order. High-energy food cues elicited greater activity than neutral pictures with sources estimated at the vmPFC and insula (~355ms), but this effect was reduced after health-goal activation. Health-goal activation also lead to heightened activity at the left inferior-frontal gyrus at an earlier stage (~100ms). Results suggest that high-energy food cues do engage vmPFC based value-integration processes in unintentional viewing, but that their regulation by health-goal priming involves inferior-frontal inhibitory processes and reduction of insula activity, and is different than that invoked during voluntary self-control or deliberate attention (involving dorsolateral prefrontal areas).

F52

THE ROLE OF ALPHA OSCILLATIONS IN DISTRACTOR INHIBITION DURING MAINTENANCE IN VISUAL WORKING MEMORY.

Sofia Deleniv[1], Mark Stokes[1]; [1]University of Oxford — Oscillatory neural activity in the alpha frequency band (8-12 Hz) has increasingly become implicated as an inhibitor of information processing by creating a state whereby neuronal populations are less responsive to external inputs. Recent research suggests that alpha oscillatory activity is subject to flexible top-down control in several respects. Specifically, there is evidence that anticipation of challenging distractors is characterised by a preparatory increase in alpha synchrony, as well as robust phase-locking of ongoing alpha rhythm to the expected onset of distraction, such that it would coincide with the most suppressive stage of the alpha cycle. The current experiment examined the extent to which alpha power is under top-down strategic control, by combining EEG recordings of oscillatory brain activity with a precision visual working memory paradigm featuring distractor interference. Critically, symbolic cues predicted weak or strong distractors on a trial-by-trial basis. Our results provide behavioural evidence that participants are able to use distractor-predictive information to protect working memory from the effects of expected distraction. Furthermore, we observe a general ramp-up in alpha power during the period of distractor anticipation, indicating that alpha oscillatory activity is used to prepare for distractor inhibition. However, we did not find any evidence that the observed alpha power is sensitive to cue-driven expectations of distractor difficulty, thereby potentially limiting the functional role of alpha oscillatory activity in top-down attentional control.

F53

NETWORK CONTROLLABILITY AS A MEDIATING MECHANISM FOR IMPULSIVITY

John Medaglia[1,2], Shi Gu[2], Fabio Pasqualetti[3], Caryn Lerman[2], Joseph Kable[2], Danielle S Bassett[2]; [1]Moss Rehabilitation Research Institute, [2]University of Pennsylvania, [3]University of California, Riverside — Delay discounting and stop-signal tasks are often used to examine dissociable aspects of impulsivity that display differential patterns of medial and inferior frontal involvement. However, the distinct neurophysiological drivers underlying individual differences in task performance remain poorly elucidated. Here, we consider task performance to be a function of the distributed integration and segregation of cognitive processes. We study these processes mechanistically in the mathematical framework of network control theory, a relatively new field of engineering that offers a principled set of tools to understand the impact of a brain region's structural connectivity on neurophysiological dynamics. Specifically, we construct structural brain networks from 106 healthy individuals by applying tractography to diffusion weighted imaging data to link 1015 brain regions by white matter streamlines. For each person, we calculate boundary controllability – a measure of a brain region's role in segregating and integrating activity across the network – and determine its relationship to individual differences in cognitive performance. We introduce a novel cluster-correction technique built on the notion of minimum spanning trees. We find that individual differences in boundary controllability in the medial frontal cortices are associated with individual differences in delay discounting. We additionally observe a double dissociation in stop signal performance: boundary controllability variability in the right inferior frontal gyrus is negatively associated with stop signal reaction time, whereas variability in the left inferior frontal gyrus is positively associated with stop signal accuracy. Together, these results provide compelling evidence for dissociable structural network mechanisms of impulsivity in the human connectome.

F54

DISENTANGLING THE RELATIVE TIMING OF RIGHT FRONTAL SUBREGIONS IN RESPONSE INHIBITION WITH INTRACRANIAL RECORDINGS IN HUMANS.

Eleonora Bartoli[1], Adam Aron[2], Nitin Tandon[1]; [1]University of Texas Health Science Center at Houston (UTHealth), [2]University of California San Diego — Stopping a response is a core process of cognitive control. Stopping paradigms consistently show recruitment of right ventral lateral prefrontal cortex, including the right inferior frontal cortex (rIFC) and the adjacent right anterior insula (rAI). Yet their relative functional roles are currently debated. Functional imaging techniques lack the temporal resolution to resolve processes occurring in rapid succession, such as stop signal processing, braking of the response, and processing the outcome. We used electrocorticographic recordings in 6 patients who each had coverage of both rIFC and rAI, to study the temporal evolution of neural activity around the stop signal reaction time (SSRT). We tested the relative timing of rAI activation: a) Does it also occur before SSRT (like the IFG is known to be, in which case it may also be involved in stopping), or does it occur afterwards (in which case it is not), b) If it does occur before SSRT, what is its timing relative to rIFC? (if earlier it may convey information to rIFC). We analyzed gamma power (50-150 Hz) for each region in each subject. We observed that: a) rIFG activation (stop vs. go trials) occurred before SSRT in most subjects, and always preceded rAI activation, b) rAI activation was more variable, but generally occurred after SSRT, therefore too late to play a causal role in stopping. Instead its activity may relate to changes in arousal or post-trial feedback. These preliminary results may help resolve debates about the functional roles of prefrontal sub-regions in stopping.

F55

THE ROLE OF THE DORSOLATERAL PREFRONTAL CORTEX IN THE SUPPRESSION OF NEGATIVE AUTOBIOGRAPHICAL MEMORIES

Jonathan Fawcett[1], Roland Benoit[2], Ana Fotachi[3], Jun Kawaguchi[4], Michael Anderson[1]; [1]MRC Cognition and Brain Sciences Unit, [2]Harvard University, [3]University of Westminster, [4]Nagoya University — Prior work has found that suppressing retrieval of an unwanted word or image when faced with a suitable reminder recruits regions within the right dorsolateral prefrontal cortex to down-regulate hippocampal activity, preventing retrieval of the target and suppressing its representation. Here, we addressed for the first time whether similar neural mechanisms are invoked to suppress the retrieval of unpleasant autobiographical memories. Thirty healthy adults described upsetting experiences that occurred to them over the past three years, providing a cue word for each that reminded them uniquely of the event. While in the fMRI scanner, participants performed trials in which they encountered a cue word from one of their events. On Think trials, they were asked to retrieve the associated memory and, on No-Think trials, to suppress retrieval of the associated memory. After scanning, participants were then presented with each of the cue words one final time and were asked to describe the associated event in detail. Our findings revealed that suppressing retrieval of an upsetting experience involves activation of a right-lateralized fronto-parietal network including the right dorsolateral prefrontal cortex, together with a bilateral de-activation of regions implicated in autobiographical retrieval, including the hippocampus and the ventromedial prefrontal cortex, and of the amygdala. Our findings demonstrate that frontal control mechanisms first isolated through laboratory studies of relatively simple materials are also invoked to prevent the retrieval of personally upsetting, person-specific memories.

F56

DELAYED AND BIASED SENSORY-PERCEPTUAL PROCESSING OF NEGATIVE OVER POSITIVE VALENCED STIMULATIONS IN MOTHERS WITH HIGH ADVERSE CHILDHOOD EXPERIENCES

Jordan Bate[1], Anne Murphy[2], John Foxe[2,3], Sophie Molholm[2], Camila Rivera-Morales[1], Kelsey Armusewicz[1], Or Dagan[1], Gregory Peters[2], Pierfilippo De Sanctis[2]; [1]The New School for Social Research, [2]Albert Einstein College of Medicine, [3]University of Rochester Medical Center Rochester — A history of childhood maltreatment and low parental protection increases individuals' risk for future physical and mental health problems. In fact, childhood experience of four or more adverse childhood experiences (ACEs) is linked to impaired affective and social functioning. Little is known about the impact of ACEs on the neural processing of emotional information. Our goal was to investigate whether individuals with ACEs scores ≥ 4 (n=12, mean age = 26.11 years) showed impaired processing of emotionally valenced stimuli relative to individuals with ACEs scores < 4 (n=10, mean age = 29.44 years). Using high-density electrophysiology, the neurodynamics of processing of emotionally valenced versus neutral images was compared between the two groups. Participants performed a go/no-go task using the International Affective Picture System, in which they responded quickly and accurately to every image, while withholding responses to immediate image repetitions. In preliminary analysis, the low ACEs-group showed affect-related modulations of visual event-related potentials (VEPs) starting at ~180ms after stimulus onset, with increased amplitude for valenced (positive or negative) relative to neutral stimuli. This suggests early-onset enhanced processing of biologically salient stimuli. In contrast, in the high ACEs-group affect-related modulations of the VEP only onset at ~300ms, and only for negative stimuli. Thus there was a delay in the onset of valence-related modulation of the VEP, and selective amplification of negative over positive valenced inputs. These preliminary data suggest impaired processing of emotional content, and a processing bias towards stimuli evoking emotional distress in individuals who underwent adverse childhood experiences.

F57

MODULATION OF FEEDBACK PROCESSING IN SOCIAL ANXIETY DISORDER UNDER OBSERVATION CONDITIONS

Rolf Voegler[1], Jutta Peterburs[1], Christian Bellebaum[2], Thomas Straube[1]; [1]Institute of Medical Psychology and Systems Neuroscience, University of Muenster, Germany, [2]Department of Biological Psychology, Heinrich-Heine University Düsseldorf, Germany — Monitoring of ongoing behavior is a crucial function of the human central nervous system. Previous research suggests that electrophysiological correlates of performance monitoring such as the feedback-related negativity (FRN) vary depending on contextual factors as well as personality traits and anxiety level. In this study, 18 patients with social anxiety disorder (SAD) and 20 healthy adult controls completed an adapted version of the Frank task, a probabilistic learning task designed to discriminate between learning from positive and negative feedback. Importantly, all participants completed the task in two distinct social conditions, an observation condition in which social observation was operationalized by means of a video camera, and a control condition without observation by a third party.

While overall learning rates were comparable, behavioral results showed that learning from positive and negative feedback differed significantly between groups depending on social context. Similarly, ERP results did not yield significant main effects for either group or condition. However, a significant group by condition interaction indicated that FRN amplitudes were more negative in patients in the observation condition, while this effect was absent in controls. Also, FRN amplitudes were more negative for positive feedback in the observation as compared to the control condition. This effect was absent for negative feedback. Results are discussed with regard to differences between groups in saliency processing, motivational tendencies and risk aversion.

F58

THE RELATIONSHIP BETWEEN EMOTIONAL/INHIBITORY CONTROL AND BRAIN MORPHOLOGY IS DEPENDENT ON DIURNAL CORTISOL SLOPE Teodora Stoica[1], Melina Ramic[1], Farah Naaz[1], Brendan Eliot Depue[1]; [1]University of Louisville — Emotional and inhibitory control are necessary self-regulatory processes to maintain stable goal driven behavior. Our recent work, as well as others suggests that variance in the ability to inhibit various psychological domains is related to morphological features of the brain, including cortical thickness, surface area, volume and gyrification. Reductions in self-regulation are also associated with various mood and anxiety disorders and more generally, negative affect. Furthermore, individuals high in negative affect exhibit dysfunction of the hypothalamic-pituitary-adrenal (HPA) axis and the endocrine response related to stress. This is frequently measured by the circadian cortisol rhythm, which exhibits a high waking level with a short 30-60-minute increase, subsequently followed by reduction throughout the remainder of the day until sleep. Individual differences in cortisol response are frequently assessed by measuring diurnal slope. Therefore, we aimed to investigate whether the relationship between emotional/inhibitory control and brain morphology was related to diurnal cortisol slope. The present study obtained neuroimaging data from the National Institute of Health's Pediatric Database (NIHPD), funded by NICHD, NIDA, NIMH and NINDS. We analyzed structural MRI data (N=154) with FreeSurfer to assess brain morphology using emotional/inhibitory control questionnaires and cortisol measures as regressors. Results indicate that individuals with more negative cortisol slopes (larger decrease over time) exhibited a positive relationship between increased emotional and inhibitory control and thickness/surface area in both the left and right prefrontal cortex. These results suggest that behavioral, neural and endocrine responses are related to individual differences in self-regulation.

F59

CONFIDENCE IN MEMORY RECALL AS STATISTICAL CONFIDENCE Paul Masset[1], Adam Kepecs[1]; [1]Cold Spring Harbor Laboratory — The capacity to learn and recall previously encountered objects or situations are central to adaptive behavior at timescales beyond those of sensory systems. The ability to know when to trust recalled memories and when to doubt them allows us to make plans about current and future actions. Although the ability to assign appropriate level of confidence to recalled memories confers an obvious evolutionary advantage, the accuracy of such confidence reports has been questioned in the literature. We specifically consider results from experiments of word recall revealing that confidence is positively correlated with recall accuracy for correct identifications but is negatively correlated for false identification of distractors. Here we present a model that accounts for this paradox. We present a statistical explanation and an implementation inspired by signal detection theory and sensory psychophysics to show that the presence of negative correlations is expected when categorizing the data according to properties only available to the experimenter. Our analysis shows that confidence reports in a memory task have all the expected signatures of confidence based on the statistical definition of confidence: the probability of a choice being correct given the evidence available to the subject. The observed confidence reports across the population suggest that individual subjects share a common discriminability measure across an abstract ensemble of stimuli that cannot be mapped on an intuitive metric. In conclusion, our analysis shows that a simple model inspired by perceptual psychophysics can explain confidence reports in memory without the need of heuristics or dual process models.

EXECUTIVE PROCESSES: Working memory

F60

PRIORITY MEDIATES THE PRECISION OF MEMORY-GUIDED ACTIONS Zuzanna Klyszejko[1], Sarah Cook[1], Clayton E. Curtis[1,2]; [1]Psychology Department, New York University, New York, NY, [2]Center for Neural Science, New York University, New York, NY — Recently, we demonstrated that the spatial priority of items determined the precision of working memory using psychophysical discrimination (Klyszejko, Rahmati, Curtis, 2014). Here, we attempt to generalize these findings by testing if the precision of memory-guided saccades is also determined by spatial priority. To test our hypothesis, we used endogenous cues to indicate target priorities, which were operationalized as the probability (0%, 10%, 20%, or 60%) with which each of four briefly presented targets will be the goal of a later memory-guided saccade. We hypothesized that priority would linearly affect the precision and latency of memory-guided saccades. Consistent with our hypothesis, we found that 1) saccadic reaction times decreased with increasing priority, and 2) the precision of memory-guided saccades increased with increasing priority. Importantly, these data extend our previous findings and show that priority determines the precision of memory-guided motor actions and does not depend on the manner in which memory is tested (i.e., discrimination vs. motor estimation). Thus, priority may sculpt the distribution of attention weights that determines the quality with which items in working memory are encoded and/or maintained.

F61

NOREPINEPHRINE ALPHA-2A RECEPTOR ACTIVATION INCREASES FRONTO-PARIETAL FUNCTIONAL CONNECTIVITY DURING WORKING MEMORY Andrew Breeden[1], Charles Lynch[1], Peter Turkeltaub[1], Chandan Vaidya[1]; [1]Georgetown University — Working memory is accompanied by precise interactions within a network of frontal and parietal regions. Although norepinephrine (NE) release increases working memory performance, it is unknown if it does so by regulating the functional connectivity of this fronto-parietal network. We hypothesized that administering a NE alpha-2a receptor agonist, guanfacine, would strengthen the fronto-parietal network during working memory. Characterizing NE's network impacts would inform neural models of working memory, and improve understanding of noradrenergic medications commonly prescribed for attentional and executive function problems. 17 healthy adults participated in two fMRI scanning visits, once receiving guanfacine and once placebo. The order of visits was counter-balanced and double-blind. After medication dosing, participants were scanned using fMRI during an N-Back working memory task. fMRI images were realigned, normalized, and smoothed. To define a fronto-parietal network, functional connectivity was computed between a left dorsolateral PFC (dlPFC) seed region and every voxel in the brain. Motion, white matter and CSF activity, and N-Back loads were regressed out. Fronto-parietal network maps were compared on drug vs. placebo visits with paired t-tests. Guanfacine increased functional connectivity between the dlPFC and bilateral parietal regions, as well as the left cerebellum ($p < .005$, $k = 10$). Furthermore, increases in dlPFC-parietal functional connectivity were significantly correlated with improvements in working memory accuracy ($r=.59$, $p < .05$). NE alpha-2a receptor activation contributed to fronto-parietal network strength in a behaviorally relevant manner. This suggests that NE may play an important role in regulating large-scale networks in the service of working memory.

F62

RESTING-STATE SIGNATURES OF DOMAIN AND DEMAND-SPECIFIC WORKING MEMORY PERFORMANCE Jeffery Durbin[1], Wessel van Dam[2], Scott Decker[2], Jennifer Vendemia[2], Rutvik Desai[2]; [1]University of Kansas, [2]University of South Carolina — Working memory (WM) represents a key component of higher-level cognition, with its multidimensional and multimodal nature illustrating the complex system of receiving, retaining, and manipulating information across modalities. The present study examined patterns of neural activity in the subjects' resting state as they relate to offline measures of working and short-term memory (STM). Participants (n =

18) completed two segments: first, resting-state functional MRI data were collected; and second, behavioral measures of verbal and visuospatial WM and STM were collected irrespective of the scanning session. Fractional amplitude of low-frequency fluctuations (fALFFs) were calculated from the resting-state fMRI data and a seed-based analysis was conducted to identify functional connectivity between frontal and parietal lobes. Correlational analyses between whole-brain fALFF values and the off-line behavioral measures indicate that the fALFF values in the fronto-parietal network positively correlated with a multimodal WM measure. Additionally, fALFF values within the right angular gyrus and left middle occipital gyrus were significantly correlated with STM performance whereas fALFF values within the right intraparietal sulcus and left dorsomedial cerebellar cortex were significantly correlated with WM performance. Finally, modality-specific WM performance showed dissociable patterns of functional connectivity such that verbal WM measures were correlated with the left fronto-parietal seed connectivity ($p = 0.52$, $p = 0.013$) and visuospatial WM measures were correlated with the right fronto-parietal seed connectivity ($p = 0.47$, $p = 0.024$). These findings contribute to the growing literature surrounding low-frequency fluctuations in the resting state brain and their relationship with differences in cognitive performance.

F63

EARLY BLINDNESS IMPACTS ON THE SPATIAL ORGANIZATION OF VERBAL WORKING MEMORY

Roberto Bottini[1], Stefania Mattioni[1], Olivier Collignon[1]; [1]Center for Mind/Brain Sciences, University of Trento — Several studies have suggested that serial order in working memory (WM) is grounded on space. For a list of ordered items held in WM, items at the beginning of the list are associated with the left side of space and items at the end of the list with the right side. Is visual experience instrumental in establishing this link between serial order in working memory and spatial processing? We tested early blind (EB), late blind (LB) and sighted individuals in an auditory WM task. Participants had to keep in mind an ordered sequence of 5 fruit and vegetable names while they did a classification task involving words that were or were not in the memorized list. Replicating previous studies, left-key responses were faster for early items in the list whereas later items facilitated right-key responses in sighted and LB individuals. In contrast, EB did not show any association between space and serial position. These results suggest that visual experience shapes the link between ordered items in WM and spatial representations. We discuss the findings in relation to previous studies investigating how visual deprivation influence the way spatial representations are used to ground non-spatial concepts such as time, order and magnitude (Bottini et al. 2015, Space and time in sighted and blind, Cognition; Crollen et al. 2013, Embodied numbers: Early vision drives the reference frame used for the spatial representation of numbers, Cortex; Ginsburg et al. 2014, The impact of verbal working memory on number-space associations, JEP:LMC)

F64

LANGUAGE DEFICITS INDUCED BY TOPIRAMATE (TPM) ADMINISTRATION

Christopher Barkley[1], Angela Birnbaum[1], Mingzhou Ding[2], Serguei Pakhomov[1], Lynn Eberly[1], Susan Marino[1]; [1]University of Minnesota, [2]University of Florida — Many widely-prescribed drugs are associated with cognitive impairments. One such drug, TPM, often causes widespread speech/language problems. Here, we aim to characterize these deficits by testing the hypothesis that TPM selectively impairs verbal working memory. Twenty healthy adults were included in a randomized/double-blind/crossover study comparing the effects of TPM to placebo. One hour after drug administration, subjects' language abilities were assessed using a: (1) semantic-category/phonemic fluency (COWA) task, as well as (2) picture-description and (3) story-recall tasks. A single blood draw was taken post-testing, enabling examination of concentration-dependent performance effects. In nine subjects, EEG was recorded while subjects performed a modified Sternberg task in order to assess effects of TPM on working-memory. Results showed that after receiving TPM, participants recalled fewer words on the MCG ($p=0.02$), an effect negatively correlated with TPM-concentration levels ($p=0.002$). On the picture-description task, TPM administration increased disfluencies, and was positively correlated with concentration levels ($p=0.03$). The results of the COWA task showed TPM negatively affected generative fluency, but no correlations between performance and concentration were observed. Results from the Sternberg task showed that TPM increased RT ($p = 0.003$) and error rate ($p = 0.037$), and at the highest memory load, amplitude reductions of the left anterior negativity (300-800 msec. post-probe onset), a component typically associated with verbal working-memory processes. The data show that TPM disrupts language at lexical and discourse levels, disruptions that appear to arise from working-memory impairments. These results elucidate the nature of TPM-induced speech/language deficits and the neurobiology of language.

F65

THE EFFECT OF NATURAL VERSUS BUILT ENVIRONMENTS ON CHILD REVERSE DIGIT SPAN PERFORMANCE: A SPECTRAL ANALYSIS

Salif Mahamane[1], Alexis Porter[1], Allison Hancock[1], Justin Campbell[1], Nicholas J. A. Wan[1], Kerry E. Jordan[1]; [1]Utah State University — Typically healthy adults, and children with ADHD, show improved performance on the reverse digit span (RDS), a demanding test of working memory, after immersion in natural versus built environments. From an Attention Restoration Theory (ART) standpoint, these findings suggest that natural environments are cognitively restorative and improve attention and working memory. Cognitive neuroscience methodology is used here to go beyond these behavioral data and assess neural activity with RDS performance during immersion in different environments that theoretically correspond to differential degrees of attention restoration. Specifically, we hypothesized less alpha (8-12Hz) desynchrony when participants are in a natural environment than a built environment. We collected data using mobile electroencephalography while children (age 7 – 12 years) performed the RDS in natural and built environments using a two-way repeated-measures ANOVA design. Participants performed the RDS shortly after arrival at the environment (Time 1) and after an attention-to-environment immersive task (Time 2). Participants completed this procedure in both environments, counterbalanced for order. Current data show an increase in alpha desynchrony from RDS Time 1 to Time 2 in the built environment whereas in the natural environment, alpha desynchrony was comparatively stable from Time 1 to Time 2. These are among the first neural data to suggest an effect of attention restoration in natural versus built environments, and the first behavioral data comparing performance in these environments for typically healthy children.

F66

ELECTROPHYSIOLOGICAL CORRELATES OF VISUOSPATIAL WORKING MEMORY FOR SEQUENTIAL STIMULI INDEPENDENT OF SPATIAL CUEING

Peter Lynn[1,2], Scott Sponheim[2,1]; [1]University of Minnesota, [2]Minneapolis VA Medical Center — To date, electrophysiological correlates of visuospatial working memory (VWM) have been primarily investigated in spatial cueing paradigms featuring multiple stimulus arrays. We administered a delayed-response task to healthy participants as well as people with schizophrenia and their relatives. Two or three test stimuli were sequentially presented in one of 16 locations, after which a probe stimulus appeared; in half of the trials, one of these stimuli was an irrelevant "distractor" stimulus. Participants indicated whether the probe appeared in the location of a previous target stimulus. Using ERP analyses, we examined neural correlates of task manipulations during encoding and retrieval, as well as their relationship to behavioral performance. ERPs revealed encoding effects of stimulus type (e.g., relevance: target vs. distractor), order of stimulus presentation (e.g., progressive VWM load: first vs. second vs. third), and retrieval effects of probe location as modulated by both the stimulus type (probe at target location vs. probe at distractor location) and order of stimulus presentation (probe at first stimulus location vs. second stimulus location vs. third stimulus location) for the encoding stimulus whose position the probe occupied; effects were observed in both early visual components (P1 and N1) as well as later components (P3). Neural abnormalities in people with schizophrenia and their relatives were also observed. These results provide important insights into neural processes underlying visuospatial processing of serially presented stimuli independent of spatial cueing, the role of irrelevant stimuli in VWM, and how these processes differ in people with schizophrenia and their relatives.

F67

DISRUPTION OF DELAY-PERIOD ACTIVITY IN HUMAN FRONTAL EYE FIELDS CAUSES SYSTEMATIC IMPAIRMENTS IN SPATIAL COGNITION Wayne Mackey[1], Clayton Curtis[1]; [1]New York University — Persistent neural activity in the prefrontal cortex (PFC) has been implicated as the neural mechanism by which primates maintain information in working memory (WM) that is no longer readily observable in the environment but necessary for a subsequent behavioral response. During human neuroimaging experiments, this persistent activity has been routinely observed in the precentral sulcus (PCS), the putative homologue of the monkey frontal eye fields. The PCS has also recently been shown to contain a retinotopic map of space. Here, we combined computational neuroimaging and repetitive transcranial magnetic stimulation (rTMS) during a classic spatial WM task to test the assumption that this persistent neural activity observed in the PCS is responsible for WM maintenance. First, we used population receptive field mapping to identify our stimulation site in individual subjects. This method allows for a much more accurate localization of the retinotopic map in the PCS. We then measured subject performance on a memory-guided saccade task where a short burst of rTMS was applied during the task delay period. During this period the location is no longer visible but must be maintained in WM. Stimulation of the PCS caused slower response times and an increase in error in the contralateral visual field. Moreover, we used computational modeling to better describe the spatial distribution of systematic error caused by the perturbation. These results provide critical insights into the function of persistent neural activity in PFC, as well as the underlying coordinate system that spatial locations are coded in within the PCS.

F68

"IS TRANSCRANIAL DIRECT CURRENT STIMULATION EVEN DOING ANYTHING?": EFFECTS ON WORKING MEMORY PERFORMANCE AND BRAIN ACTIVITY SIMULTANEOUSLY MEASURED WITH OPTICAL NEUROIMAGING Nicholas Koleits[1], Nathan Rose[1], Ans Vercammen[1], Peter Goodin[1,2], Peter Rendell[1]; [1]Australian Catholic University, [2]Swinburne University of Technology — Transcranial direct current stimulation (tDCS) is being increasingly used in attempts to modulate brain activity and cognitive performance. However, the effects of tDCS on behavioural performance are inconsistent and the extent to which it modulates neural activity in brain areas other than motor cortex is unclear. To address this issue, we applied tDCS to the dorsolateral prefrontal cortex (DLPFC) of eighteen healthy, young adult participants during the performance of an N-Back working memory task while we simultaneously recorded their brain activity in the PFC with functional near-infrared spectroscopy (fNIRS) – an optical neuroimaging technique that is well suited for assessing the effects of electrical stimulation. Participants performed the N-Back task with a load of zero, one, two, or three letters during 20 minutes of active (2 mA) and sham (0 mA) tDCS conditions (counterbalanced across participants) with the anode and cathode electrodes positioned over the left and right DLPFC, respectively. There was no difference in task performance between active tDCS and sham conditions. There was a clear effect of N-Back load on the level of oxygenated hemoglobin, with increases detected in optodes over left and right anterior PFC in both active tDCS and sham conditions, but there were no differences in oxygenated hemoglobin concentrations between the active tDCS and sham stimulation conditions.

LANGUAGE: Development & aging

F69

AGE-RELATED DIFFERENCES IN COMPREHENDING UNFAMILIAR METAPHORS Yi-Ting Tsai[1], Chia-Lin Lee[1]; [1]National Taiwan University — This study assessed event-related potentials (ERPs) from 24 healthy older adults while they read literal and unfamiliar metaphorical usages of sentence-final action verbs, and judged, 800ms post verb onset, if a probe that was either literally related or unrelated to the verb was related to the sentential message. Unlike younger adults from our previous study that showed a larger N400 response followed by a late positive component (LPC) to unfamiliar metaphors relative to the literal condition, older adults as a group showed a negativity to unfamiliar metaphors only in a later and more restricted time window (450-550ms) and no LPC effect. These age-related brain response differences were accompanied by older adults' lower accuracy on the probe (literal and unfamiliar metaphor conditions: young: 86.6%, 94.6%; old: 80.7%; 72.2%), suggesting that older adults tend to interpret unfamiliar metaphors literally at the time when probes were presented. Despite these differences in online measures, older adults were quite accurate (94.3%) in a subsequent offline metaphor-paraphrasing task, suggesting that, given time, older adults could successfully obtain the figurative readings for unfamiliar metaphors. Further analysis showed that older adults' individual variations in brain responses could be accounted for by their verbal fluency scores in that older adults with higher verbal fluency elicited a sustained negativity to unfamiliar metaphors relative to the literal condition (450-750ms) and were more accurate in probe judgment following unfamiliar metaphors (77.3%). These results suggest that high-functioning older adults are better able to seek additional cognitive-neural resources to aid unfamiliar meaning interpretations.

F70

AGE-RELATED CHANGES IN INTEGRATIVE AND PREDICTIVE MECHANISMS DURING LANGUAGE COMPREHENSION Ya-Yi Wang[1,2], Pei-Shan Huang[1], Ovid J.-L. Tzeng[2,3], Hsu-Wen Huang[3]; [1]Academia Sinica, Taiwan, [2]Taipei Medical University, Taipei, Taiwan, [3]National Chiao Tung University, Taiwan — This study aimed to investigate age-related changes in using contexts during auditory sentence comprehension. Young and old participants listened to sentences completed by predicted and unpredicted (but plausible) words, and made a judgment according to the predictability of sentence-final word. Half of the sentence contexts were highly constraint. Effects were examined by measuring ERPs responding to the onset of ending words.Both age groups showed constraint main effect on N1,highly constraint sentences elicited enhanced N1 than low constraint sentences. There were no differences in the size, and timing for the two groups. Besides, predictability effect on N400 is observed in both groups-predicted words elicited smaller N400s than unpredicted words. The N400 effects were smaller and later for older adults. Moreover, richer information eases processing of predicted words for young adults but not older adults- predicted words embedded in highly constraint sentences elicited smaller N400 than that embedded in low constraint sentences. Similarly, young adults displayed a post-N400 frontal positivity for unpredicted wordsembedded in high constraint sentences, indicating the cost of mispredicting the word.And this effect did not found for older adults (as a group). Thus, although context provides top-down information that facilitates attention allocation, older adults seemed failed to effectively make use of context information to guide semantic processing.

F71

CHILDREN BORN PROFOUNDLY DEAF SHOW TYPICAL HEMISPHERIC ASYMMETRIES IN CEREBRAL BLOOD FLOW DURING LANGUAGE PRODUCTION Heather Payne[1,2], Eva Gutierez-Sigut[1], Bencie Woll[2], Mairead MacSweeney[1,2]; [1]Institute of Cognitive Neuroscience, University College London, [2]ESRC Deafness, Cognition & Language Research Centre, University College London — Most adults show left lateralization for speech production (Price, 2012). Developmental research suggests that asymmetries in early auditory areas, linked to the low-level acoustic properties of speech, may be a precursor to left-lateralized language processes later in development (Minagawa-Kawai et al.,2011). Children born deaf, regardless of amplification, will inevitably experience a drastically different spoken language input to hearing children. Assessing hemispheric dominance in deaf children therefore allows us to test the relevance of auditory experience on language lateralization. Measuring neural activity in deaf children has been difficult to date due to incompatibility between imaging techniques and cochlear implants. Here we use functional transcranial Doppler sonography (fTCD) which is a safe and cost-effective way of assessing gross differences in hemispheric activity during cognitive tasks (Deppe et al.,2004). We measured changes in cerebral blood flow velocity in the middle cerebral arteries in 21 school-aged children (mean age 7 years 9 months) born severely or profoundly deaf (>70dB loss in better ear) whist they described an animated story (Bishop et al., 2009). At the group level, significant left lateralization during expressive language was observed (mean lateralization index=2.2 , sd=3.3; t(20)=3.06, p=.006). A comparable

proportion of children were left (78%), right (16%), and low (6%) lateralized as has been reported in studies of hearing children of a similar age (Groen et al.,2012). We discuss the relationship between strength of lateralization and behavioural performance. This study is a first step in attempting to measure neurobiological processes involved in language production in this understudied paediatric population.

F72

T-COMPLEX MEASURES IN BILINGUAL SPANISH-ENGLISH AND TURKISH-GERMAN CHILDREN AND MONOLINGUAL PEERS

Tanja Rinker[1], Valerie Shafer[2], Markus Kiefer[3], Nancy Vidal[2], Yan H. Yu[4]; [1]University of Konstanz, Germany, [2]The Graduate Center, City University of New York, USA, [3]University of Ulm, Germany, [4]St. John's University, New York, USA — Lateral temporal measures of the auditory evoked potential (AEP) including the T-complex (positive Ta and negative Tb) as well as an earlier negative peak (Na) index maturation of auditory/speech processing. They have also been shown to be sensitive to language experience in adults. Neural responses to a vowel sound at temporal sites in Spanish-English bilingual and English monolingual children and Turkish-German bilingual and German monolingual children were measured. The goal was to determine whether obligatory AEPs at temporal sites were modulated by language experience (monolingual versus bilingual) as well as the amount and quality of the language experience. Event-related potentials (ERPs) were recorded at left and right temporal sites to a 250-ms vowel [ɛ] from 20 monolingual (American)-English and 18 Spanish-English children and from 11 Turkish-German and 13 monolingual German children. Language background information and standardized verbal and non-verbal test scores were obtained for the children. The results revealed differences in temporal AEPs (Na and Ta of the T-complex) between monolingual and bilingual children. Specifically, bilingual children showed smaller and/or later peak amplitudes than the monolingual groups. Ta-amplitude distinguished monolingual and bilingual children best in both the German/Turkish-German and the English/Spanish-English groups at right sites. Amount of experience and type of experience with the target language (English and German) influenced processing. The finding of reduced amplitudes at the Ta latency for bilingual compared to monolingual children suggests that language specific experience, and not simply maturation factors, influences development of the neural processes underlying the Ta AEP.

F73

NEURAL FUNCTIONS MEDIATING WORD RETRIEVAL IN AGING

Ranjini Mohan[1], Christine Weber[1]; [1]Purdue University — Word retrieval difficulties are one of the most frustrating of memory problems in older adults. Poorer access to phonological representation of the target word has been postulated as the underlying deficit, supported by findings of improvement in word retrieval after phonological priming (Burke, MacKay, & James, 2000). The present study examines the underlying neurophysiological mechanisms of phonological priming and word retrieval in adults across the lifespan. Young (20-35 years), middle-aged (40-55 years) and older (60-75 years) adults viewed pictures that were preceded by pseudo words (prime) whose onset either matched or did not match the picture's name. Half of the pictures were low frequency words. Participants used a button press to make phonological judgments about the prime and picture's name. Behavioral and electrophysiological correlates of phonological priming and word retrieval were recorded. RTs of each group were shorter for phonologically primed pictures. Young adults were faster than both other groups for retrieval of high and low frequency words. Middle-aged adults were faster than older adults for the high, but not low, frequency words. The effect of phonological priming on the N400 elicited by high and low frequency pictures was greater over the right hemisphere for young adults. ERPs of the middle-aged and older adults did not display a priming effect until after 500ms. Thus, phonological priming benefited all ages, however priming effects were delayed in middle-aged and older adults. Poorer access to phonological representation associated with word retrieval, especially for low frequency words, may begin as early as middle age.

F74

DEVELOPMENT OF THE NEURAL ORGANIZATION UNDERLYING NON-WORD REPETITION

Carlo de los Angeles[1], Zhenghan Qi[1], Calvin Goetz[1], Michelle Han[1], Irina Ostrovskaya[1], Adrianne Harrison[2], Kelly Halverson[1], Tyler K. Perrachione[2], Helen Tager-Flusberg[2], Kenneth Wexler[1], John D. E. Gabrieli[1]; [1]Massachusetts Institute of Technology, [2]Boston University — Accurate repetition of nonwords involves coordination of systems of speech perception, speech production and phonological working memory. Nonword repetition performance correlated with children's phonological and grammatical development (Botting et al, 2011). In this study, we investigated the relation between age and the ability to repeat nonwords of varying syllable lengths (2-5 syllable) during a functional magnetic resonance imaging (fMRI) scan. The subjects were divided into three groups: younger children (n=29, 19 males, age range 5.8-9.6), older children (n=30, 14 males, age range 9.6-18) and adults (n=23, 13 males, 18-34). The groups did not differ significantly in gender ($\chi 2 = 2.13$, $p = 0.34$), non-verbal IQ ($F=2.07$, $p = 0.132$), or number of motion outliers ($F=1.703$, $p=.189$). Our findings show that although behaviorally the older children achieve the same accuracy as the adult group, there exist neurological differences within the speech network and the premotor cortex for the task over baseline contrast. The locations of these changes are in the same areas that differ between the younger and older children. The older children also had increased basal ganglia activation over the young children, with no significant homologous difference between adults and older children. Under parametric load conditions, the older children and the adults shared a superior temporal lobe activation that was absent in the younger children. This data suggests further neurological development beyond achieving behavioral success exists during the nonword repetition task.

F75

EARLY PARENTAL LANGUAGE INPUT QUALITY, BUT NOT QUANTITY, PREDICTS CORTICAL THICKNESS AT CHILD AGE 7-9

Ozlem Ece Demir-Lira[1], Meredith L. Rowe[2], Susan C. Levine[1], Susan Goldin-Meadow[1], Steven L. Small[3]; [1]The University of Chicago, [2]Harvard University, [3]University of California, Irvine — Early parental language input quantity and quality strongly predict children's later language development. Among different measures of input quality, parents' decontextualized utterances about abstract topics removed from the here-and-now uniquely predict children's vocabulary outcomes, stronger than parental background factors and overall parental input quantity. Little is known about relations between early parental input and the neurobiology of language. In the current longitudinal study, we assessed parental language input quantity and quality during naturalistic parent-child interactions of 18 dyads at child age 30 months. We acquired structural scans from children at child age 7-9 years. Using Freesurfer, we quantified cortical thickness in 7 regions of interest that have been shown to play a role in vocabulary processing: left inferior frontal gyrus (opercularis and triangularis), middle frontal gyrus, supramarginal gyrus, angular gyrus, superior temporal sulcus and middle temporal gyrus. Results showed that our measure of input quality, parental decontextualized language input, but not parental socioeconomic status or overall parental input quantity, significantly predicted cortical thickness in left inferior frontal gyrus (opercularis). These results provide the basis for our current work examining relations of parental input quantity and quality to white matter connectivity and developmental changes in gray matter structure and white matter connectivity. Overall, our results add to the existing literature examining the role of experience in shaping the neurobiology of language, and highlight the specific role of early home environment.

LANGUAGE: Lexicon

F76

THE MODULATION OF PERSONALITY ON CHINESE EMOTION WORD PROCESSING: AN ERP STUDY

Li-Chuan Ku[1], Shiao-hui Chan[1]; [1]National Taiwan Normal University — Eysenck's (1947) personality model proposed that individuals of extraversion and neuroticism have different sensibility to emotional stimuli. However, it remains unclear whether such observations can be further influenced by lexical categories of emotion words--a classification system widely adopted in linguistics. The present

ERP study thus examined whether personality traits, particularly extraversion and neuroticism, would affect the processing of Chinese two-word compounds in various lexical categories under a lexical decision task. We manipulated emotional valence (positive/neutral/negative) and lexical category (stative verbs (e.g. ashamed)/eventive verbs (e.g. deceive)/nouns (e.g. murderer)) of the stimuli. Thirty-five native Chinese speakers (Mean age=26) were divided into high vs. low extraversion and neuroticism according to their scores in the revised Eysenck personality questionnaire. To test personality effects, we conducted separate ANOVAs on the ERP data for subjects' extraversion and neuroticism. Consistent with previous literature, our results showed emotion effects in the P2, N400, and LPC amplitudes. However, we did not find connections between extraversion and the processing of emotional valence, as suggested in Eysenck's personality model. We did, however, find modulations of neuroticism on the emotion effects in N400 and LPC. Interestingly, the neuroticism modulation was also pronounced in processing stative verbs, with earlier onsets of N400 and larger mean amplitudes of LPC, indicating neurotics' sensitivity to emotion words in this lexical category. Since stative verbs are semantically less complex than eventive ones, we argued that neurotics' sensitivity to stative verbs might be due to their easier/more direct access to the core emotion concepts denoted by such verbs.

F77

RELATIONALITY IN LEFT ANGULAR GYRUS: EVIDENCE FROM MEG

Adina Williams[1], Liina Pylkkanen[1,2]; [1]New York University, Department of Linguistics, [2]New York University, Department of Psychology — The left inferior parietal cortex has been implicated for broad semantic functions such as heteromodal conceptual processing (Bonner et al., 2013), semantic integration (Lau et al., 2008) and conceptual combination (Price et al., 2015), but its precise role in semantic cognition remains elusive. More specific hypotheses have proposed it as relevant for representing event concepts (Binder & Desai, 2011), encoding relations (Boylan et al., 2014) and processing argument structure (Thompson et al., 2007). We pitted the integration hypothesis against the eventivity and relationality accounts by varying target nouns' eventivity and relationality, while presenting them in isolation and in two combinatory contexts. High relational eventive nouns described events with two participants ('murder') while low relational events had one participant ('yawn'). High relational non-events described relations between entities ('mother') whereas low relational non-events were non-relational objects ('chair'). A consonant string (e.g. 'xhlpft'), an adjective ('cute'), or a possessor (e.g. 'director's') preceded each noun. MEG source activity localized in the left inferior parietal cortex was analyzed using cluster-based permutation tests. A 2x2x3 ANOVA showed a significant main effect of relationality (high>low) in a spatio-temporal cluster 170-260ms after target noun presentation. Relational nouns elicited similarly increased amplitudes compared to non-relational nouns in isolation (murder > yawn & height > chair) and across eventivity-type and combinatory context. No evidence was found for a sensitivity in this region to eventivity or combinatory context. Thus, we found that the presence of potential relations encoded in a noun's meaning drives activity in the left inferior parietal cortex.

F78

ELABORATIVE FEEDBACK: ENGAGING THE VENTROMEDIAL PREFRONTAL CORTEX AND TASK-RELEVANT REGIONS PROMOTES LEARNING IN NONWORD READING ALOUD

Samantha R. Mattheiss[1], Edward J. Alexander[2], William W. Graves[1]; [1]Rutgers University - Newark, [2]Tufts University — The goal of this study was to determine the neural basis by which elaborative feedback (EF) may be more helpful than other types of feedback in learning orthography-phonology (spelling-sound) mappings for novel letter strings. EF (e.g. "Great, you blended po-tep."), was compared to Simple Feedback (SF; e.g. "Great, you got it correct."), and to Content Feedback (CF; "It's best to blend po-tep."), all of which were provided on correct trials. In fMRI, EF was expected to activate neural regions implicated in self-processing, reward, and orthography-phonology conversion. Our predictions were mainly supported. EF compared to SF and CF resulted in the highest accuracy; compared to CF, EF activated the ventromedial prefrontal cortex (vmPFC), implicated in reward as well as self-referential processing; and compared to SF, EF activated the posterior middle and superior temporal and supramarginal gyri— regions implicated in orthography-phonology conversion and found to be underactive in individuals with dyslexia—and the left fusiform/visual word form area—implicated in orthographic processing. Contrary to our predictions, SF, but not EF, activated the ventral striatum, yet resulted in the lowest accuracy. This suggests the enhanced effectiveness of EF may be due to concurrent activation of reward-related (vmPFC) and task-relevant regions. Thus, receiving elaborative feedback upon correctly applying a skill may not only promote learning, but may also enhance an association between the self, reward, and a target skill or behavior, thereby increasing application of the skill in the future.

F79

CONTEXTUAL MODULATION OF HIPPOCAMPAL ACTIVITY DURING PICTURE NAMING

F.-Xavier Alario[2,3], Anaïs Llorens[1,2,3], Anne-Sophie Dubarry[1,2,3], Patrick Chauvel[1,3,4], Catherine Liégeois-Chauvel[1,3]; [1]INSERM, UMR1106, Marseille, France, [2]CNRS, UMR7290, LPC, Marseille, France, [3]Aix-Marseille Université, Marseille, France, [4]AP-HM, Neurophysiologie Clinique, Marseille, France — Picture naming is a standard task used to probe language processes in healthy and impaired speakers. Picture naming recruits a broad neural network of language related areas, among which hippocampus is typically not included. Indeed, hippocampus is not frequently associated with word production deficits, and its activation is rarely reported in imaging data of word production. However, hippocampus can be expected to play a role during picture naming, subtending for example implicit learning of the links between pictured objects and their names. To test this hypothesis, we probed hippocampal activity during plain picture naming, without any memorization requirement; we further assessed whether this activity was modulated by contextual factors such as repetition priming and semantic interference. The data were recorded from intracerebral electrodes that had been directly implanted for clinical diagnosis in the hippocampi of six epileptic patients. The electrophysiological responses revealed a specific and reliable pattern of activity that was markedly modulated by repetition priming and semantic context. These results indicate that hippocampus is recruited during picture naming, presumably in relation to implicit learning, with contextual factors promoting differential hippocampal processes, possibly subtended by different sub-circuitries.

F80

MIXED METAPHORS: ERP RESPONSES TO ABSTRACT AND CONCRETE PREPOSITIONAL PHRASES

Emily Zane[1,2], Valerie Shafer[1]; [1]CUNY Graduate Center, [2]Emerson College — It has been postulated that concrete and abstract senses of a preposition are interconnected, so that each preposition has a central spatial sense, which is chained to multiple tertiary, related senses. In this account, abstract uses of prepositions are not idiomatic, but are instead cognitively associated with spatial concepts through metaphor (e.g., Lakoff, 1990). To compare the processing of abstract and concrete prepositional phrases, event-related potentials (ERPs) were used to examine the processing of reference nouns in concrete and abstract phrases headed by "in" or "on". ERPs were recorded from 28 adult participants using a 128-channel Geodesic net as they read prepositional phrases. In the phrases, nouns either matched or did not match the preceding preposition (e.g., "in the bowl/plate" and "in the wrong/mend"). ERPs were time-locked to the onset of the noun. Results indicate that while spatially unexpected concrete nouns (e.g., "in the plate") elicit a significant centro-parietal N400 response, unexpected abstract nouns (e.g., "in the mend") yield a relative, late positivity in central sites from 700ms post-noun onset to the end of the epoch. This suggests that inappropriate concrete nouns are semantically unexpected (leading to N400 effects), while mismatched abstract nouns require phrase reanalysis and/or reconstruction (leading to P600 effects). These findings cast doubt on accounts of polysemy that claim that abstract uses of prepositions are cognitively and metaphorically linked to a preposition's spatial sense, and instead suggest that abstract uses of prepositions are idiomatic and are stored in the lexicon as phrasal units.

F81

AN ELECTROPHYSIOLOGICAL STUDY OF INITIAL AMERICAN SIGN LANGUAGE ACQUISITION IN ADULT LEARNERS

Megan Mott[1], Karen Emmorey[1], Gabriela Meade[1,2], Sara Campbell[1], Phillip J Holcomb[1], Katherine J Midgely[1]; [1]San Diego State University, [2]University of California, San Diego — Previous research on second-language learning indicates changes in event-re-

lated potentials (ERPs) to L2 words, most notably an increase in amplitude of the N400 as learning occurs. The present study examined the earliest stages of learning American Sign Language (ASL), a visually dynamic language with no written form. ERPs were recorded from 32 scalp sites in college-age English-speaking monolinguals with no prior knowledge of ASL as they watched short individual video clips of a native signer producing 160 ASL signs. In a laboratory setting, participants then learned the English translations of 80 of the 160 signs via a series of associative learning protocols. Each of the learned English/ASL pairs was presented a total of five times during the learning protocols, and participants were instructed to avoid ASL outside of the lab in between experimental sessions. Post learning, ERPs were recorded as participants watched all 160 ASL clips (learned and unlearned), performing a go/no-go semantic categorization task. Pre-learning, there were no ERP differences between the 80 signs that were in the to-be-learned group and the 80 signs in the unlearned group. However, post-learning there were clear ERP differences between learned and unlearned signs, with increased negativity for the learned signs. These effects were similar in polarity and latency to those seen in previous studies of spoken and written language learning. Overall, these results suggest that comparable mechanisms underlie the formation of lexico-semantic representations for signed and spoken language learning.

LANGUAGE: Other

F82

THE EFFECT OF LEARNING TO READ ON THE NEURAL SYSTEMS FOR VISION AND LANGUAGE: A LONGITUDINAL APPROACH WITH ILLITERATE PARTICIPANTS

Falk Huettig[1], Uttam Kumar[2], Ramesh Mishra[3], Viveka Nand Tripathi[4], Anupam Guleria[2], Jay Prakash Singh[4], Frank Eisner[5]; [1]Max Planck Institute for Psycholinguistics Nijmegen, [2]Centre of Biomedical Research Lucknow, [3]University of Hyderabad, [4]University of Allahabad, [5]Radboud University Nijmegen — How do human cultural inventions such as reading result in neural re-organization? In this first longitudinal study with young completely illiterate adult participants, we measured brain responses to speech, text, and other categories of visual stimuli with fMRI before and after a group of illiterate participants in India completed a literacy training program in which they learned to read and write Devanagari script. A literate and an illiterate no-training control group were matched to the training group in terms of socioeconomic background and were recruited from the same societal community in two villages near Lucknow, India. This design permitted investigating effects of literacy cross-sectionally across groups before training (N=86) as well as longitudinally (training group N=25). The two analysis approaches yielded converging results: Literacy was associated with enhanced left-lateralized responses to written text along the ventral stream, dorsal stream, (pre-) motor systems and thalamus. These effects corroborate and extend previous findings from cross-sectional studies. However, effects of literacy were specific to written text and to false fonts. Contrary to previous research, we found no direct evidence of literacy affecting the processing of other types of visual stimuli such as faces, tools, houses, and checkerboards (cf. Dehaene et al., 2010, Science). Furthermore, we did not find any evidence for effects of literacy on responses in the auditory cortex in our Hindi-speaking participants. The latter result in particular raises questions about the extent to which phonological representations in the auditory cortex are altered by literacy acquisition or recruited online during reading.

F83

HIPPOCAMPAL DECLARATIVE MEMORY SUPPORTS LANGUAGE AND GESTURE PRODUCTION

Caitlin Hilliard[1], Susan Wagner Cook[1], Melissa Duff[1]; [1]University of Iowa — The spontaneous hand gestures that accompany spoken language affect communication, learning, and memory. Despite substantial behavioral evidence demonstrating this, the cognitive and neural mechanisms underlying gesture production remain unknown. Because the forms of gestures reflect the concept or idea being communicated, we hypothesized that gesture may directly reflect activation of information in memory, particularly hippocampally-supported memory. We examined the speech and gesture of patients with hippocampal amnesia and healthy comparison participants. Patients with bilateral hippocampal damage and severe declarative memory impairment provide a rare opportunity to examine whether degraded memory representations influence online gesture and speech production. We calculated the gesture rate (gestures/word) for speech and gesture produced during four discourse tasks in which patients talked about past personal (e.g., frightening experience) and habitual events (e.g., sandwich making). We coded spoken words for standard measures including frequency, familiarity, imageability, and length. We analyzed data using mixed effects models with a fixed effect of patient status and random intercepts for task and participant. Patients with hippocampal amnesia gestured at a lower rate than healthy comparisons (β=0.56,t=2.41,p=.03). Additionally, patients produced words that were more frequent (β=-0.13,t=-1.82,p=.08), more familiar (β=0.004,t=2.05,p=.05), and shorter in letters (β=0.05,t=2.85,p=.01) than those of comparisons. Although amnesic patients produced as much speech as comparison participants, the richness of their communication was impoverished; they produced fewer gestures and used more frequent and familiar words when communicating events from their memory. This suggests that activation of rich mental representations via the hippocampus is one mechanism of gesture production.

F84

THE IMPACT OF EURHYTHMIC STRUCTURES ON SPEECH PROCESSING: ERPS ATTEST TO EFFECTS ON SENSORY MEMORY

Victor J. Boucher[1], Annie C. Gilbert[2], Boutheina Jemel[1]; [1]Université de Montréal, [2]McGill University — Our work on speech segmentation has shown that listeners attend to marks of temporal groups in meaningful utterances or nonsense syllables (Gilbert et al, 2014, 2015). These marks are the same as those of chunking patterns that arise spontaneously in list recall, which suggest a link with processes of short-term memory. It has also been reported that speakers tend to produce eurhythmic temporal chunks in utterances (Martin 1987). One wonders if these patterns are idiosyncratic or if they reflect a general "perceptual chunking" associated with immediate memory. In exploring the latter possibility, we hypothesized that heard regular (eurythmic) groups in sequences of syllables would benefit a sensory memory of sounds as opposed series with irregular groups or no groups. EEG responses of 18 participants were monitored while they listened to series of 12 non-sense syllables containing regular 3-syllable groups, irregular 2- to 4-syllable groups, and no groups. Each sequence was followed by a target syllable which participants had to identify as present or absent in the sequence. The ERPs to target syllables showed effects of groups on the amplitude of the P300, a component that indexes the load on sensory memory (with rising amplitudes reflecting increase load). Targets presented in groupless stimuli show the largest P300 amplitudes, whereas targets presented in eurhythmic conditions show the smallest P300 amplitudes. The results demonstrate that perception of temporal groups links to sensory memory, and the fact that regular groups ease memory load may explain the tendency of eurythmic patterns in speech.

F85

THE NEURAL CORRELATES OF TEXT COMPREHENSION PROCESSES FOR BILINGUALS: AN EVENT-RELATED POTENTIALS (ERPS) INVESTIGATION.

Chin Lung Yang[1], Charles A. Perfetti[2], Jiang Ying[3]; [1]Chinese University of Hong Kong, [2]Learning, Research and Development Center, University of Pittsburgh, [3]City University of Hong Kong — We conducted a EPRs study to examine the proficiency effect on the bilingual processing of text comprehension. Four-eight English as the second language learners (L2/ESL: high vs. low proficiency, 24 each), read two-sentences passages in English where the "referent-matching" relation of the target word ("The explosion.."), to the text matches with the three levels of text representation[1]: A surface-level match as in "…exploded... The explosion…"; a textbase match as in "…blew up... The explosion…"; and a situation-model match as in "…bomb…dropped. The explosion…". Additionally, a non-sensible baseline "…bomb was stored safely… The explosion…" was used to compare the ease of integration processing among conditions. We analyzed the N400 (250-500ms post-target onset) and late positivity component (LPC, 500-700ms) to assess the proficiency effect on the semantic integration [2] and the mental-model construction processes [3,4] respectively. The results indicate robust proficiency effect when processing textbase match: the amplitude of both N400 and LPC was reduced for high-proficient L2/ESL while enhanced for low-proficient L2/ESL. No reliable proficiency effect was observed when integrating the target word with the text relied

on a surface-match and a demanding conceptual processing (i.e., inference-drawing when processing the situation match): both groups showed reduced N400 while enhanced LPC effect. The results, overall, underline the importance of the L2 semantic/conceptual processing in modulating the ease of both meaning integration and mental-model construction processes during L2 text comprehension; and also suggest the high resource constraints in bilinguals' mental-model construction processes due to their non-native lexico-semantic processing (as compared to monolinguals [3,5]).

F86

THE ROLE OF LANGUAGE PRODUCTION DURING PREDICTION IN LANGUAGE COMPREHENSION

Cristina Baus[1], Anne-Sophie Dubarry[1,2], F-Xavier Alario[1]; [1]Aix-Marseille Université, CNRS, (France), [2]INSERM (France) — This work investigated how language production modulates prediction of upcoming utterances in language comprehension. Specifically, we asked whether involving language production in a task alters the neural correlates associated to prediction in language comprehension. To do so, listeners were tested in two blocks, one involving uniquely listening trials and the other involving both speaking and listening trials. We compared the electroencephalographic (EEG) activity elicited by those listening trials in the two blocks. As an index of word predictability, we manipulated color knowledge, thus having words with highly associated colors (lemon) and words with less associated colors (umbrella). Participants were presented with a visual prime word (lemon) followed by the auditory presentation of a target color-name that was either congruent (yellow) or incongruent (blue) with the word's associated color. Activity time-locked to the target revealed the classical N400, with larger negativities for incongruent color-names than for congruent color-names. In contrast, no difference was observed between the listening trials in the two blocks. Interestingly, activities time-locked to the prime (visual word) revealed a clear effect of block: starting at 300 ms, listening trials in the listening block elicited a larger negativity than in the listening/speaking block. More importantly, differences between more predictive (lemon) and less predictive words (umbrella) in terms of their color arose in the same time-window but only in the speaking/listening block. Altogether, these results suggest that language production modulates prediction of upcoming events but not their integration during comprehension.

F87

ALEXIA WITH AGRAPHIA OF KANJI WITH PRESERVED JUKUJI-KUN READING IN A PATIENT WITH SUBCORTICAL HEMORRHAGE IN THE LEFT POSTERIOR MIDDLE TEMPORAL AND ANGULAR GYRI

Mizuho Yoshida[1], Toshihiro Hayashi[1], Shoji Tsuji[1], Yasuhisa Sakurai[2]; [1]The University of Tokyo, [2]Mitsui Memorial Hospital — Non-aphasic alexia with agraphia for kanji (Japanese morphogram) are attributed to the left posterior inferior temporal area or angular gyrus. As for reading of kanji, patients are predominantly impaired in on-reading, which conveys phonetic value, rather than kun-reading, which conveys semantic value. Jukuji-kun-reading of kanji words, whose reading is highly irregular and their meaning could not derive from each kanji character, is severely impaired in most patients. A 66 year-old patient with subcortical hemorrhage in the left posterior middle temporal and angular gyri presented with mild anomia and alexia with agraphia. Her general intelligence was preserved (WAIS-III TIQ 102). Evaluation of aphasia showed mild anomia, mild impairment of repetition, and alexia with agraphia for kanji. Reading of kana (Japanese syllabogram), tested with three-character words and non-words, was preserved. In contrast, reading of kanji, tested with two-character kanji words (three moras), was impaired (78 %). Writing of single-character kanji was impaired (29%), whereas writing of the kana transcription of the kanji characters was preserved (100%). Further evaluation of two-character kanji words reading revealed that on-reading was impaired (58%), whereas kun-reading was relatively preserved (85%). Notably, jukuji-kun-reading was also preserved (82%). These results suggest that representation of visual forms of kanji words per se and its association with semantic values were preserved, whereas association of visual forms of kanji with their phonetic values was disconnected. Furthermore, correct reading of jukuji-kun-reading could be routed via semantic representation.

F88

LONGITUDINAL RESTING STATE FUNCTIONAL CONNECTIVITY PATTERNS IN THE EARLY PHASE OF RECOVERY FROM APHASIA IN TEMPOROPARIETAL STROKE

Julian Klingbeil[1], Anika Stockert[1], Max Wawrzyniak[1], Katrin Wrede[1], Dorothee Saur[1]; [1]University of Leipzig — Substantial language improvements can be observed within the first days after stroke. However, underlying changes in the functional status of the language network during the acute phase remain to be demonstrated. In a resting-state functional connectivity (RSFC) fMRI study we assessed changes in functional connectivity repeatedly (acute(t1)=2±1, subacute(t2)=10±2 days post-onset) in aphasic patients (N=12, 62±14 years, 10 male) with left temporoparietal stroke. Language comprehension and production scores were calculated based on the Aachener Aphasie-Test. For RSFC analysis 9mm spherical ROIs reflecting core language regions in the left anterior inferior frontal (aIFG: x=-54 y=32 z=1, MNI-space), posterior middle temporal gyrus (pMTG: x=-54 y=-43 z=4) and their right hemisphere homologous were selected. Seed-to-whole-brain analysis from left aIFG or pMTG revealed RSFC to right hemisphere homologous frontal or temporal areas at t1 and t2 ($p>.05$, FWE corrected). Longitudinally, RSFC from left pMTG to left aIFG as well as RSFC from left aIFG to left frontal (operculum, insula, premotor cortex) and to right frontal (IFG, premotor cortex) areas increased significantly from t1 to t2 ($p>.001$, uncorrected). Subsequent ROI-to-ROI analysis revealed increased RSFC between left aIFG and pMTG from t1 to t2 associated with improved language production ($r=.579$, $p=.049$). During the acute phase (t1) better scores for language comprehension and production were predicted by higher RSFC between left aIFG and right aIFG ($r=.736$ $p=.006$). To conclude, we observed early ipsi- and contralesional changes in the language network's functional connectivity and associated language improvements indicative of acute diaschisis and subsequent reorganization within the distributed language network.

F89

FUNCTIONAL CONNECTIVITY NETWORKS FOR WORD PROCESSING IN EARLY ENGLISH-SPANISH BILINGUALS

Edith Brignoni-Perez[1], Nasheed I. Jamal[1], Guinevere F. Eden[1]; [1]Georgetown University — Single-word reading relies on a left-lateralized network including occipito-temporal (OTC), temporo-parietal, and inferior frontal (IFG) cortices. The use of these regions is modulated based on the age of the reader (Martin et al., 2014), the nature of the writing system (Bolger et al., 2005), and the depth of the orthography (OD) (Paulesu et al., 2000). Specifically, languages that are shallow (i.e., letter-to-sound mapping is consistent, as in Italian, German, and Spanish) tend to rely more on the left posterior portion of the superior temporal gyrus (pSTG) (for grapheme-to-phoneme mapping), while languages with a deep orthography (e.g., French and English) rely relatively more on the OTC. Here we examined the functional connectivity (FC) of fMRI data among these brain regions in early English-Spanish bilingual adults during the processing of English and Spanish words. We wanted to test whether FC maps reflect the differences in OD for the languages with which they have a lifelong experience. We performed a left-hemisphere region of interest (ROI)-to-ROI analysis by connections intensity using CONN toolbox. We found FC between pSTG and IFG during Spanish, but not English, word processing ($p < 0.05$ FDR seed-level corrected). We did not find FC between the OTC (including the visual word form area, VWFA) and any other ROI while processing words in either English or Spanish. Our finding of FC between pSTG and IFG during Spanish word processing supports the idea that languages with a shallow orthography utilize the dorsal pathway for grapheme-to-phoneme mapping.

F90

ERP CORRELATES OF WHOLE-LANGUAGE AND ITEM-LEVEL COMPETITION IN BILINGUAL LANGUAGE PRODUCTION

Zofia Wodniecka[1,2], Jakub Szewczyk[1], Paweł Mandera[1,3], Patrycja Kałamała[1], Joanna Durlik[1]; [1]Jagiellonian University, [2]Penn State University, [3]Ghent University — The goal of the study was to explore global (whole-language) and local (item-related) sources of language competition in bilingual production. 71 native speakers of Polish (L1) who were learners of English (L2), first named a set of pictures in L1, then named a different set of pictures in L2, and in a third block, named pictures in L1. In the third block, half of the items were repeated from the L2 block and half were completely new. The par-

adigm allowed calculation of two indices: 1) item-related competition: a comparison between L1 naming of the item which was previously named in L2 vs. L1 naming of a new item; and 2) whole-language competition: a comparison between L1 naming of new items before vs. after a block of L2 naming. We observed costs related to both global and local types of competition: picture naming latencies were slower both after naming a block of unrelated items in L2 and after naming the same item in L2. However, both measures yielded different neural correlates. The global costs were accompanied by centrally distributed negativity in the 200-500ms time-window for L1 trials named after a block of L2 naming (relative to L1 trials named before the block of L2 naming). The item-related costs were associated with a more pronounced P300 effect, starting at 200, and lasting to the end of the recorded epoch. The results indicate that different neural mechanisms underlie resolution of global and local language competition.

F91

THE EFFECT OF SENTENCE COMPLEXITY ON THE RESOLUTION OF AMBIGUOUS PRONOUNS

Hossein Karimi[1], Tamara Swaab[1], Fernanda Ferreira[1]; [1]University of California at Davis — Discourse processing requires accessing information from preceding sentences and relating it to incoming information. One such process involves establishing pronominal reference. Previous research has demonstrated that pronominal ambiguity incurs a processing cost that is reflected as a sustained negative shift (Nref; e.g., van Berkum, Brown, & Hagoort, 1999; van Berkum, Brown, Hagoort, & Zwitserlood, 2003). In the present study, we examined whether and how complexity of the preceding sentence affects the resolution of ambiguous pronouns. Two competing hypotheses make differential predictions in this regard: On the one hand, complexity might make it harder to establish reference because the representations of the referents might be more difficult to retrieve from memory, producing a greater Nref magnitude. On the other hand, complexity might cause the comprehension system to adopt a "good□enough" processing strategy (Ferreira, Ferraro, & Bailey, 2002), where reference is not fully established, resulting in smaller Nref magnitude (under□specification). We manipulated complexity by adding a relative clause to each of the two potential referents in the complex condition (e.g., "The actor who was visibly upset walked away from the cameraman who was critical of the show") and adding no extra information to the potential referents in the non□complex condition (e.g., "The actor walked away from the cameraman"). Our results revealed that the Nref magnitude on the frontal electrodes was reliably greater in the non□complex condition compared with the complex condition, suggesting that a complex preceding sentence results in under□specification of the reference establishment, consistent with Good Enough language processing.

LANGUAGE: Semantic

F92

PREDICTING NEURAL REPRESENTATIONS OF CONCEPT MEANINGS IN CONTEXT

Jing Wang[1], Vladimir Cherkassky[1], Marcel Just[1]; [1]Carnegie Mellon University — Although individual concepts are the fundamental elements of thought, the complexity and generativity of human thoughts stems from the ability to combine simple concepts into propositions. We have developed a predictive theory that can characterize the neural representation of a large corpus of sentences, with sufficient accuracy to decode the content of a sentence that is entirely new to the model. Seven participants read 240 sentences, containing 242 content words, varying in topic, length and structure ("The old man threw the stone into the lake.") during functional magnetic resonance imaging (fMRI) scans. The semantic properties of each word concept can be mapped to its neural representation as it occurs in various sentence contexts. The semantic properties are 43 neurally plausible features that characterize many familiar concepts in various domains (e.g. shelter, social actions). The neural representation of a word is estimated by the percent signal change in a selected group of voxels, averaged over the images of all the sentences that contain the word. The learned mapping allows the prediction of the neural signature of any new word given its semantic features. The second level of the model combines the predicted neural representations of individual words to generate the predicted neural representation of a sentence containing the words. The model can generate predicted activation patterns for each of the 240 sentences while leaving out the fMRI data from that sentence from the model's training set, resulting in a mean prediction rank accuracy of 0.81 among the 240 alternatives across participants.

F93

A BRAIN NETWORK FOR NUMERICAL PROCESSING

Amy L. Daitch[1], Josef Parvizi[1]; [1]Stanford University, Department of Neurology — In every culture, arbitrary symbols are assigned specific meanings; for example numerals are associated with numerical quantities. We have recently identified a neuronal population within the human ventral temporal cortex (VTC) selective for visual numerals, compared to other morphologically similar stimuli ('Visual number area', or 'VNA'). In line with neuroimaging and primate electrophysiology work, we have also reported the involvement of human intraparietal sulcus (IPS) in more abstract numerical representations. In this study, we took advantage of the high temporal resolution of electrocorticography (ECoG) in human subjects to track the fast temporal dynamics within and between VTC and IPS, as subjects read and manipulated visual numerals across several tasks, ranging from simple recognition to more complicated arithmetic computations. We found that during active computations, VNA became engaged later than more posterior VTC regions that were responsive to, but less selective for, numerical stimuli. VNA, but not posterior VTC, was also selective for words with numerical content relative to phonologically similar words (e.g. 'seven' versus 'heaven'). Lastly, we found selective and unidirectional coupling from IPS to VNA, relative to other VTC regions, with the low frequency phase at IPS modulating high frequency activity at VNA. These results strongly suggest a recurrent mode of communication between the VNA and IPS during numerical processing.

F94

LANGUAGE, EVENTS, AND THE HIPPOCAMPUS: TYPES, TOKENS, AND TOKEN-STATES

Zachary Ekves[1], Pedro Paz-Alonso[2], Gerry Altmann[1]; [1]University of Connecticut, [2]Basque Center on Cognition, Brain, and Language — Language comprehension often refers to an object undergoing a change in state, which creates ambiguity when we refer back to this object, as the referent could be the object before or after the change ("the man chopped an onion. The onion…"). Previous studies have implicated the left posterior vetrolateral prefrontal cortex (pVLPFC) in selecting between possible object states for reference. We examined functional connectivity during sentence comprehension to investigate the neural correlates underlying the resolution of state ambiguity and the consequences of state change for the subsequent representation of new objects. The sentences in this experiment described substantial or minimal object change ("chop/weigh"), and then subsequently referred back to that changed object ("…the onion…") or to another instance of that object type ("…another onion…"). Data revealed greater connectivity between left pVLPFC and hippocampus when referring to new instances of substantially changed objects compared to the same substantially changed object. Additionally we observed increased connectivity between the hippocampus and angular gyrus when referring to new instances of an object, compared to referring to the same object, regardless of the amount of change. We suggest that this connectivity indicates suppression by the pVLPFC of previous, salient features during the instantiation of new objects in the hippocampus. Overall, the present results highlight the importance of the hippocampus in language processing and provide early indications of regions involved in the instantiation of object-state representations during processing, which we suggest act as representational primitives of events more generally.

PERCEPTION & ACTION: Other

F95

EMBODYING EMOTION IN NARRATIVE DISCOURSE: A FACIAL EMG STUDY ON SIMULATION VS. MORAL EVALUATION IN AFFECTIVE LANGUAGE PROCESSING

Bjorn 't Hart[1], Marijn Struiksma[1], Anton van Boxtel[2], Jos van Berkum[1]; [1]Utrecht University, [2]Tilburg University — Facial electromyography (fEMG) research has shown that activation and deactivation of the corrugator supercilii ('frowning muscle') reliably indexes negative and positive affect respectively. Furthermore, work on embodiment in language processing suggests such muscle activity is involved in conceptual simulation during language comprehension. This work has focused mainly

on simple words and sentences ('happy', 'John was happy'), which provide affectively valenced lexical concepts and situation models to be simulated, but not much else. In natural language use, however, people usually also affectively evaluate things. Importantly, corrugator activity involved in evaluation might be at odds with corrugator activity implicated in simulating the described concepts or events, e.g. when an immoral character enjoys something positive. To investigate the extent to which, in more complex situations, corrugator activity reflects simulation (lexical/situation model valence) and/or moral evaluation (reader appraisal), we asked participants to read 64 narratives that orthogonally manipulated valence at both levels. Reading about characters behaving in a morally laudable or objectionable fashion in the first half of the narrative immediately led to decreased or increased corrugator activity respectively. Critically, corrugator activity at subsequent events happening to these characters primarily patterned with moral desirability or 'justice' of the event (people frowned most when bad things happened to good people and when good things happened to bad people), while simultaneously showing a small effect of lexical/situation model valence. This suggests that neither language-driven simulation nor moral evaluation alone determines embodied fEMG activity, highlighting the importance of considering evaluative stance in research on embodied language processing.

F96

LANGUAGE COMPREHENSION DOES NOT REQUIRE PERCEPTUAL SIMULATIONS

Markus Ostarek[1,2], Adil Ishag[3], Falk Huettig[1,4]; [1]Max Planck Institute for Psycholinguistics, Nijmegen, The Netherlands, [2]International Max Planck Research School for Language Sciences, Nijmegen, The Netherlands, [3]University of Leipzig, Germany, [4]Donders Institute for Brain, Cognition, & Behavior, Nijmegen, The Netherlands — Zwaan and Yaxley (2002) found that participants activated information about the shapes of objects implied in sentences; they responded faster to pictures of objects matching rather than mismatching the implied shapes in a picture-sentence verification task. This has been widely interpreted as evidence for perceptual simulation. The present study was based on the following rationale: If visual simulations underlie the facilitation effect, interfering with visual processing should considerably reduce the effect. We used dynamic Mondrian-type masks that interfere strongly with basic visual processing (especially in V1, V2, V3; Yuval-Greenberg & Heeger, 2013) as visual noise to impair any low-level visual simulations. In a within-subjects design, 112 participants listened to 80 sentences while looking at visual noise or at a blank screen and their reaction times to subsequently appearing matching vs. mismatching target pictures were measured. Linear mixed-effects modelling revealed a robust match effect ($t=4.22$, $p<.001$), which, crucially, was not affected by visual noise ($t<1$, $p>0.4$ for the interaction). These results suggest that, in contrast to the received view, perceptual simulation is not responsible for the shape priming in the current paradigm. More generally, the findings speak against the idea that language comprehension involves the automatic activation of modality-specific representations.

LANGUAGE: Semantic

F97

MALE FASHIONISTAS AND FEMALE FOOTBALL FANS: HOW GENDER STEREOTYPES AFFECT NEUROPHYSIOLOGICAL CORRELATES OF SPEECH COMPREHENSION

Angela Grant[1], Sarah E. Grey[1], Janet G. van Hell[1]; [1]The Pennsylvania State University — Recent studies have found that pre-existing contextual information, such as gender stereotypes, is incorporated online during comprehension (Van Berkum, van den Brink, Tesink, Kos & Hagoort, 2008). Fewer studies, however, have measured how we create new contexts when we are not given explicit instructions (Regel, Coulson & Gunter, 2010). We studied the effects of exposure to stereotypically congruent and incongruent patterns of speech on the processing of semantic incongruities. Participants listened to 240 critical sentences, consisting of a female speaker and a male speaker reading sentences about stereotypically feminine (fashion) and stereotypically masculine (sports) topics. Half of the participants heard a stereotype congruent pattern of sentences (e.g. for the female speaker, no errors about fashion but errors on sports sentences) and the other half heard a stereotype incongruent pattern. Aside from the pattern of errors, no explicit information was given regarding the speakers. We assessed the influence of correctness and stereotype congruence during the first and second halves of the experiment. We found that gender-incongruent incorrect sentences elicit larger N400s than gender-congruent incorrect sentences, but only in the first half of the experiment. These results suggest that a) stereotype congruence affects listener's reaction to gender-based semantic incongruities, and b) that participants are able to create new, speaker-specific contexts online in order to adjust their expectations and responses.

F98

CROSS-LANGUAGE FMRI DECODING OF SENTENCES IN THREE LANGUAGES: PORTUGUESE, ENGLISH AND MANDARIN

Ying Yang[1], Cyntia Bailer[2], Vladimir Cherkassky[1], Jing Wang[1], Marcel Just[1]; [1]Carnegie Mellon University, [2]Federal University of Santa Catarina, Brazil — This study investigated the universality of concept representations in the human brain across languages and across people. We tested whether neural concept representations are sufficiently common to allow a predictive model trained on the mapping between concepts and fMRI patterns of one person reading in one language, to recognize those concepts in another person reading in another language. The stimuli were 3 sets of 60 translation equivalent sentences in either English, Portuguese or Mandarin, read by 9-12 young adult native speakers of these languages while fMRI images were acquired. A regression model mapped between the semantic properties of each content word (characterized by a set of 42 semantic (e.g. social interaction, physical action, person) and 6 case role features (e.g. subject, main verb)) and the corresponding brain activity pattern. The model, iteratively trained on 59 of the sentences in one language, can predict the translation equivalent of the left-out sentence in the other languages with a mean rank accuracy of .70 (where chance level is .5). To further enhance the model's prediction, Canonical Correlation Analysis (CCA) was used to project the mapping of the activation patterns of a pair of languages into a latent space to maximize the pattern commonalities. For the pairwise cross-language sentence predictions obtained from CCA, rank accuracies range from .71 (Portuguese to English) to .79 (Portuguese to Mandarin) (critical value at $p = .01$ was .56). These findings provide the first evidence for a meta-language neural universality of concept representation at the sentence level.

F99

MAPPING NOVEL WORD FORMS TO MEANING IN BEGINNING CHILD AND ADULT SECOND LANGUAGE LEARNERS: ELECTROPHYSIOLOGICAL AND BEHAVIORAL EVIDENCE

Katharine Donnelly Adams[1], Fatemeh Abdollahi[1], Kathleen Ammerman[1], Ping Li[1], Janet Van Hell[1]; [1]The Pennsylvania State University — In ERP and behavioral studies, we examined the development of lexical knowledge in beginning classroom second language (L2) learners at two ages, Kindergarten and young adulthood, both tested at around 20-25 hours of L2 instruction. Leading theoretical models (e.g., Revised Hierarchical Model), developed to describe L2 learning in adults, assume that beginning L2 learners connect L2 word forms to native-language (L1) word forms, and access the meaning of an L2 word via the L1 translation. As L2 learners become more proficient, L2 word form-to-meaning-mapping is strengthened and L2 meaning is accessed directly without first translating to L1. However, because adults are integrating novel L2 words into an entrenched L1 lexicon (likely to be less permeable to new L2 words), this learning pattern may not hold true for children. In fact, because children are still building L1 lexical codes as part of their ongoing L1 literacy development, child L2 learners may be more likely to map novel L2 words to meaning rather than to L1 lexical forms. In a translation recognition task, learners were presented with correct (e.g., burro–donkey), semantically-related incorrect (burro–spider), or semantically-unrelated incorrect (burro–rainbow) translations. Both child and adult L2 learners showed increased negativity (N400) to semantically-related relative to unrelated incorrect translations. Behaviorally, however, performance was at chance. These findings indicate that both child and adult L2 learners, after only 20-25 hours of instruction, have established L2 word-to-concept mappings, and exploit conceptual information during L2 processing as reflected in ERPs, but not (yet) in behavioral accuracy.

F100

DECOMPOSING FMRI SENTENCES INTO WORDS, THEN WORDS INTO EMBODIED NEURAL FEATURES, THEN REASSEMBLING THE PIECES TO PREDICT NEW WORDS WITHIN SENTENCES

Andrew Anderson[1], Jeffrey Binder[2], Leonardo Fernandino[2], Colin Humphries[2], Lisa Conant[2], Mario Aguilar[3], Xixi Wang[1], Donias Doko[1], Rajeev Raizada[1]; [1]Brain and Cognitive Sciences, University of Rochester, NY 14627, [2]Medical College of Wisconsin, Department of Neurology, Milwaukee, WI 53226, [3]Teledyne Scientific Company, Durham, NC 27703 — We introduce new methods that enable model-based predictions of word and feature-level semantic content of embodied neural activity automatically induced in sentence-comprehension. How meaning is coded in the brain is a major question, and important recent advances have used semantic-models to predict neuro-semantic representations and break down elements of the brain's code by linking model-features to neural activity components. To date analyses have largely focused on brain patterns associated with isolated nouns. However it is more natural for words to appear in sentences, when not only are there multiple words, but combinatorial meanings induced by word order and semantic enrichment arising from inferences. Nevertheless behavioral tests predict that there will be some degree of context-invariant activity associated with individual words even when they are presented in sentences. It is unknown what forms the semantic content of context-invariant word representations and how they are distributed throughout the brain. As an early step toward understanding sentence-level neural activity we target these questions by recording fMRI for 240 sentences describing everyday situations using 242 nouns, verbs and adjectives (distributed across sentences). We apply a recently developed semantic model that uses naive human ratings to estimate the strength of association between individual word-labels and different elements of neural activity in sensory, motor, social, emotional and cognitive networks. In a series of tests we show: where in the brain context-invariant word activity can be detected, where multiple words accumulate, and how different embodied-model components contribute to explaining neural activity patterns across the brain.

LONG-TERM MEMORY: Episodic

F101

EVENT-RELATED FMRI STUDIES OF FALSE MEMORY: AN ACTIVATION LIKELIHOOD ESTIMATION META-ANALYSIS

Kyle A Kurkela[1], Nancy A Dennis[2]; [1]Penn State University, [2]Penn State University — A wealth of research in the domain of episodic memory has focused on understanding the neural correlates mediating false memories, or memories for events that never happened. While several qualitative reviews have attempted to synthesize this literature, methodological differences amongst empirical studies have limited broader conclusions regarding the neural mechanisms underlying false memories. The current study performed a voxel-wise quantitative meta-analysis to investigate commonalities within the false memory functional magnetic resonance imaging (fMRI) literature. The results were broken down by memory phase (Encoding/Retrieval) and within retrieval by contrast baseline (Hit/CR) and stimulus type (Verbal/Pictorial). The general retrieval analysis identified loci of consistency in the left inferior parietal lobe and bilateral prefrontal cortex (PFC). Additionally, studies utilizing a Hit baseline showed consistent activity in late occipital cortices, whereas studies utilizing a CR baseline showed consistent activity in right parietal cortex and left caudate. Breaking down the studies by stimulus type, consistent loci of activity were found in several left prefrontal regions for verbal tasks whereas pictorial stimuli activated right inferior PFC as well as occipital cortex when pictorial lures were perceptually related to targets. Encoding studies were associated with common activity in the left middle temporal gyrus. Additionally, while all analyses identified the medial PFC as a consistent loci of activation, none found common activation in the medial temporal lobe. Together, results provide quantitative evidence for the critical role of medial PFC in mediating false memories as well as regions associated with specific experimental designs.

F102

EFFECTS OF RETRIEVAL PRACTICE ON THE MODIFICATION OF LONG-TERM MEMORIES

Rosalie Samide[1], Hongmi Lee[2], Franziska Richter[3], Brice Kuhl[1]; [1]University of Oregon, [2]New York University, [3]University of Cambridge — Studies on the consequence of retrieval practice have traditionally focused on the strengthening that reactivated memories experience ('testing effect'). However, theories of consolidation suggest that reactivation can also modify memories, and may shift memories toward more semantic representations. In order to test whether retrieval changes the nature of mnemonic representations, we conducted a three-phase behavioral experiment. In the initial study phase, subjects learned to associate words with pictures of a face, scene, or object. During the following retrieval phase, half of the previously learned words were presented alone. Subjects retrieved the pictures associated with the words and rated the vividness of the memory. In the final memory test phase, subjects were tested on their recognition memory for the pictures. There were three types of test pictures: novel, studied, and critical 'lure' pictures perceptually and semantically similar to the studied pictures. Subjects indicated whether the test pictures were exactly the same as the studied ones or not, and how confident they were in their judgments. We found that vivid retrieval increased overall recognition accuracy for the pictures, consistent with previous studies. However, this memory advantage was driven by an increased hit rate, and not by reduced false alarm to the lures. In fact, vivid retrieval increased high-confidence false alarm rates, suggesting that retrieval modifies memories to be less perceptually precise and more semantic or gist-based. In a separate fMRI study we related distributed, pattern-based evidence of neural reactivation to behavioral measures of retrieval-based modification and strengthening.

F103

IMPROVED PRECISION OF SUCCESSFUL RECOLLECTION 24 HOURS AFTER TARGETED STIMULATION OF POSTERIOR HIPPOCAMPAL-CORTICAL NETWORKS

Aneesha Nilakantan[1], Donna Bridge[1], Elise Gagnon[1], Jane Wang[1], Sungshin Kim[1], Joel Voss[1]; [1]Northwestern University — The posterior hippocampal-cortical network, specifically the hippocampus, posterior cingulate, and lateral parietal cortex, is thought to support spatial and episodic memory. We have previously shown that multiple-day repetitive transcranial magnetic stimulation (rTMS) increases functional connectivity among these network regions and improves associative memory. Here, we aimed to extend these findings by examining neural correlates of associative spatial recall following stimulation. Targeted hippocampal-cortical network rTMS used subject-specific stimulation targets in the parietal cortex based on intrinsic resting-state functional-connectivity MRI with the hippocampus. Twelve participants completed five consecutive days of targeted hippocampal-cortical network stimulation and five consecutive days of vertex (sham) stimulation over two separate weeks in counter-balanced order. The spatial task involved recall of 96 object-locations, and was administered with a unique set of stimuli 24 hours before and 24 hours after each week of stimulation. Successfully recollected object locations were more precisely recalled (i.e., placed closer to the studied location) following five days of network-targeted stimulation, relative to sham. Event related potential (ERP) correlates of the recollection precision improvement included reduced late-positive potentials at parietal electrode locations, relative to pre-stimulation. Targeting the posterior hippocampal-cortical network with multiple-day rTMS therefore improves recollection precision and modulates neural correlates of recollection for at least 24 hours after stimulation. These findings support the causal role of posterior hippocampal-cortical networks in precision tuning of episodic memory. Analyses of task-related and resting-state frequency-domain EEG changes due to stimulation will also be discussed.

F104

THE DEVIL IN THE DETAIL: EXPOSURE DURATION DURING ENCODING AFFECTS RETRIEVAL-RELATED BRAIN ACTIVITY

Flavia Schechtman Belham[1], Stephanie Hatzifilalithis[1], Leun J. Otten[1]; [1]Institute of Cognitive Neuroscience, University College London (UCL), UK — Longer stimulus durations generally lead to better memory. It is unknown, however, whether this is because of quantitative or qualitative changes in processing. Here, we investigated how exposure duration of emotional images during encoding influences encoding-related and retrieval-related brain activity.

Healthy adults made indoor/outdoor judgments on negative and neutral images preceded by cues that indicated the emotional valence of the upcoming item. In separate blocks, images were presented for either a short (1 s) or longer (2 s) period of time. Memory for the images was probed with a remember/know recognition test in which exposure duration was held constant. Brain activity was measured via scalp-recorded EEG. Memory performance was better following longer exposures regardless of valence. With respect to brain activity, all images elicited the anteriorly-distributed ERP subsequent memory effect usually attributed to semantic processing. However, these effects differed quantitatively, being larger in the short duration condition, and for negative images. In contrast, qualitative differences as a function of exposure duration were seen for retrieval-related activity. The left-parietal old/new effect associated with recollection was elicited by all images except negatives ones that were studied longer. These images instead elicited the frontal post-retrieval monitoring effect, which was also observed for neutral images presented briefly. These findings suggest that different exposure durations during encoding lead to memory traces that are retrieved in qualitatively different ways. This, in turn, indicates that small differences in experimental design can have big impacts on brain activity.

F105

TRACKING COLLECTIVE SCHEMAS IN INDIVIDUAL MEMORIES

Pierre Gagnepain[1,2,3,4], Thomas Vallée[1,2,3,4], Fausto Viader[1,2,3,4], Denis Peschanski[5,6], Francis Eustache[1,2,3,4]; [1]U1077, INSERM, Caen, France., [2]UMR-S1077, Université de Caen Basse-Normandie, Caen, France., [3]UMR-S1077, Ecole Pratique des Hautes Etudes, Caen, France., [4]U1077, Centre Hospitalier Universitaire, Caen, France., [5]CNRS, Paris 1 Panthéon-Sorbonne, [6]CHS 20e siècle, équipex Matrice — Schemas describe mental structures storing recurrent and organized patterns of information (van Kesteren et al., 2012). Previous brain imaging studies have exclusively considered schemas isolated from their collective contexts. Social-cultural frameworks stored in collective memory, however, might also shape the construction and organization of individual memories. We recorded brain activity using fMRI in a group of 24 young adults while there were remembering pictures from a tour at the WWII Memorial (Normandy). An image arrangement task (Kriegeskorte & Mur, 2012) was used to capture the structure of participants' semantic space (individual schema). The organization of collective memory was measured at two different levels using: 1) topic modelling analysis (Steyvers & Griffiths 2007) of a corpus (http://www.matricememory.fr/) composed of more than 20000 French television and radio News about WWII (sociocultural schema), and 2) an internet-based image arrangement task measuring common representations across control individuals (shared schema). These schemas were then compared to the neural organization of individual memories using Representational Similarity Analysis (Nili et al., 2014). Semantic distances between images based on visual categories irrespective of historical content served as baseline. Analyses focused on the anterior temporal cortex (ATC) and medial prefrontal cortex (mPFC) given their their core role in mediating social knowledge (Olson et al., 2013). Analyses revealed that individual, shared and sociocultural schemas explained activity patterns in the ATC better than baseline. The ventral portion of mPFC was specifically sensitive to shared schemas. These finding demonstrate that human memory encapsulates the collective structure of knowledge transcending individuals' own representations.

F106

STRESS ENHANCES MNEMONIC DISCRIMINATION OF NEGATIVE OBJECTS

Stephanie L. Leal[1,2], Tony J. Cunningham[3], Michael A. Yassa[2], Jessica D. Payne[3]; [1]Johns Hopkins University, [2]University of California, Irvine, [3]University of Notre Dame — Emotional modulation of memory influences how we remember significant events and how these events shape future behavior. Recently, we showed that emotion modulates the ability to discriminate highly similar information, where emotional detail memory (mnemonic discrimination) is impaired and emotional gist memory (target recognition) is preserved compared to neutral memory. The current study sought to examine the effects of stress on mnemonic discrimination of negative and neutral information. Participants encoded scenes composed of negative or neutral objects placed on neutral backgrounds and then underwent a psychosocial stressor or matched control task. During testing, objects and backgrounds were presented separately, with some identical old objects (targets), some new objects (foils), and some similar but not identical objects (lures). We measured target recognition (d') and lure discrimination index (LDI) and found enhanced discrimination for negative objects in the stress group compared to controls [$F(1,48)=5.0$, $p=0.03$]. We also found a general emotional modulation effect for d' [$F(1,48)=17.6$, $p<.001$], suggesting mnemonic discrimination is sensitive to stress-related enhancements in detail memory. Finally, we found a quadratic inverted-U relationship between negative LDI and maximum cortisol increase [$F(2,47)=3.7$, $p=0.03$], where cortisol release benefited negative discrimination to a point, but excessive concentrations hindered performance. This suggests that stress may lead to better memory for negative detail information. Further, this relationship may be mediated by cortisol, suggesting excessively low or high levels impair memory, while mid-levels of cortisol enhance memory for negative detail information.

F107

SUPERIOR EPISODIC, BUT NOT WORKING, MEMORY PERFORMANCE IN INCONSISTENT- RELATIVE TO CONSISTENT RIGHT-HANDERS

Neil Patel[1], Ruth E. Propper[1], Stephen D. Christman[2]; [1]Montclair State University, [2]University of Toledo — Superior episodic memory in inconsistent- relative to consistent-right-handers (ICH vs CRH), has been found across a wide variety of stimuli types. Christman and Propper and colleagues theorize ICH have an advantage during episodic retrieval because ICH have greater access to the right hemisphere, and greater interhemispheric communication. Neurological findings offer support: The hemispheric encoding/retrieval activation model proposes involvement of left prefrontal areas during encoding, and right prefrontal areas during retrieval, of episodic verbal information, and studies indicate significantly larger callosal volumes with increasing inconsistent-handedness. Memory performance not requiring right hemisphere access or interhemispheric interaction may be equivalent between handedness groups. Phonological aspects of working memory involve primarily left hemisphere processes; thus, episodic, but not working memory, may be superior in ICH. Methods: 62 female undergraduates (36 CRH, 26 ICH) were visually presented 36 list words, at a rate of 5 seconds each. Following a 2-3 minute distractor task, participants had 3 minutes to verbally recall as many words as possible. Results: Episodic memory: number of words recalled from the first 5 words presented (Primacy Words). Working memory: number of words recalled from the last 5 words presented (Recency Words). Unpaired t-tests revealed significantly ($t(60)=2.04$, $p<.05$) greater Primacy Words recalled by ICH ($x=2.42$, $sd=1.37$) than by CRH ($x=1.78$, $sd=1.61$), but no between group differences in Recency Word recall ($p>.8$). Conclusions: Memory tasks presumed to require greater right hemisphere access, or corpus callosum-mediated interhemispheric interaction, are performed better by ICH; left hemisphere mediated, working memory performance does not differ between groups.

F108

THE TWO PROCESSES UNDERLYING THE TEST EFFECT ---EVIDENCE FROM EVENT-RELATED POTENTIALS (ERPS)

Xiaonan Liu[1,2], Deborah Tan[2], Ya Zhang[3], Lynne Reder[2]; [1]Xiamen University, [2]Carnegie Mellon University, [3]University of Pittsburgh — Theoretical explanations of the testing effect have focused on either a retrieval process or a re-encoding process after retrieval. Based on prior neuroimaging evidence, we propose that both processes contribute to the benefits of testing. To test this account, we recorded ERPs while subjects studied, re-studied or took cued-recall tests of word pairs. ERPs were analyzed based on current and subsequent test accuracy, yielding three conditions: both tests correct, both in correct and correct followed by incorrect. The mean amplitudes of waveforms between 400-700 ms during the first test were highest when both tests were correct and lowest when both were incorrect while the mean amplitudes between 700-1000 ms only differed as a function of subsequent memory, higher when the later test was correct. We interpreted the earlier time window as a component reflecting a retrieval process and the later time window as a component reflecting a re-encoding process.

F109

EPISODIC SIMULATION AND PROSOCIALITY IN YOUNGER AND OLDER ADULTS

Caspian Sawczak[1,2,3], Mary Pat McAndrews[1,2], Morris Moscovitch[1,3]; [1]University of Toronto, [2]Toronto Western Research Institute, University Health Network, [3]Rotman Research Institute — Recent work has shown that vividly imagining oneself helping people in situations of need increases one's self-reported willingness to help those individuals (Gaesser & Schacter, 2014). The underlying mechanism, however, has yet to be elucidated. It is widely accepted that the hippocampus, in addition to supporting episodic memory, is critical for the vividness of episodic simulation (imagination). We have previously shown that older adults, like patients with medial temporal lobe lesions, have impaired episodic simulation which contributes to deficiencies in open-ended problem solving (Sheldon, McAndrews, & Moscovitch, 2011). Here, we hypothesized a similar aging effect on the link between imagination and prosocial intent. We recruited older adults (M age = 71.5, SD = 4.72) and younger adults (M age = 18.1, SD = 0.33) and had them vividly imagine helping people in situations of need. Participants then verbally described what they had imagined. We found that vividly imagining oneself helping people, compared to a baseline task involving verbal fluency, significantly increased willingness to help in younger adults but not in older adults. Further, self-reported willingness to help was significantly correlated with the level of perceptual detail in descriptions of imagined events for younger adults, but not for older adults, and the latter group produced significantly fewer perceptual details compared to younger adults. We interpret these results as preliminary evidence that the effect of imagination on willingness to help relies on intact hippocampal functioning.

F110

DIFFERENCES IN TEMPORAL MEMORY PRECISION IN THE ANTERIOR AND POSTERIOR MEDIAL TEMPORAL LOBES

Maria E. Montchal[1], Michael A. Yassa[1]; [1]UC Irvine — Recent studies suggest that anterior and posterior regions of the hippocampus support memory for space at different levels of precision (Nadel et al., 2013). Anterior and posterior hippocampus have differential cortical connectivity, and differences in precision may reflect unique contributions of anterior and posterior medial temporal lobe (MTL) networks. The anterior hippocampus is more connected with anterior MTL regions (perirhinal cortex [PRC] and prefrontal cortex [PFC]), and the posterior hippocampus is more connected with posterior MTL regions (parahippocampal cortex [PHC] and retrosplenial cortex [RSC]) (Duan et al., 2015). PRC activity has been correlated with familiarity (a feeling of "knowing" without contextual details), whereas PHC and RSC are more engaged when participants successfully recall contextual details (Ranganath & Ritchey, 2012). This is consistent with posterior MTL networks supporting memory for precise details and anterior MTL networks supporting memory for more general information. This study targeted anterior/posterior MTL differences in the precision of temporal memories. During MRI scanning, participants watched an episode of a sitcom. At test, participants were presented with still frames from the episode and asked to place each on a timeline, one at a time. Based on their error (the temporal distance between when the still frame occurred and their response), we classified trials as "precise" or "general." We find greater engagement of anterior MTL regions for "general" trials and greater engagement of posterior MTL regions for "precise" trials. These findings suggest that there may be representations at different time scales in the anterior and posterior MTL.

F111

REACTIVATION-EXTINCTION OF PAVLOVIAN CATEGORY THREAT MEMORY RESULTS IN RETURN OF THREAT RESPONSES AND A SELECTIVE PROACTIVE AND RETROACTIVE EPISODIC MEMORY ENHANCEMENT

Marijn Kroes[1], Joseph Dunsmoor[1], Qi Lin[1], Elizabeth Phelps[1,2]; [1]New York University, [2]Nathan Kline Institute — Reactivating a previously acquired threat memory prior to extinction can prevent the return of threat responses. This reactivation-extinction procedure raises hope to permanently modify specific memories during reconsolidation that contribute to psychiatric disorders using a straightforward behavioral intervention. An important caveat to existing studies investigating the reactivation-extinction procedure is the use of simple associative threat learning tasks (e.g., a tone or a picture predicts shock administration). The applicability of this work to memories that can consist of associations between multiple related cues and aversive outcomes, such as those implicated in trauma, may be limited. We tested if reactivating a category threat memory prior to extinction would affect the return of physiological threat responses and subsequent episodic memory for a variety of stimuli associated with the aversive learning experience. In contrast to research on simply associative threat memories, we found across two experiments in humans (N=37 and N=38) that reactivating an aversive category threat memory prior to extinction did not prevent the return of threat-related skin conductance responses. A test of episodic memory for category exemplars revealed a retroactive and proactive enhancement of episodic memory selective to items related to the reinforced category. Our results indicate a potential boundary condition for the reactivation-extinction effect, specifically that the procedure does not prevent the return threat responses to stimuli related to those encountered during threat learning. Moreover, our findings indicate that reactivating a category threat memory can result in selective strengthening of relevant episodic memories.

F112

PHASE SYNCHRONIZATION IN THE HUMAN MEDIAL TEMPORAL LOBE PREDICTS THE PRECISION OF SPATIAL MEMORY ENCODING: EVIDENCE FROM INTRACRANIAL RECORDINGS

Andrew Watrous[1], Brad Lega[2], Michael Sperling[3], Ashwini Sharan[3], Gregory Worrell[4], Barbara Jobst[5], Robert Gross[6], Joel Stein[7], Sandhitsu Das[7], Daniel Rizzuto[7], Michael Kahana[7], Joshua Jacobs[1]; [1]Columbia University, [2]University of Texas-Southwestern, [3]Thomas Jefferson University, [4]Mayo Clinic, [5]Dartmouth University, [6]Emory University, [7]University of Pennsylvania — Patient lesion and fMRI studies have identified the hippocampus and adjacent cortical areas in the medial temporal lobe (MTL) as critical areas for spatial memory encoding, although the electrophysiological basis for spatial encoding is less clear. Prior invasive MTL studies have implicated oscillatory phase as a possible mechanism for coordinating activity within and between different MTL structures during episodic encoding. Here, we asked whether similar phase based mechanisms support spatial encoding by testing patients with pharmaco-resistant epilepsy on a virtual Morris water maze task. Patients were able to successfully encode an object location in the environment and return to this location during a retrieval test. Assessing phase synchronization between all MTL electrodes in each of 43 patients in the low and high theta bands, we found that particular phase relations between MTL subregions was related to the precision of spatial encoding. These observations 1) were statistically robust both on individual electrode pairs and in the majority (27) of patients, 2) were strongest in the slow theta/delta band, and 3) showed subregionally specific effects in right MTL regions, particularly CA1, with 28% of electrode pairs showing significant effects. These findings further implicate slow theta phase as a mechanism of information representation and transmission in the human MTL.

F113

STABILITY AND CONSISTENCY OF NARRATIVE PRODUCTION ACROSS TIME IN HIPPOCAMPAL AMNESIA

Jake Kurczek[1], Melissa Duff[2]; [1]Haverford College, [2]University of Iowa — There has been increased interest in the relationship between memory and narrative (Gaesser et al., 2011; Race et al., 2013; Zeman et al., 2013). Examination of narrative in patients with hippocampal amnesia has shown that these patients produce narratives composed of significantly fewer episodic details (Kurczek et al., 2015; Race et al., 2013) and that are less coherent (Kurczek & Duff, 2011) than healthy adults. An open question is what happens to these narratives when told repeatedly across time. For example, in healthy participants, narratives can change in length and in the accuracy or consistency of details with repetition (Bartlett, 1932; Nadal et al., 2007; Neisser, 1981). We asked six individuals with bilateral hippocampal damage and amnesia and 12 demographically matched healthy comparison participants to tell and retell six personal stories four times over the course of a month. Consistent with previous work, we found that the individuals with amnesia produced significantly fewer episodic details in their tellings (mean = 0.60, SD = 0.04) than comparison participants (0.76, SD= 0.04; $F(1, 11) = 8.34$, $p = 0.015$). Looking at narrative production across time, the retellings of healthy comparison

participant narratives were quite consistent across retellings, with a high proportion of repeated details. Narratives from amnesia participants, in contrast, were inconsistent with a high proportion of new or added details across each retelling. This difference was significantly different ($F(1, 11) = 57.78$, $p < 0.001$). These findings suggest a role for the hippocampus in the stability of narrative production across time.

F114

MENTAL TRAVELS IN TIME AND IN SPACE: PARIETAL OVERLAP IN DISSOCIATED NETWORKS

Baptiste Gauthier[1], Benoît Martin[1], Karin Pestke[1], Virginie van Wassenhove[1]; [1]Cognitive Neuroimaging Unit, CEA DSV/I2BM, INSERM, Université Paris-Sud, Université Paris-Saclay, NeuroSpin center, 91191 Gif/Yvette, France — Does Mental Time Travel (MTT) involve building an internal map of time (Arzy et al, 2009)? Neurocognitive models for mapping spatial memories have been elaborated (Burgess, 2001) but it is not known whether MTT relies on similar principles. After having learned a set of events, participants performed temporal or spatial judgments (TJ and SJ) while being recorded with M/EEG and with fMRI. They were asked to tell whether events (e.g. "Katrina Hurricane") occurred "before/after" (TJ) or "east/west" (SJ) of their imagined self- location in time and space (e.g. Paris in nine years). Possible self-locations were egocentric (Paris, now) or not (Cayenne or Dubaï, nine years before or after). If TJ and SJ did not differ regarding reaction times (RT) or error rates (ER), fMRI and M/EEG contrasts revealed that TJ recruits posterior part of the brain while TJ activate more frontal regions. Moreover, judging from non-egocentric locations led to higher RT and ER than from egocentric ones. These self-location changes in time and space elicited overlapped fMRI activations in right angular gyrus, precuneus and superior frontal gyrus along with posterior/frontal space/time dissociation. Larger temporal or spatial distances between imagined self-location and events produced faster and more accurate responses (Gauthier & van Wassenhove, 2014). These parametric effects of distance on brain activity were found in both posterior and frontal topographies in M/EEG and located in right angular gyrus and right anterior insula in fMRI. Together, despite global dissociations, behavior and right parietal overlaps suggest similar egocentric mapping of time and space.

LONG-TERM MEMORY: Other

F115

DYNAMIC NEURAL CORRELATES OF OVERT AND COVERT AUTOBIOGRAPHICAL MEMORY RETRIEVAL USING HIGH-RESOLUTION FMRI

Charles Ferris[1], Cory Inman[1], G. Andrew James[2], Stephan Hamann[1]; [1]Emory University, [2]University of Arkansas for Medical Sciences — Retrieval of autobiographical memories (AM) is a complex process that recruits dynamically changing networks of brain regions as processing shifts between memory search, access, and content elaboration. In prior fMRI work we have used graph analyses to characterize whole-brain changes in dynamic connectivity during AM retrieval, highlighting time-varying engagement of the hippocampus, PFC, and other regions. Here we extended these investigations, using high temporal (1 second TR) and spatial (2 mm isotropic) resolution fMRI, an optimized experimental design, and both covert and overt (spoken) retrieval to test theoretical accounts of AM retrieval. Motion minimization and post-processing ICA was used to minimize speech artifact effects. During scanning, healthy adults retrieved unrehearsed AMs to cue words across a long retrieval period, followed by ratings of vividness and emotion, with overt (spoken) retrieval during half of the runs. We identified regions active during different retrieval periods and used graph theory analyses to examine dynamic changes in network connectivity. A broadly similar core AM retrieval network was identified for covert and overt AM retrieval, with relatively greater hippocampal activation during memory access. Network connectivity changed substantially across AM retrieval, particularly for hippocampal-neocortical interactions. These findings provide evidence that accessing and reconstructing autobiographical memories involves the large-scale reorganization of memory networks that reflect changing retrieval processes both during covert and overt retrieval.

F116

VENTROMEDIAL PREFRONTAL DAMAGE REDUCES MIND-WANDERING

Elisa Ciaramelli[1], Elena Bertossi[1]; [1]Department of Psychology, University of Bologna — Mind-wandering is the tendency to engage in spontaneous thought unrelated to the current task. Previous work shows that the Default Mode Network (DMN) is activated during mind-wandering (e.g., Christoff et al., 2009). Little is understood, however, about the causal contribution of individual DMN nodes to mind-wandering. Here, we focus on the ventromedial prefrontal cortex (vmPFC). Patients with lesions to the vmPFC (vmPFC patients), control patients with lesions not involving vmPFC, and healthy individuals performed three tasks requiring increasing amount of cognitive resources (Smallwood et al., 2009). In each task, thought probes were periodically presented, and participants reported the degree to which their attention was off-task (mind-wandering), and classified the temporal direction of thoughts occurring during mind-wandering. Across groups, mind-wandering was less frequent during relatively difficult vs. easy tasks. Across conditions, vmPFC patients engaged in mind-wandering less frequently and intensely than healthy and brain-damaged controls, whereas no significant difference was found between the control groups. Importantly, vmPFC damage also altered the content of mind-wandering, which tended to focus on the present, rather than the future. These findings indicate that vmPFC plays a critical role in mind-wandering, possibly by mediating shifts of attention towards internal information, or the construction of future experiences which typically populate spontaneous thoughts.

F117

NEURAL EFFECTS OF PLAUSIBILITY DURING EPISODIC AND SEMANTIC COUNTERFACTUAL THINKING

Natasha Parikh[1], Luka Ruzic[1], Gregory W. Stewart[1], R. Nathan Spreng[2], Felipe De Brigard[1]; [1]Duke University, [2]Cornell University — Previous research has shown that episodic counterfactual thoughts (eCFT)—mental simulations of alternative ways past personal events could have occurred—engage the default network (DN). Such engagement is modulated by the perceived plausibility of eCFT, with greater engagement of DN areas for imagined alternatives perceived as plausible relative to implausible. A parallel line of research has shown that self-oriented eCFT activates the DN to a greater extent than other-oriented counterfactual simulations involving more semantic information. It remains unclear whether the level of DN activity during counterfactual simulation depends mainly on perceived plausibility or involvement of episodic as opposed to semantic information. The current fMRI study aims to clarify this issue by comparing brain activity during plausible and implausible episodic and semantic (sCFT) counterfactual thoughts. Participants recalled specific autobiographical events and, in the scanner a week later, created plausible and implausible counterfactual simulations to these and factual statements. Consistent with previous results, we found greater engagement of DN areas—including cingulate gyrus, medial prefrontal, and parietal cortices—for eCFT > sCFT. Conversely, sCFT > eCFT recruited regions involved in semantic processing, such as the lateral temporal cortex. Greater hippocampal activity was found for implausible relative to plausible eCFT, suggesting an increased constructive role of the hippocampus during implausible simulations. In contrast, the parahippocampal gyrus was preferentially recruited during plausible versus implausible sCFT, suggesting greater contextual coherence during the former. These results illuminate differences in the neural mechanisms involved during plausible and implausible counterfactual simulation and their relation to the DN.

F118

WHITE MATTER PREDICTORS OF PERFORMANCE IMPROVEMENT FOLLOWING MEMORY TREATMENT IN TRAUMATIC BRAIN INJURY

Kathy S. Chiou[1], Joshua Sandry[1,2], Mark D. Zuppichini[2], Nancy D. Chiaravalloti[1]; [1]Kessler Foundation, [2]Montclair State University — Memory impairment is a common and significant concomitant symptom of traumatic brain injury (TBI). Problematically, efforts to develop treatments to improve memory have been met with mixed results. Thus, there has been increased interest in determining factors that can be used to predict success of treatment. This pilot study utilizes diffusion tensor imaging (DTI) to investigate whether white matter integrity at baseline could be used to predict changes in performance associated with use of a memory intervention by adults with TBI. Adult participants with moderate to severe TBI and documented memory

impairment on neuropsychological testing were recruited to participate in a larger study involving a 5 week randomized clinical trial of a memory retraining intervention. Prior to starting the intervention, participants received a DTI scan and completed the Memory Assessment Scales Prose Memory Test (PMT). The PMT was completed again upon completion of the intervention. A change score between performance on the PMT at baseline and follow-up was calculated. For participants in the treatment group, correlation analyses were conducted between white matter fractional anisotropy (FA) at baseline and PMRT change scores. Results showed positive correlations between PMRT change scores and white matter integrity in the left inferior fronto-occipital fasciculus, uncinate fasciculus, left superior longitudinal fasciculus, and left anterior thalamic radiation assessed at baseline. These findings support the potential use of white matter metrics to predict the efficacy of a memory retraining intervention after TBI.

F119

NOT ALL SPACING IS CREATED EQUAL: EYETRACKING AND PERFORMANCE

Patti Simone[1], Matthew Bell[1]; [1]Santa Clara University — Spacing enhances memory, although exactly why that happens is not well understood. We replicated Kornell et al. (2010) paired associates task presenting artists and paintings. Subjects saw 12 artists and 24 paintings (2 per artist). Each artist-painting pairing was presented 6 times. For half of the artists, paintings were presented in a massed fashion for the first half of the session and a spaced fashion for the second half of the session. For the remaining artists paintings were presented in a spaced fashion for the first half of the session and a massed fashion for the second half of the session. Subjects were randomly assigned to either speak the name of the artists aloud or read them silently. Eye tracking data were collected during this learning phase. Following a brief distractor task, the subject's memory for the paintings and induction for a new painting by the same artist was tested. We hypothesized that (1) speaking the artist's name aloud would increase memorability, (2) that in spaced conditions, more time would be spent looking at the artist's name, and (3) that any spacing effects would be equal regardless of when the spaced trials occurred. We found a main effect of spacing (M = 81% for spacing vs. 66% for massing), that saying the name aloud (M = 60%) lead to lower performance than reading quietly (M = 88%) and an interaction between spacing and time of presentation. Preliminary analysis of cognitive load collected using eyetracking equipment shows no difference between groups.

F120

SLEEP FACILITATES RULE LEARNING THROUGH 'TEMPORAL SCAFFOLDING'

Shira Lupkin[1], Itamar Lerner[1], Alan Tsai[1], Mark Gluck[1]; [1]Rutgers University — Human studies investigating the effects of sleep on memory consolidation suggest that sleep both strengthens newly acquired memories and facilitates the discovery of hidden regularities embedded within these memories. The strongest evidence for a facilitatory effect of sleep on such 'hidden-rule' learning can be seen using tasks that involve regularities embedded within a temporal structure (i.e., those that include associations between temporally disparate events). However, it remains unclear to what extent sleep aids in the extraction of hidden non-temporal regularities. To investigate this, we employed four novel tasks: two with hidden temporal structures and two with non-temporal hidden structure. In each experiment, participants completed the task twice, separated by a 12-hour interval, which either did or did not include sleep. For the temporal tasks, the sleep group performed better on measures of rule learning than the wake group, suggesting superior extraction of the hidden temporal structure. In contrast, for the non-temporal tasks, there was no difference in performance between the two groups. These findings, as well as those from previous studies, can be understood in light of our recently developed computational model that argues that the time-compressed memory replay in the hippocampus during slow-wave-sleep allows the alignment and association of temporally disparate events through Hebbian learning, leading to the discovery of temporal regularities that may, because of their temporal separation, go undetected during wake.

F121

DOPAMINE INDEPENDENT PREFERENTIAL MEMORY CONSOLIDATION FOR NEGATIVELY REINFORCED STIMULI

Elizabeth Coulthard[1], John Grogan[1], Demitra Tsivos[1], Alan Whone[1], Rafal Bogacz[2]; [1]University of Bristol, [2]University of Oxford — When learning, dopamine enhances positively reinforced information whereas Parkinson's disease (PD; depleted dopamine) favours negatively reinforced information. However the role of dopamine after learning, during consolidation of memory, is more controversial. Here we investigate whether dopamine during consolidation enhances retention of positively or negatively reinforced information over a 24 hour period in people with PD. We tested 18 PD patients and 18 healthy age-matched controls on a reinforcement learning task. 2 pairs of symbols were presented (A/B and C/D) with feedback that A and C were correct 80 and 65% and B and D correct 20 and 35% of the time, respectively. After 24 hours participants then viewed novel pairs (A/C, A/D, B/C and B/D) and we measured propensity to Choose A or Avoid B. PD participants performed learning and novel pairs in four medication conditions day1/day2: ON/ON; ON/OFF; OFF/OFF and; OFF/ON (order counterbalanced). 14 PD patients also did the task ON and OFF medication without the 24 hour delay. There were no consistent effects of PD or dopamine on Choose A or Avoid B even without the 24 hour delay. Interestingly, however, after 24 hours, all participants preferentially avoided A rather than chose B. In contrast, no such bias for negatively reinforced information was found without the 24 hour delay. Thus, we have demonstrated selective retention of negatively reinforced information over 24 hours in those with PD and perhaps healthy participants. We have not replicated previous findings that dopamine and PD enhance learning from positive and negative reinforcement, respectively.

F122

A BRAIN SYSTEM FOR MENTAL ORIENTATION IN SPACE, TIME, AND PERSON

Michael Peer[1], Roy Salomon[2], Ilan Goldberg[1,3], Olaf Blanke[2], Shahar Arzy[1]; [1]Hebrew University of Jerusalem, Israel, [2]École Polytechnique Fédérale de Lausanne (EPFL), Geneva, Switzerland, [3]McGill University, Montreal, Canada — Orientation is a fundamental mental function that processes the relations between the behaving self to space (places), time (events), and person (people). Behavioral and neuroimaging studies have hinted at interrelations between processing of these three domains. To unravel the neurocognitive basis of orientation, we used high resolution 7T functional MRI as 16 subjects compared their subjective distance to different places, events, or people. Analysis at the individual-subject level revealed cortical activation related to orientation in space, time, and person in a precisely localized set of structures in the precuneus, inferior parietal, and medial frontal cortex. Comparison of orientation domains revealed a consistent order of cortical activity inside the precuneus and inferior parietal lobes, with space orientation activating posterior regions, followed anteriorly by person and then time. Core regions at the precuneus and inferior parietal lobe were activated for multiple orientation domains, suggesting also common processing for orientation across domains. The medial prefrontal cortex showed a posterior activation for time and anterior for person. Finally, the default-mode network, identified in a separate resting-state scan, was active for all orientation domains and overlapped mostly with person-orientation regions. These findings suggest that mental orientation in space, time, and person is managed by a specific brain system with a highly ordered internal organization, closely related to the default-mode network.

F123

ELECTROPHYSIOLOGICAL EVIDENCE FOR LEARNING DIFFERENCES IN TRAUMATIC BRAIN INJURY

Lauryn Zipse[1], Yael Arbel[1]; [1]MGH Institute of Health Professions — People who have experienced a traumatic brain injury (TBI) often exhibit impaired self-monitoring of their performance and behavior, which may negatively impact treatment effectiveness and generalization. Concerns about treatment effects have prompted an interest in learning in TBI, and there is some evidence that errorless learning, in which a person is prevented from making errors during the learning process, may result in better outcomes than more traditional error-based learning in this population. In this study, we examine two electrophysiological markers of error and feedback processing, the error-related negativity (ERN) and the feedback-related negativity (FRN), during a controlled

nonword learning task. We compare these markers across errorless and errorful learning conditions in people with TBI and in healthy controls. Our preliminary sample includes people with TBI who report persistent cognitive deficits, yet mostly score within normal limits on clinical measures of cognitive functions. Among these individuals, however, differences in electrophysiological markers of processes critical to learning are observed.

F124

NEURAL CORRELATES OF SEMANTIC CONGRUENCY AND MULTIPLE REPETITIONS IN RECOGNITION MEMORY

Azlina Amir Kassim[1], Jess Price[2]; [1]HELP University, Kuala Lumpur, Malaysia, [2]University of Nottingham Malaysia Campus, Semenyih, Malaysia — Past research has shown that stimuli presented in more than one modality (multi-modal) facilitate recognition memory compared to stimuli presented in a single modality. Furthermore, the semantic congruency of the multi-modal stimuli plays a crucial role in facilitating recognition memory. However, whether this effect is observed after multiple repetitions is still unclear, as are the underlying neural processes related to this. Event related potentials (ERPs) were recorded while participants made old/new discriminations in a continuous recognition test where visual and auditory stimuli were either semantically congruent (e.g. picture of a dog presented with a spoken word "bark"), or semantically incongruent (e.g. picture of a ball presented with a spoken word "cup"). Stimuli were presented once, repeated after a short delay (first repetition) and repeated again after a long delay (second repetition). Behavioral results showed that participants made fewer errors when multi-modal stimuli were congruent compared to when they were not congruent. However, this was only observed for the first repetition. Semantic congruency had no significant effect in performance at the second repetition. ERP results showed an early frontal old/new effect, thought to index familiarity for the first repetition in both conditions, but this effect was significantly diminished for the second repetition. In contrast, the parietal old/new effect was observed for both repetitions in both conditions. The findings of this study suggest that semantic congruency only has an effect for the first repetition, which relies on familiarity in recognition performance, but has no effect in subsequent repetitions, which rely on recollection.

F125

AUTOBIOGRAPHICAL MEMORY OF VIOLENT SEXUAL-AFFECTIVE RELATIONSHIPS: EXPLORING ITS EMOTIONAL RECONSTRUCTION THROUGH THE EXPERIENCE OF SCIENTIFIC READING ON LOVE

Sandra Racionero-Plaza[1], Lídia Puigvert[2], Leire Ugalde[3], Carmen Martín-Gómez[1]; [1]Loyola University Andalusia, [2]University of Cambridge, [3]Universidad del País Vasco — Research has shown some female adolescents' attraction toward violent masculinities. Once violent sexual-affective relationships have been experienced, memories of those become the ground for perceiving and processing next intimate experiences. However, little has been inquired about which type of experiences and language uses may induce recall of those autobiographical episodes to generate their emotional reconstruction. Starting from the malleability of autobiographical memory, and the relevance of language in memory processes, we examined in a sample of female adolescents (N = 10, age range 17-20) whether reading a scientific text on love, written using 'language of desire', modified in any ways the autobiographical memories of violent sexual-affective relationships, particularly their associated emotions. This was compared with a control group (N =10, age range 17-20). Memory reports were collected before and after the reading and coded to quantify the amount of episodic details in each (Levine et al., 2002) and to qualify their emotional content. Memory quality was assessed with memory quality questionnaires (Alea & Bluck, 2007). Compared to controls, the experimental group had a higher ratio of negative emotional content in the second round of memory reports and showed greater consciousness about how the relationship actually was. Also, experimental participants showed changes in the emotional quality of those memories after the intervention, with average decrease in positive emotions and average increase in negative emotions. This did not occur in the controls. The results deepen into the role of language and reasoning in autobiographical memory retrieval and reconstruction of violent sexual-affective relationships.

LONG-TERM MEMORY: Priming

F126

ASSOCIATIVE LEARNING SIMILARLY CONTRIBUTES TO REPETITION PRIMING ACROSS DISTINCT STIMULUS FORMATS

Hope Tobin[1], Layla Rao[1], Tala Brewster[1], Elizabeth Race[1]; [1]Tufts University — Accumulating evidence suggests that learned associations between stimuli and responses (S-R bindings) as well as stimuli and decisions (S-D bindings) make significant contributions to the behavioral and neural facilitation observed in repetition priming paradigms (Henson et al., 2014). An important outstanding question is how factors such as stimulus format influence the magnitude of these associative learning contributions to priming. While prior evidence suggests that associative learning impacts priming for both stimuli presented as pictures and stimuli presented as words (Horner and Henson, 2011), the magnitude of neural facilitation in left inferior frontal regions during priming is reduced for pictures compared to words, potentially reflecting differential analysis of semantic information across stimulus formats and a greater contribution of facilitated perceptual processes for pictures (Wager et al., 1997). If this is the case, it follows that the magnitude of associative learning contributions to priming may be reduced for stimuli presented as pictures compared to stimuli presented as words. The current study investigated this possibility by having participants perform a semantic classification priming task in which critical stimuli were presented as either pictures or words. A robust associative learning effect was observed for stimuli presented as pictures as well as stimuli presented as words. Importantly, the magnitude of this associative learning effect was not reduced for pictures compared to words. These results reveal that associative learning makes similar contributions to repetition priming across distinct stimulus formats and emphasize the broader impact of learned associations on behavior.

F127

SYMBOLIC NUMBER RECOGNITION ACROSS TASKS: AN EVENT-RELATED POTENTIAL STUDY OF THE EFFECT OF INCIDENTAL REPETITION

Danielle Dickson[1], Kara D. Federmeier[1]; [1]University of Illinois at Urbana-Champaign — Do symbolic numbers contact their semantics (information associated with them in long-term memory) using mechanisms similar to those for semantic access of words? We assessed the effect of incidental, delayed repetition on the ERP response to numbers across tasks that vary in levels and types of encoding processes. Of particular interest is whether the effect of symbolic number repetition resembles the N400 facilitation seen for other potentially meaningful visual elements (e.g., letter strings) in similar paradigms, or whether numbers elicit an effect that differs in distribution or emerges on a different (earlier/later) component entirely. Task demands influence repetition effects in the language domain, and we suspected that the same should be true of symbolic digits. We presented the critical items (double-digit numbers) in three task contexts, with the critical number always followed by a task-specific probe that required a response. The probes require attention to have been paid to different properties of the critical numbers (physical characteristics, semantic value, or arithmetic knowledge). We find that symbolic numbers elicit repetition effects that are both sensitive to task demands and different from those observed to words. Thus, there are important differences in how symbolic numbers and other potentially meaningful stimuli make contact with long-term memory, as well as differences in how numbers are processed as a function of the particular demands of a task.

F128

EFFECTS OF EMOTIONAL VALENCE ON REPETITION SUPPRESSION DURING A RECOGNITION MEMORY TASK

Sarah Kark[1], Scott Slotnick[1], Elizabeth Kensinger[1]; [1]Boston College — Repetition suppression (RS) effects are reflected by reduced activation upon repeated presentation of a stimulus. While earlier studies have shown greater RS of the amygdala, prefrontal cortex, and visual processing regions for emotional items compared to neutral items, others have reported no emotional modulation of amygdala RS effects. We investigated the effect of valence on repetition effects during a recognition memory task. While undergoing fMRI, twenty-four participants studied negative, positive, or neutral images (i.e., they viewed each line-drawing outline immediately followed by the complete

photo) and then performed a recognition memory test in which they distinguished studied from nonstudied line-drawings. For each line-drawing, participants made an old-new recognition judgment and followed by a sure-unsure confidence rating. RS effects were identified using a parametric approach to identify regions that showed a reduction in activity from high-confidence (HC) CRs, to low-confidence (LC) CRs, to LC Misses, to HC Misses. Consistent with prior research, RS effects were revealed in the PFC, visual processing regions, and the amygdala, and follow-up analyses showed no emotional modulation of RS effects in the majority of these regions. When analyses queried for valence-specific RS effects, the orbital frontal cortex showed greater RS effects for negative items compared to neutral items. No RS effects were specific to positive valence. The present study confirms the utility of using recognition memory paradigms to examine unconscious influences within emotional memory and offers novel evidence for a nonconscious memory signature in the OFC for negative visual stimuli.

PERCEPTION & ACTION: Audition

F129

NEURAL ENTRAINMENT TO THE BEAT: THE "MISSING PULSE" PHENOMENON

Idan Tal[1], Eshed Rabinovitz[1], Charles Schroeder[2,3], David Poeppel[4], Edward Large[5], Elana Zion Golumbic[1]; [1]Bar Ilan University, Israel, [2]Nathan Kline Psychiatric Institute, USA, [3]Columbia University Medical Center, USA, [4]New York University, USA, [5]University of Connecticut, USA — Humans perceive music as having a regular pulse marking equally spaced time-points within which the musical notes are organized. Moreover, an automatic and unique human response when listening to music is to move to the beat. The Neural Resonance Theory (NRT; Large 2008) proposes a computational model for how a periodic representation of a pulse may be induced from non-periodic stimuli through non-linear coupling between two oscillating systems. The goal of this study was to determine whether there is evidence for pure neural entrainment to the pulse, beyond the frequencies present in the stimuli themselves. Using MEG, we recorded neural activity from human participants listening to syncopated rhythms engineered such that a perception of a pulse emerges yet does not exist in the acoustics' spectrum. We found that in addition to mirroring the spectrum of the acoustics, the neural response showed clear peaks at the pulse frequency, even though the stimuli did not contain energy at this frequency. Moreover, the power of the pulse frequency peaks correlated with the subject's ability to tap to the pulse, linking this response directly to pulse perception rather than stimulus properties. Source localization revealed clear peaks at the pulse frequency in primary auditory regions bilaterally. These results support the NRT model and provide evidence for neural entrainment to the pulse, beyond the sensory representation of the stimulus, which may arise through coupled auditory oscillators resonating at the pulse frequency.

LONG-TERM MEMORY: Priming

F130

BRAIN MECHANISMS OF WORD-SPECIFIC REPETITION EFFECTS ON EARLY STAGES OF VISUAL WORD RECOGNITION

Chun-Hsien Hsu[1], Chia-Ying Lee[1]; [1]Academia Sinica — Previous ERP/MEG studies have demonstrated the enhancement of the P2 activity for repetition of words, but not to pseudowords. The word-specific repetition effect on P2 suggests that P2 reflects early access to long-term memory representations of words during visual word recognition. This study aims to further examine how orthographic neighborhood size modulates the word repetition effect on P2 and to elucidate brain mechanisms underlying early lexical processing. ERPs were recorded from 27 participants while performing a go-nogo semantic judgment task. The no-go trials consisted of sixty real characters, which were divided into subsets with large and small phonetic combinability (the number of characters sharing the same phonetic radical), and sixty pseudocharacters. The means of the number of strokes and radical combinability were matched between real characters and pseudocharacters. The results replicated the typical repetition effect on P2 for real characters, but not for pseudocharacters. Furthermore, characters with large combinability yielded bilateral P2 repetition effect, while characters with small combinability yielded left lateralized P2 repetition effect. By applying the exact low-resolution brain electromagnetic tomography method, the repetition enhancement effects were localized on the left middle frontal gyrus, the left precentral gyrus, and the right inferior temporal gyrus for high combinability character. For small combinability characters, the repetition enhancement effects were found on the left inferior parietal gyrus, the left inferior temporal gyrus, and the left precuneus. These findings suggest a trade-off between processing efforts and orthographic neighborhood size in word repetition.

F131

SEQUENTIAL PRIMING INFLUENCES MNEMONIC DISCRIMINATION OF SIMILAR OBJECTS IN A DIRECTIONALLY DEPENDENT MANNER

Jared Roberts[1], Krista Kernodle[1,2], Jessica Noche[1], Elizabeth Murray[1], Michael Yassa[1]; [1]University of California, Irvine, [2]University of Michigan — Computational models describing sequence memory such as the temporal context model and others predict that activation of a memory also activates temporally proximate memories. Prior work by our lab has been guided by a model of the hippocampal DG/CA3 network as supporting multi-domain pattern separation/completion. We applied this model to an investigation of the temporal aspects of memory encoding and retrieval using a variation of a well-established mnemonic discrimination task. During the basic task, participants undergo an incidental encoding phase in which they are shown everyday objects and are asked to make a category judgment. Following encoding, they undergo a recognition memory test, where they are shown repetitions (targets), novel foils, and similar lures (to tax pattern separation). To test the effect of sequential priming, we examined discrimination performance during test on similar lures that were presented following three different types of target cues. The first was the same target that immediately preceded the similar object seen during encoding (FORWARD). The second was the target that immediately followed the similar object seen during encoding (REVERSE). The third was an out of sequence target (RANDOM). We predicted that sequential priming would activate the similar object's neural representation thus increasing interference and biasing the network towards pattern completion. Accordingly, we found reduced lure discrimination in the FORWARD condition. However, we found that REVERSE priming facilitated lure discrimination. We discuss these results in the context of sequence memory, neural prediction, and models of the DG/CA3 network as a multi-domain pattern separation/completion network.

METHODS: Electrophysiology

F132

LOCALIZING THE NEURAL SIGNATURES OF TARGET DETECTION: AN ELECTROCORTICOGRAPHY STUDY

Julia W. Y. Kam[1], Sara M. Szczepanski[1], Ryan T. Canolty[2], Adeen Flinker[3], Kurtis I. Auguste[4,5], Nathan Crone[6], Heidi Kirsch[5], Rachel A. Kuperman[4], Josef Parvizi[7], Robert T. Knight[1]; [1]University of California, Berkeley, [2]University of Houston, [3]New York University, [4]Children's Hospital and Research Center, [5]University of California, San Francisco, [6]Johns Hopkins University, [7]Stanford University — Although the temporal dynamics and spatial distribution of the scalp EEG response to goal-relevant events are well established, the electrophysiology and neuroimaging literature provide conflicting evidence for the specific neural contributions to this target detection process. Specifically, scalp EEG studies center the origin of the P3b ERP component in temporal-parietal cortex, whereas numerous fMRI studies reported increased activation in both frontal and parietal cortices. Our study aims to account for this discrepancy by examining the sources that give rise to the target detection process using electrocorticography (ECoG). To address this question, we recorded ECoG activity directly from the surface of the human cortex in 13 patients undergoing pre-surgical monitoring for intractable epilepsy, as they performed a target detection task in either the auditory or visual modality. We examined the target-related response in two domains: high gamma (HG; 70-150Hz) and the P3b. Across tasks, while a robust increase in HG power to targets relative to non-targets was observed in numerous electrodes over frontal and parietal cortices, fewer electrodes showed larger P3b amplitude to targets than non-targets. Notably, there was minimal overlap in the electrodes that

showed HG and P3b. These results revealed that the target detection process can be characterized by at least two neural markers (i.e., HG & P3b) occurring across numerous distinct locations on the cortex. Our findings suggest that separate neural mechanisms are driving the differential patterns of activity observed in fMRI and scalp EEG studies, highlighting the notion that target detection is not a unitary phenomenon.

F133

SUBSEGREGATION WITHIN THE AUDITORY 'WHAT' STREAM

Chrysa Retsa[1], Pawel J. Matusz[1,2], Jan Schnupp[1,3], Micah Murray[1,4,5,6]; [1]The Laboratory for Investigative Neurophysiology (The LINE), Neuropsychology & Neurorehabilitation Service , University Hospital Center and University of Lausanne, [2]Attention, Brain, and Cognitive Development Group, University of Oxford, [3]Department of Physiology, Anatomy and Genetics, University of Oxford,, [4]EEG Brain Mapping Core, Center for Biomedical Imaging (CIBM) of Lausanne and Geneva, [5]Department of Hearing and Speech Sciences, Vanderbilt University, [6]Department of Ophthalmology, University of Lausanne, Jules-Gonin Eye Hospital — Distinct anatomical and functional pathways are postulated for analysing a sound's object-related and space-related information (i.e. and antero-ventral pathway for 'what' and postero-dorsal pathway for 'where'). Most studies have focused on this 'what' vs. 'where' distinction. It remains unresolved to what extent there are dedicated brain resources for the processing of specific object-related dimensions. To address this topic, we recorded high-density auditory evoked potentials (AEPs) while participants discriminated sounds according to their pitch, speaker identity, uttered syllable or their location (i.e. 3 'what' conditions, 1 'where' condition). The to-be-discriminated dimension was varied across blocks; sound acoustics were held constant. AEPs were analysed within an electrical neuroimaging framework to differentiate modulations in response strength from modulations in response topography; the latter of which forcibly follow from changes in the configuration of underlying sources. In this way, we investigated how selective attention modulates brain responses both between 'what' and 'where' feature dimensions and also across specific 'what' feature dimensions. There were no differences in performance across feature dimensions. As early as 80ms post-stimulus onset, the AEP topography significantly differed between 'what' and 'where' conditions, replicating prior works. Critically and for the first time, we show that AEP topographies also differed across 'what' conditions, supporting there being functional subsegregation within the auditory 'what' pathway. These differences may constitute the neural substrates by which we are able to attend to and extract specific information in complex auditory scenes, such as when listening out for someone talking about you at a conference.

F134

EARLY AUDITORY BRAINSTEM RESPONSES TO SPEECH SOUNDS IN PARKINSON'S DISEASE

Fatemeh Mollaei[1,2], Douglas M. Shiller[1,3], Shari R. Baum[1,2], Vincent L. Gracco[1,2,4]; [1]Centre for Research on Brain, Language and Music, [2]School of Communication Sciences and Disorders, McGill University, [3]School of Speech-Language Pathology and Audiology, Université de Montréal, [4]Haskins Laboratories — Parkinson's disease (PD), as a manifestation of basal ganglia (BG) dysfunction, is associated with a number of speech deficits, including reduced voice modulation and vocal output. Interestingly, previous work has shown that the compensatory response to altered auditory-feedback of vocal pitch (fundamental frequency) in PD participants is associated with an enhanced response relative to control participants. Moreover, the detection of pitch differences is enhanced in PD when participants are monitoring their own speech output. The origin of this enhanced perceptual and motor response to pitch alterations remains unclear. Previous studies of auditory evoked cortical responses in PD have provided mixed results. Here we asked whether individuals with PD show an enhanced response at the level of the auditory brainstem during speech processing. We recorded the auditory brainstem response (ABR) to the speech syllable [da] in individuals with PD and age- and gender-matched control participants. Using scalp-recorded ABR, we observed the degree of neural synchrony to the repeated syllable. PD participants displayed a larger auditory brainstem response and an enhancement in the frequency following response related to the fundamental frequency relative to the control group. The current results suggest a BG contribution to early stages of auditory processing in the brainstem and may reflect one component of a sensorimotor processing impairment in PD linked to their enhanced motor and sensory responses to auditory feedback alterations observed in prior studies.

F135

INDEPENDENT CONTRIBUTIONS OF THETA AND DELTA TIME-FREQUENCY ACTIVITY TO THE VISUAL ODDBALL P300

Matthew D. Bachman[1], Edward M. Bernat[1]; [1]University of Maryland, College Park — A growing body of work has begun to demonstrate that the P300 (P3) event-related potential (ERP) component is better understood as a mixture of task-relevant processes (Polich, 2007). This activity is mainly described as two theoretical subcomponents, composed of an early frontocentral salience response, and later centroparietal stimulus evaluation. The P3 subtypes (P3a/P3b) are caused by differing contributions of these subcomponents due to stimulus context. These theoretical subcomponents parallel recent work based on time-frequency (TF) methodology, which finds that the P3 from gambling (Bernat et al., 2015) and go-nogo tasks (Harper et al., 2014) are composed primarily of centroparietal delta (0-3 Hz) activity related to complex stimulus processing and frontocentral theta (3-7 Hz) activity related to salience processing. This study (N = 238) aimed to determine the contributions of these time-frequency components to the visual oddball P3. Delta and theta TF regions of interests were extracted to assess their contributions to the time-domain target and non-target P3, as well as differences between targets and non-targets, target-to-target interval (TTI), and target habituation. Results replicate and extend earlier work indicating that delta and theta account for a majority of variance in both the target and non-target P3, and newly indicates that theta and delta activity can have unique contributions to target – non-target differences, target TTI, and target habituation effects. Findings suggest that both delta and theta are critical components of the P3 whose selective changes can relate to amplitude differences, and could serve as reasonable representations of these theoretical P3 subcomponents.

F136

DECREASED SALIENCE AND CONTROL ACTIVITY DURING INHIBITORY PROCESSING IN COCAINE USERS INDEXED USING EEG TIME-FREQUENCY MEASURES

Anne Tootell[1], Vaughn Steele[2], Selin Aviyente[3], Vince Calhoun[4], Ed Bernat[1]; [1]University of Maryland College Park, Department of Psychology, [2]Intramural Research Program, Neuroimaging Research Branch, National Institute of Drug Abuse, National Institutes of Health, Baltimore, MD, [3]Michigan State University, Electrical and Computer Engineering Department, [4]The Mind Research Network, New Mexico — There is growing evidence supporting a neurobehavioral dual-process model consisting of salience and control systems. The salience system is involved in automatic processing that evaluates the motivational significance of stimuli, while the control system integrates slower, reflective processes with salience input to manage behavior, often recruiting dorsolateral prefrontal regions. Substance use disorders have been hypothesized to result from a decrease in salience system activity toward substance irrelevant stimuli combined with a decrease in control/regulatory systems. Previous work in our group has utilized time-frequency (TF) analyses to demonstrate that theta (3-7 Hz) energy can index salience system activity, medial-lateral TF interchannel phase-synchrony (ICPS) can index control networks, and delta (0-3 Hz) activity is relevant to more complex evaluative processing. The current study investigated theta and delta TF amplitude and theta-band ICPS between medial and lateral prefrontal regions, in subjects with cocaine-use (N=47, M age=41.2, 63% male) and non-using controls (N=90, M age=32.0, 43% male) during a go/no-go task. Consistent with previous go/no-go studies, processes associated with response inhibition were engaged during no-go trials as indexed by increased theta and delta activity and medial-lateral prefrontal functional connectivity, regardless of substance use. Importantly, cocaine users had reduced go/no-go amplitude differences compared to controls in theta and delta activity ($t=6.216$, $t=5.912$, respectively, $ps < .001$), as well as reduced medial-lateral ICPS ($t=2.135$, $p=.038$). These findings suggest that cocaine users remain engaged in the response inhibition task, but have decreased engagement of salience and control systems on no-go trials compared to controls.

F137

REWARD POSITIVITY: EFFECTS OF GAIN, EVEN, AND LOSS CONTEXTS ON EEG TIME-FREQUENCY DELTA

Adreanna Massey[1], Mary Fernandes[1], Edward Bernat[1]; [1]University of Maryland — The role of experimental context has been investigated as an important factor in feedback processing. Previous work has demonstrated that the amplitude of the feedback negativity (FN) depends on the value of the outcome relative to the range of possible outcomes in a given context, not the objective value of the outcome (Holroyd et al., 2004). Time-frequency decomposition techniques have shown that time-domain ERPs are better understood as separable processes in delta (0-3 Hz) and theta (3-7 Hz) (Bernat et al., 2015). Furthermore, recent work has suggested that differences in FN amplitude are due in part to the superposition of a reward positivity (RP) component primarily composed of delta activity (Bernat et al., 2008; Holroyd et al., 2008). The current study assessed whether the role of context in feedback processing is better elucidated using time-frequency analysis. Participants (N=132) completed a modified gambling task, which comprised three contexts (gain, even, and loss) with a best and worst outcome in each context. Time-frequency analysis revealed an interaction between context and outcome in delta ($F(2,130)=44$, $p<.001$), where delta RP amplitude to best outcomes scaled positively with reward value (gain > even > loss). When considered with the worst outcomes (i.e., delta best-worst differences), effects were positively associated with the valence of the context, where the gain context produced the largest difference and the loss context showed no difference. Results suggest that delta scales positively with the objective value of a reward (best outcomes); however, context is influential when considered with the worst outcomes.

F138

P300 AMPLITUDE REDUCTION ACROSS EXTERNALIZING AND INTERNALIZING AS AN INDICATOR OF A GENERAL FACTOR OF PSYCHOPATHOLOGY (P): A PRELIMINARY FINDING

Jessica S. Ellis[1], Matthew D. Bachman[1], Edward M. Bernat[1]; [1]University of Maryland College Park, Department of Psychology, Clinical and Cognitive Neuroscience Lab — A widely accepted representation of psychopathology is a two-dimensional model including externalizing (aggression, substance use, and impulsivity) and internalizing (anxiety and depression) problems. These two dimensions are moderately correlated, and their shared variance has been modeled using a general p factor of psychopathology (Caspi et al., 2013), suggesting p may reflect shared neurobiological markers. Both internalizing and externalizing problems have been associated with P300 amplitude reductions (P3AR) in target and novel stimuli using common oddball tasks, indicating P3AR may index variance associated with p. The current study assessed shared variance between externalizing and internalizing P3AR in the novel condition of a visual oddball task (target effects are the same, but trend-level), and computed a single factor of psychopathology across indicators of externalizing, depression, and anxiety. Subjects (N = 126) completed a three-stimulus visual oddball task, with IAPS pictures serving as novel stimuli. Results replicated significant parietal P3AR relative to novel stimuli in externalizing ($r= -.22$, $p=.013$), depression ($r= -.25$, $p=.005$), and anxiety ($r= -.18$, $p=.040$). All three lose significance when predicting P3 amplitude together in a regression model, reflecting the shared underlying variance in predicting P3. A computed shared-variance p factor, explaining 69.6% of the questionnaire variance, significantly predicted novelty P3 amplitude ($r= -.26$, $t= -2.98$, $p=.004$), mediating the relationship of each constituent questionnaire. The results indicate that P3AR is accounted for by the shared variance within externalizing, depression, and anxiety. This suggests that P3AR may represent a neurobiological indicator of the general p factor of psychopathology.

F139

RELATIONSHIP BETWEEN HEART RATE VARIABILITY AND TIME-FREQUENCY THETA AND DELTA MEASURES DURING AN INHIBITION TASK

Lucy Wang[1], Anne Tootell[1], Ellie Stern[1], Edward Bernat[1]; [1]University of Maryland, College Park — The emerging neurovisceral integration model posits that heart rate variability (HRV) is a peripheral index of neural processes, including executive functioning, attention, and emotion regulation (Thayer, 2000). Past literature has found that decreased HRV during a task compared to baseline HRV (at rest) is associated with anxiety and depression, suggesting lower autonomic reactivity to stress is an important marker of psychopathology. The current study aims to assess the relationship between task HRV and neural correlates. Participants' (N=113) HRV and ERP data were collected during the performance of a response inhibition go/no-go task. ERP data were analyzed using Time-Frequency (TF) approaches to extract theta (3-7 Hz) and delta components (0-3 Hz) from the time-domain ERP. High Frequency (HF) HRV was extracted from EKG data and was indexed using frequency-domain measures (AR and Welch Power). HF-HRV at rest and HF-HRV collected while participants completed the go/no-go task were significantly correlated ($r=.782$, $p=.000$), suggesting that these measures index similar neural processes, yet indicate substantial unique variance. TF-ERP analyses revealed that higher task HF-HRV was correlated with enhanced delta activity on go and no-go trials ($r=.25$, $p=.006$), while HF-HRV was selectively correlated with increased theta activity on no-go inhibition trials ($r=.20$, $p=.035$). Individuals with higher HF-HRV had higher activity in inhibitory processing, suggesting greater engagement in the go/no-go task.

F140

RESTING EEG DYNAMICS: AMPLITUDE AND FUNCTIONAL CONNECTIVITY CHANGES OVER TIME

Mary A. Fernandes[1], Jessica S. Ellis[1], Selin Aviyente[2], Vince D. Calhoun[3], Edward M. Bernat[1]; [1]University of Maryland, College Park, [2]Michigan State University, [3]The Mind Research Network — Recent work has begun to investigate dynamic functional connectivity based on fMRI measures indexing change over time during the resting-state and during tasks. There is a current interest in additional investigation of these dynamics using EEG measures, which could provide valuable insight beyond what has been found with fMRI. The present study assesses dynamic changes in resting state amplitude and connectivity across time in delta (0-3 Hz), theta (3-7 Hz), and alpha (8-15 Hz) frequency bands using time-frequency amplitude (activity) and interchannel phase synchrony (ICPS; functional connectivity) approaches. Participants (N=147) completed a resting-state task which included two two-minute periods, eyes-open and eyes-closed. During the eyes open period, subjects were instructed to focus their gaze on a fixation cross in the middle of a black screen. Results indicate significant modulation of delta, theta, and alpha amplitudes in both conditions over time, specifically showing decreased amplitude over time in theta and alpha frequency bands across frontal and central brain regions during both eyes open and eyes closed ($p<.01$). Analyses of spatiotemporal ICPS activity also highlights dynamic changes in functional connectivity across time in multiple frequency bands for eyes open and eyes closed conditions, including dynamic connectivity between occipital and prefrontal (medial and lateral) regions ($p<.01$). The present findings provide evidence that EEG measures can index functional dynamics of brain systems over time during the resting state, offering new information and motivating the integration of EEG and fMRI measures.

F141

ERP MEASURES OF ACTIVITY AND FUNCTIONAL CONNECTIVITY INDEX PERFORMANCE ON A GO/NO-GO TASK

Andrew Gradone[1], Anne Tootell[1], Matthew Bachman[1], Selin Aviyente[2], Edward Bernat[1]; [1]University of Maryland, College Park, [2]Michigan State University — The current study sought to assess the role of neurophysiological inhibitory processing in performance (reaction time, RT; accuracy, ACC) on a go/no-go task (N=138). Inhibition is particularly relevant to performance in this task because it represents both the implementation of inhibitory processing during no-go trials, and the shift from response execution to inhibition. Recent work from our group has utilized time-frequency (TF) approaches to suggest common go/no-go ERP components are accounted for by unique contributions of activity in the delta (0-3 Hz) and theta (3-7 Hz) ranges. Using TF analysis, we extracted delta and theta amplitude, and theta functional connectivity (based on TF interchannel phase-synchrony; ICPS). Results showed that longer RT was associated with greater theta energy ($r = .43$, $p < .001$), delta energy ($r = .34$, $p < .001$) and ICPS between medial and lateral prefrontal cortical regions ($r = .39$, $p < .001$) on no-go trials. Although this effect was also observed on go trials, these correlations were accounted for by activity on no-go trials using regression analyses, suggesting the effect lies mainly within the processes involved in the no-go trials. Increased medial-lateral frontal functional connectivity during inhibitory no-go processing is also consistent with an increase in executive control during the switch to inhibi-

tion from execution. Broadly, greater no-go inhibitory activity (amplitude and ICPS) was associated with lower performance (longer RT and lower ACC), suggesting the multiple processes indexed during inhibitory processing are important for understanding behavioral task performance.

PERCEPTION & ACTION: Multisensory

F142

BEYOND MODALITIES: INTEGRATING MULTISENSORY INFORMATION ACROSS DIFFERENT REFERENCE FRAMES

Yuqi Liu[1], Jared Medina[1]; [1]University of Delaware — When integrating inputs from multiple modalities to form a single percept, information is weighted based on the precision of each input. Are multisensory representations within different reference frames also weighted based on the strength of each representation? To address this question, we placed participants' hands in a mirror box with the hidden hand 6" from the mirror, and the viewed hand next to the mirror. The two hands were in opposite postures (palm up, palm down), and we asked participants to move their fingers in a spatially congruent (e.g. simultaneous upward/downward movement) or motorically congruent (e.g. simultaneous flexion/extension) manner for 60 seconds. To assess multisensory integration, we measured the sense of ownership and perceived limb position of the hand behind the mirror. In Experiment 1, we examined multisensory integration during one- and four-finger movements. We found significantly more multisensory integration for externally congruent versus motorically congruent one-finger movements, with no difference for four-finger movements. In Experiment 2, we increased the amount of motor outflow by having participants fully flex/extend all of their finger joints. Interestingly, ownership ratings were significantly higher for motorically versus spatially congruent movements. These findings suggest that in multisensory integration, multisensory representations in different reference frames are dynamically weighted based on the strength of information from each reference frame.

F143

THE NEURAL SUBSTRATES OF HAND GESTURE COMPREHENSION: EVIDENCE FROM A QUANTITATIVE META-ANALYSIS STUDY

Jie Yang[1], Michael Andric[2], Mili Mathew[3]; [1]ARC Center of Excellence in Cognition and its Disorders, Department of Cognitive Science, Macquarie University, Australia, [2]Center for Mind/Brain Sciences (CIMeC), University of Trento, Italy, [3]ARC Center of Excellence in Cognition and its Disorders, Department of Linguistics, Macquarie University, Australia — Hand gestures along with speech convey meaning during face-to-face communication. Although previous research has pinpointed the neural substrates for gesture comprehension, these findings are inconsistent due to different types of gestures (e.g., iconic gestures, metaphoric gestures, and beats) and various task demands (e.g., passive viewing, semantic judgment, and memory tasks). The current activation likelihood estimation meta-analysis investigated the brain networks underpinning gesture comprehension while considering the impact of gesture type (co-speech gestures vs. speech-independent gestures) and task demand (implicit processing vs. explicit processing). The meta-analyses of 31 fMRI studies showed that comprehending gestures involved three networks: a perceptual-motor network responsible for action understanding and consisted of premotor-parietal areas (bilateral dorsal and ventral premotor cortices and bilateral inferior parietal lobule) and superior temporal sulcus; a semantic network involved in the conceptual processing of gestures and consisted of posterior middle temporal gyrus and inferior frontal gyrus (BA 45); and a social cognitive network involved in the processing of emotive information of gestures and consisted of inferior frontal gyrus (BA 47), insula and putamen. These findings highlight the complexity of the neural substrates for gesture comprehension, and suggest that future research is necessary in order to clarify the dynamic interactions among these networks.

F144

ERP SEARCH FOR A CAUSE OF THE SIMILARITY OF QUALIA ASSUMED ACROSS INDIVIDUALS

Bruno Debruille[1,3,4], Sheila Bouten[1], Hugo Pantecouteau[2]; [1]Douglas Mental Health University Institute, Montreal, QC, Canada, [2]École Normale Supérieure de Lyon, Lyon, 69007, France, [3]Department of Psychiatry, McGill University, Montreal, Qc, Canada, [4]Department of Neurology and Neurosurgery, McGill University, Montreal, QC, Canada — We function as if we were perceiving the world as it really is. We believe we capture colors, sounds and smells that exist in our environment. This belief persists despite the failure to find corresponding qualities in the outside world, where just lengths of electromagnetic and air pressure waves can be measured and molecules identified. We keep our belief even knowing that electromagnetic, acoustic and chemical signals are all transformed into something completely different, namely, into nerve impulses that are processed by the brain. Seeing our perceptual world as an original creation emerging from this processing continues to be difficult even though we know, from our dreams, that brains can make up scenes. This difficulty could be due to one of the consequences of this creation idea: the immense difference that could then exist between perceptual worlds across individuals; a consequence that appears instantly wrong since we successfully interact with others assuming that they are in a world similar to ours. But then, how could that similarity exist when perceptual worlds are created by different brains, which, when processing stimuli, do not influence each other? To check such an absence of influence, we recorded the event-related brain potential (ERPs) elicited by IAPS stimuli in 16 pairs of closely related persons (32 partners) who were side by side and processed separately stimuli that occurred simultaneously. We found that the activity of the brain triggered by stimuli had a statistically significant impact on the N400- and P600-ERP of the partner.

F145

CHANGES IN CORTICAL FUNCTIONAL CONNECTIVITY FOR AUDIOVISUAL SPEECH PERCEPTION ASSOCIATED WITH HEARING AID USE WITH OR WITHOUT AUDITORY TRAINING

Luodi Yu[1], Aparna Rao[2], Yang Zhang[1], Phillip C. Burton[3], Dania Rishiq[4], Harvey Abrams[5]; [1]University of Minnesota, Minneapolis, MN 55455, [2]Department of speech and hearing sciences, Arizona State University, Tempe, AZ, 85287-0102, [3]Office of the CLA Associate Dean for Research, University of Minnesota, Minneapolis, MN 55455, [4]Department of Otorhinolaryngology, Mayo Clinic, FL, [5]Starkey Hearing Technologies, Eden Prairie, MN 55344 — This event-related fMRI study investigated changes in cortical functional connectivity in hearing aid users. Our experimental protocol relied on the well-known McGurk effect of hearing /da/ from visual articulation of /ga/ dubbed with the /ba/ sound. Previous research has shown stronger connectivity between areas for multimodal integration (i.e., superior temporal sulcus, STS) and unimodal regions (Nath et al., 2012) in McGurk perceivers than non-perceivers. Participants in our preliminary study were two adults with moderate hearing loss who were first-time hearing aid users. A structured auditory training program, ReadMyQuips™ (RMQ), was applied, targeting audiovisual speech perception. After 4 weeks of hearing aid use, the experimental participant received RMQ training for 4 weeks. The control participant used hearing aids for 8 weeks and did not receive the training. Identical fMRI tests were administered at pre-fitting and post-training to assess effects related to hearing aid use with or without RMQ training. An independent functional localizer was used to identify unimodal regions of interest (ROIs) including voxels within auditory and visual cortex, and a multimodal ROI within posterior STS. Enhanced connectivity between unimodal ROIs and the multimodal ROI was observed at posttest compared to pretest in both participants, with greater magnitude of change observed in the trained experimental participant. The results show initial evidence of facilitation for audiovisual speech perception from hearing aid use with additional benefit from the RMQ training program.

F146

MULTISENSORY SPEECH PERCEPTION IN NOISE: A SEX-LINKED AUTISM SPECTRUM ENDOPHENOTYPE

Victor A. Del Bene[1], Lars A. Ross[1], Sophie Molholm[1], John J. Foxe[2]; [1]Albert Einstein College of Medicine, [2]University of Rochester School of Medicine and Dentistry — Children with an Autism Spectrum Disorder (ASD) are significantly impaired in their ability to integrate multiple sensory inputs, and this is particularly pronounced for audiovisual speech. The clear relevance of audiovisual language abilities for social communication and the magnitude and the early emergence of this impairment in ASD, raises questions about its role in the disease process and whether it might represent a behavioral endophenotype of genetic

liability. Here we investigated whether unaffected siblings of children diagnosed with ASD showed a deficit in the ability to benefit from visual speech signals during speech perception in noise. We hypothesized that if this represents a behavioral endophenotype, unaffected first degree relatives should show performance deficits relative to healthy controls, due to inherited genetic liability, but not as severe as ASD children. Based on our recent finding of a sexual dimorphism on this task, we also explored the specificity of this behavioral endophenotype to (male) sex. To test our hypotheses we compared audiovisual speech perception of 26 unaffected siblings, 63 children with ASD, and 121 typically developing children between the ages of 5 and 15 years. In line with our prediction, male siblings showed impaired audiovisual speech perception. This level of impairment was intermediary between males with an ASD and neurotypical controls. In contrast, female siblings' performance was not distinguishable from female controls. These findings suggest that audiovisual speech perception is affected by genetic liability to develop ASD. This effect is pronounced in male siblings and may therefore represent a sex-linked behavioral endophenotype.

F147

INFERIOR FRONTAL OSCILLATIONS REVEAL VISUO-MOTOR MATCHING FOR ACTIONS AND SPEECH: EVIDENCE FROM HUMAN INTRACRANIAL RECORDINGS

Pär Halje[1,2], Margitta Seeck[3], Olaf Blanke[1,3], Silvio Ionta[1,4]; [1]Laboratory of Cognitive Neuroscience, Ecole Polytechnique Fédérale de Lausanne (EPFL), Switzerland., [2]Integrative Neurophysiology and Neurotechnology, Department of Experimental Medical Sciences, Lund University, Sweden., [3]Presurgical Epilepsy Evaluation Unit, Department of Neurology, Geneva University Hospital (HUG), Switzerland., [4]The Laboratory for Investigative Neurophysiology (The LINE), Department of Radiology and Department of Clinical Neurosciences, University Hospital Center and University of Lausanne, Switzerland. — Exploiting electrocorticography recording in awake humans, this article focuses the multimodal representation of actions. The direct, even though partial, correspondence between the neural systems responsible for the observation and execution of actions has been reported in non-human primates since the original description of so-called "mirror neurons" in the ventral premotor cortex of the macaque brain (area F5). Based on intracranial electrophysiology and surface electroencephalography, similar visuo-motor matching systems have been hypothesized in humans. Given the homology between the monkey area F5 and Broca's area (inferior frontal gyrus, IFG) in the human brain, IFG is the best candidate for grounding this action visuo-motor matching system in humans, further extending to language. Yet, the direct comparison between visual, motor, and linguistic representations of actions was still missing. Here we provide for the first time evidence for comparable mu-rhythm suppression in IFG during observation, execution, and verbal description of the same action. We recorded intracranial local field potentials with implanted subdural electrode grids covering frontal, parietal, and temporal regions. During the data recording participants observed an experimenter performing an action (visual condition), performed the same action themselves (motor condition), and verbally described the action (language condition). Results showed that IFG activation was present for all the conditions, no matter the modality (observation, execution, language), and independent of oro-facial movements. By showing visuo-motor-language matching systems for action representation, the IFG exhibit the typical pattern of mirror activity. These data support the notion of a multimodal representation of actions further extending to language processes.

F148

CAN'T FIGHT THIS FEELING: ACCESS TO SEMANTIC KNOWLEDGE OF GRASPABLE OBJECTS IS INFLUENCED BY SOMATOSENSORY PRIMING

Chelsea Ekstrand[1], Eric Lorentz[1], Layla Gould[1], Marla Mickleborough[1], Ron Borowsky[1]; [1]University of Saskatchewan — Embodied cognition theories assert that the sensorimotor system plays a functional role in the semantic processing of graspable objects. Previous research has indicated that motor tasks have the ability to interfere with object processing and that motor information contributes to semantic processing depending on specific learning experience. While this research suggests that the motor system is involved in object processing, involvement of the somatosensory system has remained relatively unexplored. Therefore, we developed a novel somatosensory priming paradigm. In Experiment 1, participants received a vibratory hand prime (on half the trials) prior to viewing a picture of either a graspable (e.g., a razor) or non-graspable (e.g., an elephant) object and reported how they would interact with it. In Experiment 2, non-graspable objects were replaced with 'foot' objects (objects with easily identifiable foot related affordances; e.g., a soccer ball). In both experiments, somatosensory priming effects on reaction time arose for the graspable objects, while the non-graspable and foot objects showed no priming benefits. These results suggest that semantic knowledge of objects includes contributions from the somatosensory system. As well, we provide clear evidence that pure somatosensory contributions can aid object processing even in the absence of motor execution.

F149

THE BINDING PROBLEM 2.0: MULTISENSORY INTERACTIONS REVEAL MECHANISMS OF CATEGORY-SPECIFIC OBJECT PROCESSING

Pawel J. Matusz[1,2], Antonia Thelen[1,3], Joseph Nour[1], Jean-Francois Knebel[1,4], Celine Cappe[1,5], Micah Murray[1,3,4,6]; [1]The Laboratory for Investigative Neurophysiology (The LINE), University Hospital Centre and University of Lausanne, Switzerland, [2]Attention, Brain, and Cognitive Development Group, University of Oxford, UK, [3]Vanderbilt University, Nashville, TN, USA, [4]EEG Brain Mapping Core, Center for Biomedical Imaging (CIBM), Lausanne, Switzerland, [5]Centre de Recherche Cerveau & Cognition - UMR5549, Toulouse, France, [6]Jules-Gonin Eye Hospital, University of Lausanne, Switzerland — Object recognition is a staple of goal-directed behaviour in real-world environments, but its mechanisms remain unclear. Traditional, unisensory studies revealed that categorical boundaries are an organising principle of how the brain represents objects, but the dynamics whereby these representations are discriminated seem surprisingly slow (~150ms post-stimulus). Real-world environments are multisensory in nature, and the facilitatory influence of multisensory integration on stimulus processing is well-established. We assessed whether multisensory processes and their neural mechanisms (160-channel EEG) vary across object categories. Participants categorised sounds, drawings or auditory-visual pairs of environmental objects in a living/man-made go-nogo task. Behavioural analyses revealed no multisensory benefits, besides overall performance benefits for living objects. Multisensory benefits were, however, observed, when analyses were performed at a subordinate level within the living-object category (conspecifics, mammals, birds). Only perception of conspecifics showed multisensory facilitation. At the brain level, multisensory interactions differed across both the ordinate as well as subordinate object categories. Interactions in ERP topography occurred early (<100ms post-stimulus) for living but not for man-made multisensory objects. At the same early latency, interactions in ERP strength differed in polarity between conspecifics and non-human mammals; i.e., sub-additive for conspecifics and super-additive for other living objects. First, our results provide empirical evidence that in multisensory environments the identification of conspecifics is more efficient. More generally, we provide the first evidence that object categorization is accomplished faster in multisensory environments. This opens the possibility that in real-world environments object recognition occurs via the fusion of semi-extracted object attributes from each of the senses.

F150

THE INTERACTING RHYTHMS BETWEEN PERCEIVED AND PRODUCED SPEECH

M Florencia Assaneo[1], David Poeppel[1,2]; [1]Department of Psychology, New York University, [2]Max-Planck-Institute, Frankfurt — The classical approach to study the sensorimotor integration of speech is through exploring the inhibitory/excitatory effect that motor and auditory cortices exert on each another. Here we propose a shift in this paradigm: we aim to characterize the interaction of those brain regions by examining the relationship between the rhythms of perceived and produced speech. More specifically, we developed a psychophysical and an MEG protocol to investigate the coupling between the phases of the slow oscillations in motor and auditory cortices. In a psychophysical experiment, subjects are instructed to continually repeat a set of three syllables, while their auditory feedback is blocked and replaced with a manipulated, 'alien' voice pronouncing a different set of syllables at a fixed rate. We observe that synchronization between heard and produced speech occurs only when the externally imposed syllable rate is close to participant's own rate. We designed an MEG protocol to identify the neural substrates of the synchronization. First,

a source localization protocol was employed to localize each subject's motor and auditory cortical regions. Second, the MEG signals originating in those areas - while hearing syllables at different rates - are extracted and evaluated for synchronization. We found that synchronization occurs for just a narrow range of rates, as in the psychophysical experiment. The specific features of the coupling between the produced and perceived speech invite the hypothesis that the motor and auditory cortices behave as two weakly coupled phase oscillators. This coupling could be crucial at the early stages of speech development.

F151

DECODING GRAPHEME-COLOR SYNESTHESIA USING MULTIVARIATE PATTERN ANALYSIS

Radhika Gosavi[1], Emma Meyering[1], Nathan Rose[1], Bradley Postle[1], Edward Hubbard[1]; [1]University of Wisconsin- Madison — Synesthesia is a condition in which the stimulation of one sensory modality evokes experiences in a second, unstimulated modality (for a review, see Simner & Hubbard, 2013). In the "grapheme-color" variant, synesthetes reliably, automatically experience a specific color when viewing black-and-white graphemes. Previous neuroimaging studies using univariate analyses have shown that synesthesia is associated with activity in color areas (for reviews, see Hubbard, 2013; Rouw et al., 2011). However, these approaches are inherently unable to address a question of fundamental theoretical interest: Is the subjective experience of synesthetic color generated by the same, or different, neural processes from those that support the perception of veridical color? We have addressed this question using multivariate pattern analysis (MVPA) by first training a classifier to discriminate neural patterns evoked by the visual perception of four different color patches, then decoding activity from separate scanning blocks during which six synesthetes and six nonsynesthetes viewed the four letters associated with each of the four colors. We included voxels within V1-V4 in the posteromedial ROI and within downstream extrastriate areas in the anterolateral ROI. Our classifier was able to classify color significantly above chance in both ROIs for synesthetes and nonsynesthetes, but decoding generalized to letters significantly above chance only for synesthetes, and only in the anterolateral ROI. These findings suggest that the synesthetic experience of color may be generated by the same mechanisms that support the visual perception of color. We are currently extending these results using representational similarity analysis (RSA) and searchlight procedures.

F152

DRAWING MUSIC: AN ANALYSIS OF VISUAL REPRESENTATION OF MUSICAL SOUNDS

Natalie Callahan[1], Zoe Bertz, Ferrinne Spector; [1]Edgewood College — In the realm of audio-visual integration, we have moved beyond the question of whether auditory and visual stimuli are consistently associated and into exploration of how information is represented across domains. The purpose of this study is to further explore how the elements of an auditory stimulus reliably relate to visual elements across individuals. To this end, we recruited non-synesthetic adults (N = 40) and audio-visual synesthetic adults (N = 20) (who actually have visual experiences in response to music). All participants responded to musical sounds by drawing their associations or experiences using a box of 120 crayons and plain poster board. Participants listened to five 10-second clips of recorded instrumental music and drew what they best associated with each music clip. Drawings were analyzed for abstract and non-abstract form constants (Kluver, 1929), shape, and color relating to pitch and rhythm. In all participants, we found form constants present in across visualizations. However, we found other shapes not categorized as form constants - providing evidence of the need to expand our vocabulary of form constants. We also found similarities in shapes and colors in response to pitch and rhythm. These results give credence to the hypothesis that sensory information can be reliably translated across domains. Taken together, these results add to the evidence that multisensory mapping is the norm and conscious awareness of it is experienced on a spectrum with everyone potentially capable of providing a window into the neural architecture underlying multisensory integration.

F153

ALPHA BAND ACTIVITY AS A MEASURE FOR ASSESSING THE IMPACT OF LIP-READING ON THE PERCEPTION OF ACOUSTICALLY DEGRADED SPEECH

Stanley Shen[1], Jess Kerlin[1], Antoine Shahin[1]; [1]University of California, Davis — Natural speech is more difficult to process in adverse listening situations; however, listening effort decreases when the listener has access to visual information via lip-reading. As alpha band (8-14 Hz) suppression in electroencephalography (EEG) is associated with neural engagement in perceptual and cognitive tasks, we sought its use as an indicator of listening effort during audiovisual speech perception. We hypothesized that acoustic degradation leads to greater listening effort, as reflected in greater alpha band suppression; meanwhile, clear video of lip movement, which provides linguistic context to functionally restrict auditory processing, reduces listening effort and thus alpha band suppression. In this study we presented normal hearing subjects with video clips of a male speaker uttering common monosyllabic English words that refer to either an animate or inanimate object. In each video clip, clear or 24-channel vocoded speech sound was paired with clear or blurred lip movement, producing four different audiovisual conditions. EEG was acquired during an auditory oddball lexical-semantic task, in which the participants responded to the animate/inanimate oddball word while listening and fixating on the mouth area. Data were aligned to the acoustic onset of each word. Event-related time-frequency analysis using wavelet transform shows greater post-stimulus alpha suppression in vocoded versus clear audio conditions in posterior channels, suggesting increased auditory involvement when acoustic information is degraded. However, clear versus blurred visual information did not consistently reduce alpha suppression in response to vocoded speech, perhaps reflecting individual differences in the stage at which visual information impacts auditory speech restoration.

F154

HAZARD RATE MODULATES REACTION TIME TO AUDITORY AND VISUAL STIMULI IN A PROBABILITY LEARNING TASK

Matthias Grabenhorst[1], Cornelius Abel[1], Wolff Schlotz[1], Vera Dehmelt[1], David Poeppel[1,2]; [1]Max Planck Institute for Empirical Aesthetics, Frankfurt, Germany, [2]New York University, New York, NY, USA — Anticipating the timing of salient events is crucial for successful interaction with the environment. Recent quantitative research demonstrates that the analysis of temporal cues embedded in sensory information is based on representing elapsed time and on calculating the probability of an event (formalized by the hazard rate, HR) (Janssen and Shadlen, 2005). It is unclear whether sensory input modality affects these computations. In a series of psychophysical experiments, participants' reaction times (RTs) to auditory and visual stimuli were recorded. The temporal trial structure was the same in auditory and visual blocks and consisted of 'ready', 'set' and 'go' cues. The waiting time between 'set' and 'go' cues was drawn randomly from a fixed probability distribution. Participants were asked to react as fast as possible to the 'go' cue. To analyse the relationship between RTs and HR of the presented distribution within and across modalities, we fitted a mixed-effects multi-level regression model. The HR was robustly predictive of the RTs. The model identified a significant mean difference of RT modulation between visual and auditory modalities: the average response to visual stimuli was slower compared to auditory stimuli. Importantly, HR modulated RT, indicating that participants learned the probability distribution encoded in the trial structure. Although the effect was more pronounced in the auditory modality, our data suggest that calculating hazard rate may be one basic computation in probability learning in both sensory modalities.

PERCEPTION & ACTION: Vision

F155

CORTICAL SPECIALIZATION FOR DIFFERENT TYPES OF INFORMATION ABOUT LETTERS CAN BE REVEALED BY MULTIVARIATE, BUT NOT UNIVARIATE, ANALYSIS OF FUNCTIONAL MRI DATA

Mitchell Valdes Sosa[1], Jorge Iglesias[1], Marlis Ontiveiro[1], Agustin Lage[1], Gong Jinnan[2], Dezhong Yao[2]; [1]Cuban Neuroscience Center, Cuba, [2]University of Electronic Science and Technology of China — Cortical specialization for object rec-

ognition has been established by pitting different categories against each other in fMRI activation studies. Here we show that multivariate pattern analysis (MVPA) can reveal specialization for different types of abstract information derived from the same set of visual objects (in this case letters). Letter identity recognition depends on neural coding which discard variations in physical layout (such as position and size) that nevertheless are used by attention and when assembling higher-order reading units. We used MVPA of responses to compound figures that allowed dissociation of letter identity and format (i.e. hierarchical level) to examine which cortical areas carry each type of information. Although many areas carried both, abstract-letter identity dominated in the lateral posterior fusiform and inferior occipital gyri, whereas abstract-level information dominated areas in more medial ventral temporal cortex. Unexpectedly, abstract letter identity was found in the foveal representation of V1, which is inconsistent with conceiving the role of this area as only dedicated to simple visual feature detection. The interaction of these two sub-systems could be important in guiding the process of reading. More generally, these studies show how MVPA plays a complementary role to traditional activation studies in revealing cortical specialization for different types of abstract information.

F156

AN ERP INVESTIGATION INTO ATTENTION RESTORATION THEORY

Alexis Porter[1], Salif Mahamane[2], Allison Hancock[3], Nicholas John Alexander Wan[4], Kerry Jordan[5]; [1]Utah State University — Attention Restoration Theory (ART) suggests certain features within different environment types (natural or built) can best help restore attention (Kaplan & Kaplan, 1989). In several different cognitive studies, natural environments have specifically been found to possess greater restorative features than built environments (Akbar, 2011; Berman et al, 2008; Kaplan, 1995), but very few studies have investigated ART from a neural perspective (Aspinall et al, 2013). We investigate ART through event-related potentials, specifically predicting a lesser positive P300 potential and also lesser late positive potential (LPP) for oddball stimuli presented within nature-immersed stimulus streams vs built-immersed stimulus streams. Lesser positive potential for either P300 or LPP would contribute to a faster return to baseline, suggesting faster attention restoration for immersion in natural environments than built environments. Sixty adult participants passively viewed a set of images. One block contained 80 nature images with 20 built images; the other block contained 80 built images with 20 nature images. Blocks were counterbalanced across participants. Participants viewing oddball stimuli in nature-immersed image streams showed a lesser LPP than when viewing oddball stimuli in a built-immersed image stream. This is some of the first neural evidence for ART, in which attention may be more quickly restored when immersed in natural environments as opposed to built environments.

F157

INTERDEPENDENT MECHANISMS FOR PROCESSING THE GENDER AND EMOTION OF A FACE? THE SPECIAL STATUS OF ANGRY MALE FACES

Daniel Harris[1], Vivian M. Ciaramitaro[1]; [1]Developmental Brain Sciences, University of Massachusetts Boston — Previous models suggest face features (e.g., gender, ethnicity, emotion) may be processed independently of each other (Bruce & Young, 1986); while other evidence suggests interdependent processing (Haxby, Hoffman, Gobbini, 2000; Ng, Ciaramitaro, Anstis, Boynton, Fine, 2006). We used contingent adaptation to investigate if mechanisms for processing gender and emotion were interdependent. Participants (64; 18females/condition) were either adapted to happy male and angry female faces (Experiment1) or to angry male and happy female faces (Experiment2). For adaptation, we used 15 unique female and 15 unique male faces, happy or angry. For test, we used 4 unique male and 4 unique females faces, morphed along an emotional continuum (80% happy to 80% angry). Participants rated morphed faces as angry or happy in a two-alternative-forced-choice design. To quantify adaptation effects, data were fit with a cumulative normal to determine the point of subjective equality (PSE), the morph supporting 50% performance for each participant pre- and post-adaptation. In Experiment1 we found significant contingent adaptation effects, with male images biased towards angry and female images towards happy ($p < .001$). Interestingly, in the complementary Experiment2 we found no significant contingent adaptation effects, with both male and female images biased towards angry. Our results highlight how interdependent tuning mechanisms may only emerge for certain feature combinations, especially for emotional information, given how maladaptive it is to stop responding to threatening information, with male angry faces being the most threatening. The role societal norms and early exposure have in creating such biases remain important avenues for future work.

F158

LOCATION PRIMING USING FLASH-LAG ILLUSION DEPENDS ON THE PERCEPT, NOT PHYSICAL STIMULUS

Dinara Guliyeva[1], Marjan Persuh[1]; [1]Borough of Manhattan Community College, City University of New York — An influential proposal suggests that response priming is independent of awareness, depends on rapid feedforward sweep of visual information processing and depends on physical characteristics of the stimulus. We tested this hypothesis using a well-characterized flash-lag illusion: when a static stimulus is briefly presented in alignment with a moving stimulus, it is perceived as lagging behind it. This illusion is especially well suited for testing the priming hypothesis for the following reasons: (1) it is very robust, (2) a large body of literature suggests that it is a high-level cognitive illusion and (3) it shows a strong dissociation between physical and perceived location. To prime for location, two horizontal bars, moving downwards or upwards were presented at the center of the display. A dot was then flashed between the bars. When bars were moving downwards, dot position was perceived above the bar and vice versa. Participants made speeded responses to targets, which followed primes and consisted of two static horizontal bars with dot positioned above or below them. If response priming is based on physical characteristics of the stimulus no priming would be expected because dot was spatially aligned with the bars. Our data revealed strong priming, demonstrating that response priming depends on the percept and not the physical characteristics of the stimulus. There was no priming for moving bars alone. Because flash-lag illusion is considered high-level cognitive phenomenon, our data further suggest that visual system rapidly computes perceptual quality of the stimulus, which can affect even fast motor responses.

F159

DOES AVERSIVE CONDITIONING RETUNE HUMAN VISUAL CORTEX?

L. Jack Rhodes[1], Aholibama Ruiz[1], Matt Rìos[1], Thomas Nguyen[1], Brandon Gibb[1], Vladimir Miskovic[1]; [1]SUNY Binghamton — Recordings of single-unit spiking indicate that aversive and appetitive conditioning induce rapid and profound remodeling of sensory receptive fields in many mammalian species. Surprisingly little is known about whether aversive learning can produce similar changes at the population level in human cortex. Here, we sought to address this question by assaying learning-dependent shifts in orientation tuning bandwidths (half-width half-heights [(θ1/2)]) using a combination of visual psychophysics and high-density steady state visual evoked potentials (SSVEPs). Behavioral measures of tuning consisted of just noticeable difference thresholds and error rates from a two-sine wave method while en masse orientation tuning of visual cortex was measured using non-linear SSVEP intermodulation products selective for orientation of counterphase modulated sine wave gratings. Bandwidth narrowing following threat (CS+) relative to safety (CS-) conditioning would constitute evidence for sensory sharpening while broadening would argue in favor of enhanced generalization. The behavioral and SSVEP tuning curves were compared across a sweep of orientation offsets. All subjects had peak electrophysiological and behavioral error response rates between -2 and +2 degrees offset from the target orientation. Our results provide evidence of θ1/2 broadening following aversive learning, consistent with fear generalization (data collection remains ongoing). In some instances, behavioral error tuning curves post-CS+ were nearly flattened with effects extending beyond ±10 degree offsets. These findings provide preliminary evidence in support of orientation re-tuning driven by acquired affective salience.

F160

DECODING THE SELECTIVE AND DYNAMIC MAINTENANCE OF UNSEEN SENSORY FEATURES IN THE HUMAN BRAIN

Jean-Remi King[1], Niccolo Pescetelli[2], Stanislas Dehaene[3]; [1]New York University, [2]Oxford, [3]College de France, Paris — Recent working memory studies have challenged the classic association between the visibility of a stimulus and the maintenance of its corresponding neural representation. In the present study,

we investigated the neural architecture underlying sub- and supraliminal maintenance using novel multivariate pattern analyses of magnetoencephalography recordings (MEG). Subjects were presented with a masked target Gabor patch, whose angle had to be compared to that of a subsequent memory probe. Our results first revealed that many sensory features (presence, spatial frequency, phase, contrast, angle) could be decoded from subjects' early brain responses. Second, only the sensory features relevant to the task appeared to be selectively maintained during the brief retention period. Third, these selected codes were exclusively modulated by visibility, but, critically, were sustained in the unseen condition. Temporal generalization analyses showed that the maintenance of seen and unseen targets was performed by a long hierarchical network. Together, these results challenge current neural and computational models of visual awareness and suggest that visual perception relies on a long hierarchical network that i) simultaneously and unconsciously encodes multiple sensory features, ii) selectively recodes those relevant to the task in multiple brain regions and iii) generate visibility inference from these spatially and temporally distributed representations.

F161

CONTRIBUTION OF FAR FIELD EFFECTS OF CORTICAL TDCS IN THE CEREBELLUM TO LEARNING IN AN OBJECT DETECTION PARADIGM

Aaron P. Jones[1], Michael C. Trumbo[1], Brian A. Coffman[2], Michael A. Hunter[1], Charles S. Robinson[1], Angela Combs[1], Kinsey Steuterman[1], Vickey Massey[1], Mohamed Aboseria[3], Alexander David[3], Marom Bikson[3], Vincent P. Clark[1]; [1]The University of New Mexico, [2]University of Pittsburgh, [3]The City College of New York — Transcranial direct current stimulation (tDCS) has been shown to alter cognitive function in many domains. Our lab has demonstrated that using either F10 anode/left arm cathode or T5 cathode/left arm anode montages increased the ability to detect hidden objects in a complex visual environment, with Cohen's ds of 1.83 and 1.28, respectively (Coffman et al., 2012; Clark, Coffman, Trumbo, & Wegele, 2014). However, an F10 anode/T5 cathode montage produced a much smaller effect (Cohen's d = 0.21, unpublished). Finite element modeling (FEM) indicated that the F10/arm and T5/arm montages produce far-field effects in the cerebellum, among other regions, whereas the F10/T5 montage produced no cerebellar effects. The present study was performed to see if cerebellar tDCS produced a similar effect size as our prior F10 or T5 vs. contralateral arm studies. Thirty-six participants received anodal, cathodal, or sham stimulation over medial posterior cerebellum vs. left arm during training in an object detection task. Learning was calculated as the difference in performance accuracy between post-training and pre-training tests. Neither anodal nor cathodal cerebellar tDCS led to significant increases in learning compared to sham (Anode Cohen's d = 0.21, Cathode = 0.25). The lack of effects of cerebellar tDCS on learning suggest that far-field effects in the cerebellum do not play a critical role in our prior studies, and also that the cerebellum is not significantly involved in this task, which is consistent with our prior fMRI studies (Clark et al. 2012). The small F10/T5 effects remain perplexing.

F162

TOWARDS A RESOLUTION OF CONFLICTING MODELS OF ILLUSORY CONTOUR PROCESSING IN HUMANS 2.0: LINES, ORIENTATION, AND LATERALITY

Jacques Anken[1,2], Jean-François Knebel[1,2], Micah M. Murray[1,2,3,4]; [1]University Hospital Center, Lausanne, Switzerland, [2]University of Lausanne, Lausanne, Switzerland, [3]Department of Ophthalmology, Jules-Gonin Eye Hospital, Lausanne, Switzerland, [4]Vanderbilt University, Nashville, TN, USA. — Illusory contours (ICs) refer to the perception of borders in the absence of contrast gradients. Despite decades of research on the psychophysics and neurobiological mechanisms of IC processes across a multitude of species and using a range of brain imaging/mapping techniques, debate continues as to whether or not ICs are the result of a low-level (presumably feedforward) process or instead occur first in higher-order brain regions. Studies supporting a low-level mechanism have most often involved stimuli inducing IC lines rather than IC forms/shapes. By contrast, studies in humans have most often involved IC forms/shapes and identified a visual evoked potential (VEP) correlate of IC sensitivity, the "IC effect" that onsets at ~90ms and is localized to bilateral lateral occipital cortices (LOC). This IC effect is observed across a wide range of stimulus parameters, though always involving object forms. The IC effect is moreover delayed in time (i.e. ~200ms onset) and has a lateralized topography/localization when the stimuli are presented to one or the other visual hemifield. The present VEP study addressed this knowledge gap by presenting IC stimuli that induce perceptions of lines that were oriented horizontally or vertically and were also presented centrally or laterally (left/right) within the parafovea (i.e. 5°). IC sensitivity to induced lines modulated the VEP topography at ~250-300ms and seems reflect retinotopic visual field representations. These results are consistent with effects originating within low-level visual cortices, albeit at relatively late stimulus processing stages. We conclude by situating these results within existing modelling of IC processing.

F163

OBJECT SELECTIVITY OR MOTIVATIONAL RELEVANCE: FUSIFORM ACTIVATION TO FACES AND FOOD

Kayleigh Adamson[1], Carly Hyde[1,2], Vanessa Troiani[1]; [1]Geisinger Autism and Developmental Medicine Institute, [2]Bucknell University — While activation of the fusiform gyrus (FG) is most commonly linked to face processing, the FG is also activated by food images. Because objects must compete for our visual attention, an intriguing hypothesis is one in which parts of the ventral visual stream respond to salient objects, determined by individual preferences or item value. Here, we examine whether altered motivation in one domain (food) will have an impact on another domain (faces). We characterized category-selectivity and brain-behavioral correlates in the FG in response to various categories of objects in a cohort of 48 healthy adults (24 female; mean age=22.33) using an fMRI block design with 4 object categories (faces, food, scenes, clocks). Body mass index (BMI) was used as a measure of food motivation. We calculated face-selectivity in bilateral FG by contrasting face and food blocks and correlated this with BMI. We find that males show a significant impact of food motivation on face-selectivity in the right FG (r=-0.550; p=0.003). That is, with increasing BMI, the right FG shows a diminished differential response to faces relative to food. This suggests that the FG may not be specific to perceptual aspects of face processing, but may also respond to other items of motivational relevance. One possibility is that the FG typically serves face processing, but can be hijacked in cases of chronically altered motivation. Further research exploring individual differences in motivational relevance is warranted and will impact the fields of obesity, autism, neurodevelopmental and neuropsychiatric illness.

F164

THE SYNESTHETE'S A: OFTEN RED, ALWAYS SPECIAL

Nicholas Root[1], Vilayanur Ramachandran[1]; [1]University of California, San Diego — Although color-grapheme associations in synesthesia are often idiosyncratic, some consistent findings have been reported. For example, the letter "A" is red for about 40% of synesthetes (Simner et al, 2005). Here we describe an additional, second-order property of synesthetes' "A": the color that a synesthete experiences for the letter "A" is very distant from the color experienced for all other letters. We constructed a distance matrix of pairwise color distance between letters (in CIELuv space), and found that the average distance of the "A" column was significantly larger than any other column. In our sample, for ~65% of synesthetes "A" was the most distant letter; for ~85% of synesthetes, "A" was one of the five most distant letters. Importantly, our effect cannot be explained by the "A is often red" effect, but the reverse is true: at maximum chroma, red is perceived as more saturated than other colors (cf., the furthest point from white on the both the CIELuv chromaticity plane and the Munsell color system), so mapping "A" to red would allow for the maximum possible average distance in color space from every other point. The dramatic effect size also suggests that second-order effects reported in synesthesia (e.g., that letter ordinality and hue distance are correlated) might need to be re-analyzed to account for the uniqueness of the letter "A".

THINKING: Decision making

F165

FUNCTIONAL CONNECTIVITY BETWEEN DOPAMINERGIC MIDBRAIN AND STRIATUM CHANGES OVER PROBABILISTIC LEARNING

William Lloyd[1], Tiffany Bell[1], Anastasia Christakou[1]; [1]University of Reading, UK — Striatal activity is associated with reward-based decision making. This association is thought to be driven by the prediction error-coding dopa-

minergic influence from the midbrain. If midbrain structures are driving striatal activation during learning, we may expect changes in the relationship between activation in the midbrain and the striatum over a learning episode. Using probabilistic learning, we tested whether midbrain-striatal connectivity during feedback changes once criterion is reached. 17 participants chose between four card decks with different winning probabilities during functional magnetic resonance imaging (fMRI). Learning criterion was set as the repeated selection of either of the two highest decks for at least eighteen out of twenty consecutive trials. We concentrated on activation during feedback presentation. fMRI activity timecourses were extracted for the feedback epoch from the following midbrain and striatal regions of interest: substantia nigra (SN), ventral tegmental area (VTA), caudate, putamen, and ventral striatum. The correlation coefficient was calculated between each midbrain and each striatal region before and after criterion for each subject. Group data was tested for a significant ($p<0.05$) change in correlation post-criterion. An increase in correlation was found between SN and ventral striatum (left, $p=0.024$) and VTA and ventral striatum (left, $p=0.011$). No significant change in correlations were found in any other midbrain-striatal ROI combinations, or in the right hemisphere. Results show increased correlation between midbrain and striatum when a task has been learnt compared to when a task is being learned. This demonstrates an adaptive aspect of the midbrain-striatal pathways utilised in reward-based learning.

F166

LEARNING IN UNCERTAIN ENVIRONMENTS IS MODULATED BY REINFORCEMENT TYPES AND INTOLERANCE OF UNCERTAINTY IN SUBCLINICAL OBSESSIVE-COMPULSIVE CHECKERS

Camila G. Victorino[1], Annette Sterr[1,2], Ellen Seiss[1,3]; [1]University of Surrey, [2]Department of Neurology, University of São Paulo, [3]Bournemouth University — Decision making (DM) and learning deficits are found in Obsessive Compulsive Disorder (OCD) in uncertain environments and when previous reinforcer information is important to succeed (Starcke et al., 2009). Some authors have argued that the DM deficit in OCD could be related to altered perception of reinforcers (Cavedini et al., 2006) while others state this might be related to the uncertainty in the task per se (Kaczkurkin, 2013). Here, we examine DM deficits in OCD related to specific changes in monetary and emotional reinforcement (including OCD-related stimuli) in a probabilistic learning task. Three emotional DM experiments were employed with a total of 36 subclinical checkers and 36 controls. In all experiments, participants had to repeatedly choose between 2 cards learning how to improve their decisions based on: previous monetary gain and a positive emotional picture (positive experiment), monetary loss and a negative picture (negative experiment) or monetary loss and a checker symptom-related picture (symptom-related experiment). A learning curve analysis revealed that checkers learned faster in the positive condition presenting a higher accuracy at the beginning of the block ($p=0.03$). Also, checkers had a decreased probability to shift options after losing (lose-shift) in the previous trial for the negative ($p=0.01$) and positive ($p=0.003$) but not for the symptom-related experiment ($p=0.95$). Finally, we found a significant correlation between scores in the intolerance of uncertainty questionnaire (IU) and lose-shift values ($r=-0.239$). It is possible the intolerance of uncertainty is partly responsible for the lose-shift strategy change in checkers in specific emotional environments.

F167

LOSS AVERSION PREDICTS RELIANCE ON GOAL-DIRECTED CONTROL

Alec Solway[1], Terry Lohrenz[1], P. Read Montague[1,2]; [1]Virginia Tech Carilion Research Institute, [2]. Wellcome Trust Centre for Neuroimaging, University College London — Research on reward-based decision making has drawn a distinction between two different types of controllers: one that is slow to adapt, but cheap to use, identified with the common sense notion of "habit", and another that is flexible and goal-directed, but computationally expensive by comparison. These systems have been identified with model-free and model-based reinforcement learning, respectively, opening the door for generating precise quantitatively driven hypotheses. An active area of research aims to determine the factors that drive the degree to which individuals rely on each system. While some work suggests that the brain uses a sophisticated meta-controller, other studies are consistent with the idea that simple heuristics are also involved. Here we show that reliance on model-based control is related to loss aversion, a measure of how much losses are weighed relative to gains. Individuals that are particularly sensitive to losses are happy to pay the cost of using the model-based controller in order to better avoid them. A related quantity, risk aversion, is unrelated to model-based control. Neither quantity is related to model-free control.

F168

DEVELOPMENTAL CHANGES IN TEMPORAL DISCOUNTING IN ADOLESCENTS: A LONGITUDINAL FMRI STUDY

Erik de Water[1], P. Cedric M.P. Koolschijn[2], Gabry W. Mies[1], Bernd Figner[1], Yuliya Yoncheva[3], Wouter van den Bos[4], F. Xavier Castellanos[3], Antonius H.N. Cillessen[1], Anouk Scheres[1]; [1]Radboud University, [2]University of Amsterdam, [3]New York University, [4]Max Planck Institute — Adolescents frequently engage in impulsive behaviors, such as substance use. Temporal discounting (TD) tasks have been widely used to study one important aspect of impulsivity: the preference for immediate rewards. TD tasks involve choices between small rewards that are immediately available, and larger rewards that are available after a delay. Adolescents show a decline in their preference for immediate rewards with increasing age, driven by decreased activation of the ventral striatum (VS) and increased activation of frontoparietal brain areas. However, to date, no longitudinal fMRI studies on TD have been conducted. The goal of the present study was to examine the neural mechanisms of developmental changes in TD in adolescence. Forty-two adolescents aged 12-17 years were scanned with fMRI twice, approximately one year apart, while they completed a TD task with money and candy rewards. We used a mixed-effects model approach to decompose participants' TD choices into three components: 1) general immediate reward preference; 2) immediate reward sensitivity; 3) delay aversion. Adolescents who showed a stronger longitudinal increase in VS activity during immediate reward choices, showed greater decreases in their general immediate reward preference and delay aversion over time. Adolescents who showed a stronger longitudinal increase in activation of the precuneus and dorsolateral prefrontal cortex during delayed reward choices, showed greater decreases in their general immediate reward preference and delay aversion over time. These findings indiciate that the development of reward valuation and cognitive control networks contributes to decreased impulsivity in adolescence.

F169

NEURAL SIGNATURES OF EXPERIENCE-BASED IMPROVEMENTS IN DECISION-MAKING

Joshua Tremel[1], Mark Wheeler[2], Patryk Laurent[3], David Wolk[4], Julie Fiez[1]; [1]University of Pittsburgh, [2]Georgia Institute of Technology, [3]Johns Hopkins University, [4]University of Pennsylvania — Feedback about our choices is crucial to how we gather information and learn from our environment. It provides key information about decision experiences that can ultimately be used to optimize future choices. However, our understanding of the processes through which feedback translates into improved decision-making is lacking. Using fMRI and cognitive models of decision-making and learning, we examined the influence of feedback on multiple aspects of decision processes across learning. Subjects learned correct choices to 50 word pairs across eight repetitions of a concurrent discrimination task. Predictions derived from drift-diffusion and reinforcement learning models were then used as fMRI regressors to identify regions whose activity modulated with specific cognitive processes described by the models. The patterns of intersection of these neural effects support three main inferences about feedback's influence on decision-making. First, frontoparietal, cerebellar, and caudate nucleus regions behave like performance monitors, reflecting errors in performance predictions that signal the need for changes to control over decision-making. Second, posterior cingulate and precuneus regions behave like confidence monitors, reflecting differences in the quality of learned information available to guide a decision. Last, medial temporal lobe and putamen regions behave like memory storage sites, reflecting differences in learned item values that inform optimal decision choices. As information about optimal choices is accrued, these neural systems dynamically adjust, shifting the processing from controlled performance monitoring to bottom-up, stimulus-driven choice selection. Collectively, the results provide a detailed perspective on the fundamental ability to use past experiences to improve future decisions.

F170

DECONSTRUCTING WIN-STAY LOSE-SWITCH: AN FMRI DISCORDANT TWIN PAIR ANALYSIS

Rashina D. Seabury[1], Deanna M. Barch[1], Pamela A. F. Madden[1], Andrew C. Heath[1], Bradley L. Schlaggar[1], Christina N. Lessov-Schlaggar[1]; [1]Washington University in Saint Louis School of Medicine

— Reward-based decision-making involves a conjunction of multiple cognitive processes in order to complete a task with an uncertain outcome. The present study sought to examine the relationship between reward processing and decision-making in female monozygotic twin pairs who are discordant for heuristic response strategies during an event-related two-button choice monetary reward guessing task using functional magnetic resonance imaging (fMRI). Based on button press responses following each of three task conditions including monetary win, monetary loss, or neutral feedback, subjects were categorized to stay or switch strategy categories. Using repeated measures ANOVAs, we compared activation between strategy groups for each task condition. Win-stay subjects showed increased activation in areas with high functional connectivity to the cerebellum and the cingulo-opercular, dorsal attention, and visual systems compared to their win-switch co-twins. Lose-switch subjects, compared to their lose-stay co-twins, showed increased activation in areas associated with the default-mode, dorsal attention, somatomotor, and visual systems. Neutral-stay subjects, compared to their neutral-switch co-twins, showed increased activation in left putamen only. Using a study design where groups are matched on genetic and many familial background factors, our findings indicate that subjects who employ strategies that ostensibly minimize monetary loss (win-stay, lose-switch, and neutral-stay) utilize systems that coordinate top-down task control, motor coordination, and visual processing to a greater extent than subjects who employ a more uncertain response strategy (win-switch and lose-stay).

F171

USING A NEW VISUAL CATEGORY LEARNING PARADIGM TO ELICIT IMPLICIT LEARNING

Catherine Ives-Louter[1], Ben Reuveni[1], Paul J. Reber[1]; [1]Northwestern University

— Research suggests that both explicit and implicit memory are implicated in visual category learning, which offers a unique opportunity to study the mechanisms and interactions of these memory systems. However, the study of implicit visual category learning is often challenged by the ability of healthy individuals to explicitly remember study stimuli used and consciously extract rules. Here we introduce a new visual category learning paradigm that uses movement and time pressure to reduce the tendency of healthy participants to identify the category structure explicitly. The visual categories to be learned are based on sine wave gratings that vary on two continuous dimensions, orientation and spatial frequency, that are commonly used in studies of rule-based (RB) and information-integration (II) category learning. Participants were shown falling sine wave gratings (velocity of 14.5cm/s, giving 1.6s to respond and total presentation time of 1.9s, similar to traditional static presentation) and were instructed to categorize each stimulus into one of two categories. Participants learned the underlying category structure by trial-and-error with feedback provided after each response, gradually improving performance over 1000 trials and performing reliably above chance. Post-learning interviews indicated low rates of conscious knowledge of the underlying category structure when presented with a traditional II paradigm. In contrast, participants shown stimuli categorized by an RB rule exhibited an early, step-like jump in performance characteristic of explicit learning. By using movement to create a sense of time pressure, we were successfully able to elicit implicit, II category learning with little contamination from explicit rule discovery.

F172

NEURAL AND PSYCHOLOGICAL INDIVIDUAL DIFFERENCES IN PROBABILISTIC REINFORCEMENT LEARNING

Tiffany Bell[1], Michael Lindner[1], Angela Langdon[2], Ying Zheng[1], Anastasia Christakou[1]; [1]University of Reading, UK, [2]Princeton University, USA

— Performance in decision-making tasks varies between people in a way that indicates decision-making is guided by more than just choice feedback. In this study, we used a multi-alternative probabilistic learning task during high resolution, multiband fMRI, to examine neural and psychological differences between people who learn the task (i.e. reach a pre-determined performance criterion) and people who do not (approximately one third of participants are typically unable to learn to criterion). Behavioural data was modelled using a temporal difference reinforcement-learning algorithm. The model captured the impact of participants' subjective choice value on future behaviour (value parameter) and learning rates based on positive and negative prediction errors. Learners had significantly higher value parameter estimates than non-learners. Across the whole sample, higher value parameter estimates were associated with increased activation in the striatum during feedback, whereas low value parameter estimates were associated with increased activation in the thalamus. After accounting for learning rate, non-learners showed increased activation in the hippocampus during presentation of their total cumulative score at the end of each trial. These results suggest that differences between learners and non-learners in the task may not be restricted to the degree of neural activation, but may be driven by qualitative differences in thinking style, memory processing, or strategy.

F173

CULTURAL INFLUENCES ON NEURAL PROCESSING OF CONTEXTUAL SCENES

Chih-Mao Huang[1], Pei-Shan Ho[1], Yi-Chen Lee[2], Ho-Ling Liu[3], Robert Doole[1], Chien-Te Wu[2], Hsu-Wen Huang[1]; [1]National Chiao-Tung University, [2]National Taiwan University, [3]University of Texas MD Anderson Cancer Center

— Converging behavioral evidence indicates that East Asian and Western individuals have different biases for processing information that may stem from contrasting cultural values. East Asians appear to be more sensitive to contextual information shaped by the collectivistic/interdependent culture. In contrasts, Westerners have a tendency to process focal and salient objects of the environment due to their individualistic/independent representation. In this cross-cultural study, we employed event-related functional MRI to examine how collectivistic and individualistic biases of East Asian and Western cultures affect the neural function associated with the contextual processing of visual scenes by manipulating the congruence of the pictures presented. Both Taiwanese and Western participants were instructed to perform visual categorization task (i.e., animacy judgment) for the visual scenes in which the salient object was either congruent or incongruent with the background. Each participant's degree of endorsement of individualistic and collectivistic values was assessed by their self-report on the Singelis Self-construal Scale (SCS). Taiwanese rated higher SCS scores than Westerners in collectivistic value and Westerners rated higher SCS scores than Taiwanese in individualistic value. A whole-brain contrast when processing incongruent pairs between two cultural groups showed that Taiwanese elicited greater activity in cortical regions that correspond to attentional and inhibitory controls, including dorsolateral prefrontal cortex and anterior cingulate cortex. These results are consistent with the collectivistic-individualistic dichotomy, and suggest that East Asians devoted more neurocognitive resources to a holistic information-processing bias in which object and contextual information are jointly encoded and in which relational information is prioritized over categorical information.

F174

THE ROLE OF THE VENTROMEDIAL PREFRONTAL CORTEX IN CATEGORY LEARNING: DECISION EVIDENCE OR EXPECTED REWARD?

Kimberly Morris[1], Darrell Worthy[2], Kaileigh Byrne[2], Bailey Brashears[1,3], Tyler Davis[1]; [1]Texas Tech University, [2]Texas A&M, [3]Rice University

— Ventromedial prefrontal cortex (VMPFC), has been found to track subjective value estimates in a number of behavioral economic and reward learning tasks. However, VMPFC also tends to track cognitive processes not clearly identified with expected value such as episodic memory formation, metamemory judgments, and measures of decision evidence in basic decision making tasks. Together, these results suggest that the VMPFC may have a more general role in cognition such as signalling confidence rather than computing subjective value per se. To test this hypothesis, we conducted an fMRI study in which expected value of responses was anti-correlated with the decision evidence associated with making a choice. Subjects learned to categorize perceptual stimuli that differed along two perceptual dimensions using trial and error. In this task, items located closer to the boundary, separating the categories, tend to be the hardest to classify and items far from the boundary the easiest. To pit expected value against decision evidence, we thus rewarded items more the closer they were to the boundary. Subject specific predictions for expected value, probability correct, and prediction error were estimated from behavior using rein-

forcement learning models and were used to interrogate the fMRI data. We found that VMPFC only tracked probability correct, our measure of decision evidence. No voxels in VMPFC were correlated with expected value at even liberal thresholds. These results suggest that in category learning, VMPFC may not code subjective value per se, but a more general function related to decision evidence.

F175

ECONOMIC GAMES WITH HUMANS AND SOCIAL ROBOTS

Stephanie Tulk[1], Eva Wiese[1]; [1]George Mason University — More work is needed in the domain of Human-Robot Interaction (HRI) to see what qualities of social robots and virtual agents are necessary for team building, trust and social connection. Such information is necessary to appropriately design agents that can be used as teachers, collaborators and care takers. The social treatment of a non-human agent involve some degree of anthropomorphism (Epeley, Waitz & Cacioppo, 2007), which modulates social attention, as can be observed through reaction times (Wiese, Wykowska, Zwickel & Müller, 2012). Trust can be examined through the use of Economic Games (EGs), where an individual's rejection of an unfair offer results in activation of bilateral anterior insula (a region often associated with anger and disgust) (Sanfey et al., 2003). This study explores the relationship between agent type (morphed images, some percent human and robot) and monetary offers in EGs. Using a 2-way repeated measures ANOVA, preliminary data shows differences across agent type in percentage of offers accepted and mean reaction times, especially in the 80/20 split (i.e., mostly unfair) condition, which may suggest uncertainty of punishment towards non-human agents.

Poster Topic Index

ATTENTION: Auditory
A1 – A8, A10 - A11, Saturday, April 2, 5:00 - 7:00 pm
C1 – C2, C5 - C8, C10, Sunday, April 3, 5:00 - 7:00 pm

ATTENTION: Development & aging
C12 – C19, Sunday, April 3, 5:00 - 7:00 pm

ATTENTION: Multisensory
B1 – B2, B5 - B10, Sunday, April 3, 8:00 - 10:00 am

ATTENTION: Nonspatial
A12 – A17, Saturday, April 2, 5:00 - 7:00 pm

ATTENTION: Other
B11 – B19, Sunday, April 3, 8:00 - 10:00 am
F1 – F5, F7 - F9, Tuesday, April 5, 8:00 - 10:00 am

ATTENTION: Spatial
D1 – D15, Monday, April 4, 8:00 - 10:00 am
E1 – E14, Monday, April 4, 1:30 - 3:30 pm
F10 – F17, Tuesday, April 5, 8:00 - 10:00 am

EMOTION & SOCIAL: Development & aging
B20 – B33, Sunday, April 3, 8:00 - 10:00 am
F18 – F21, Tuesday, April 5, 8:00 - 10:00 am

EMOTION & SOCIAL: Emotion-cognition interactions
A18 - A28, Saturday, April 2, 5:00 - 7:00 pm
B34 – B44, Sunday, April 3, 8:00 - 10:00 am
C20 – C31, Sunday, April 3, 5:00 - 7:00 pm
D16 – D27, Monday, April 4, 8:00 - 10:00 am
E15 – E25, Monday, April 4, 1:30 - 3:30 pm
F22 - F32, Tuesday, April 5, 8:00 - 10:00 am

EMOTION & SOCIAL: Emotional responding
A29 – A36, Saturday, April 2, 5:00 - 7:00 pm
C32 – C39, Sunday, April 3, 5:00 - 7:00 pm
E26 – E32, Monday, April 4, 1:30 - 3:30 pm
F33, Tuesday, April 5, 8:00 - 10:00 am

EMOTION & SOCIAL: Other
C40 – C45, Sunday, April 3, 5:00 - 7:00 pm
D28 – D36, Monday, April 4, 8:00 - 10:00 am
F39, Tuesday, April 5, 8:00 - 10:00 am

EMOTION & SOCIAL: Person perception
A37 – A43, Saturday, April 2, 5:00 - 7:00 pm
D37 – D41, Monday, April 4, 8:00 - 10:00 am
E33 – E37, Monday, April 4, 1:30 - 3:30 pm
F6, Tuesday, April 5, 8:00 - 10:00 am

EMOTION & SOCIAL: Self perception
F35 - F38, F40 - F42, Tuesday, April 5, 8:00 - 10:00 am

EXECUTIVE PROCESSES: Development & aging
B45 – B51, Sunday, April 3, 8:00 - 10:00 am
D42 – D48, Monday, April 4, 8:00 - 10:00 am
F43 – F49, Tuesday, April 5, 8:00 - 10:00 am

EXECUTIVE PROCESSES: Goal maintenance & switching
B52 – B59, Sunday, April 3, 8:00 - 10:00 am
D49 – D55, Monday, April 4, 8:00 - 10:00 am

EXECUTIVE PROCESSES: Monitoring & inhibitory control
A44 – A51, Saturday, April 2, 5:00 - 7:00 pm
C46 – C55, Sunday, April 3, 5:00 - 7:00 pm
E38 – E47, Monday, April 4, 1:30 - 3:30 pm
F50 – F59, Tuesday, April 5, 8:00 - 10:00 am

EXECUTIVE PROCESSES: Other
A52 – A59, Saturday, April 2, 5:00 - 7:00 pm
C56, C58 – C62, Sunday, April 3, 5:00 - 7:00 pm
E48 – E54, Monday, April 4, 1:30 - 3:30 pm

EXECUTIVE PROCESSES: Working memory
A60 – A67, Saturday, April 2, 5:00 - 7:00 pm
B60 – B68, Sunday, April 3, 8:00 - 10:00 am
C3, C63 - C70, Sunday, April 3, 5:00 - 7:00 pm
D56 – D64, Monday, April 4, 8:00 - 10:00 am
E55 – E62, Monday, April 4, 1:30 - 3:30 pm
F60 – F68, Tuesday, April 5, 8:00 - 10:00 am

LANGUAGE: Development & aging
A68 – A83, Saturday, April 2, 5:00 - 7:00 pm
C9, C71 - C78, Sunday, April 3, 5:00 - 7:00 pm
D65 – D72, Monday, April 4, 8:00 - 10:00 am
F69 – F75, Tuesday, April 5, 8:00 - 10:00 am

LANGUAGE: Lexicon
B69 – B76, Sunday, April 3, 8:00 - 10:00 am
D73 – D78, Monday, April 4, 8:00 - 10:00 am
F76 – F81, Tuesday, April 5, 8:00 - 10:00 am

LANGUAGE: Other
A84 – A93, Saturday, April 2, 5:00 - 7:00 pm
B3, B77 - B86, Sunday, April 3, 8:00 - 10:00 am
C79 – C84, C86 - C88, Sunday, April 3, 5:00 - 7:00 pm
D79 – D88, Monday, April 4, 8:00 - 10:00 am
E63 – E71, Monday, April 4, 1:30 - 3:30 pm
F82 – F91, Tuesday, April 5, 8:00 - 10:00 am

LANGUAGE: Semantic
B87 – B95, Sunday, April 3, 8:00 - 10:00 am
C89 - C90, C92 – C97, Sunday, April 3, 5:00 - 7:00 pm
E72 – E77, E79 - E80, Monday, April 4, 1:30 - 3:30 pm
F92 – F94, F97 - F100, Tuesday, April 5, 8:00 - 10:00 am

LANGUAGE: Syntax
E81 – E89, Monday, April 4, 1:30 - 3:30 pm

LONG-TERM MEMORY: Development & aging
C98 - C109, Sunday, April 3, 5:00 - 7:00 pm
E90 – E99, Monday, April 4, 1:30 - 3:30 pm

LONG-TERM MEMORY: Episodic
A94 – A112, Saturday, April 2, 5:00 - 7:00 pm
B96 – B112, Sunday, April 3, 8:00 - 10:00 am
C110 – C128, Sunday, April 3, 5:00 - 7:00 pm
D89 – D108, Monday, April 4, 8:00 - 10:00 am
E100 – E117, Monday, April 4, 1:30 - 3:30 pm
F101 – F114, Tuesday, April 5, 8:00 - 10:00 am

LONG-TERM MEMORY: Other
A113 – A123, Saturday, April 2, 5:00 - 7:00 pm
F115 – F125, Tuesday, April 5, 8:00 - 10:00 am

LONG-TERM MEMORY: Priming
F126 – F128, F130 - F131, Tuesday, April 5, 8:00 - 10:00 am

LONG-TERM MEMORY: Semantic
B113 – B119, Sunday, April 3, 8:00 - 10:00 am
D109 – D117, Monday, April 4, 8:00 - 10:00 am

LONG-TERM MEMORY: Skill learning
B120 – B128, Sunday, April 3, 8:00 - 10:00 am
D118 – D123, D125 - D127, Monday, April 4, 8:00 - 10:00 am

METHODS: Electrophysiology
E118 – E121, E123 - E127, Monday, April 4, 1:30 - 3:30 pm
F132 – F141, Tuesday, April 5, 8:00 - 10:00 am

METHODS: Neuroimaging
A124 – A125, A127 - A133, Saturday, April 2, 5:00 - 7:00 pm
B129 – B136, B138, Sunday, April 3, 8:00 - 10:00 am
C129 – C137, Sunday, April 3, 5:00 - 7:00 pm

METHODS: Other
D128 - D135, Monday, April 4, 8:00 - 10:00 am

NEUROANATOMY
E164 – E171, Monday, April 4, 1:30 - 3:30 pm

OTHER
B137, Sunday, April 3, 8:00 - 10:00 am
C57, C85, Sunday, April 3, 5:00 - 7:00 pm
D124, Monday, April 4, 8:00 - 10:00 am
E122, E155, E162, Monday, April 4, 1:30 - 3:30 pm
F34, Tuesday, April 5, 8:00 - 10:00 am

PERCEPTION & ACTION: Audition
A134 – A144, Saturday, April 2, 5:00 - 7:00 pm
C4, C138 - C147, Sunday, April 3, 5:00 - 7:00 pm
F129, Tuesday, April 5, 8:00 - 10:00 am

PERCEPTION & ACTION: Development & aging
C165 – C167, Sunday, April 3, 5:00 - 7:00 pm

PERCEPTION & ACTION: Motor control
A9, A154, Saturday, April 2, 5:00 - 7:00 pm
B139 – B150, Sunday, April 3, 8:00 - 10:00 am
D136 – D148, Monday, April 4, 8:00 - 10:00 am

PERCEPTION & ACTION: Multisensory
A145 – A153, A155 - A157 Saturday, April 2, 5:00 - 7:00 pm
E78, Monday, April 4, 1:30 - 3:30 pm
F142 - F154, Tuesday, April 5, 8:00 - 10:00 am

PERCEPTION & ACTION: Other
B151 – B157, Sunday, April 3, 8:00 - 10:00 am
C91, Sunday, April 3, 5:00 - 7:00 pm
E128 – E137, Monday, April 4, 1:30 - 3:30 pm
F95 - F96, Tuesday, April 5, 8:00 - 10:00 am

PERCEPTION & ACTION: Vision
C148 – C157, Sunday, April 3, 5:00 - 7:00 pm
D149 – D156, Monday, April 4, 8:00 - 10:00 am
E138 – E148, Monday, April 4, 1:30 - 3:30 pm
F155 - F164, Tuesday, April 5, 8:00 - 10:00 am

THINKING: Decision making
A158 – A167, Saturday, April 2, 5:00 - 7:00 pm
B4, B158 - B167, Sunday, April 3, 8:00 - 10:00 am
C158 – C164, Sunday, April 3, 5:00 - 7:00 pm
D158 – D166, Monday, April 4, 8:00 - 10:00 am
E149 – E154, Monday, April 4, 1:30 - 3:30 pm
F165 - F175, Tuesday, April 5, 8:00 - 10:00 am

THINKING: Development & aging
C168 - C173, Sunday, April 3, 5:00 - 7:00 pm

THINKING: Other
A126, Saturday, April 2, 5:00 - 7:00 pm
E156 – E161, E163, Monday, April 4, 1:30 - 3:30 pm

THINKING: Problem solving
A168 – A172, Saturday, April 2, 5:00 - 7:00 pm
D167 – D171, Monday, April 4, 8:00 - 10:00 am

THINKING: Reasoning
B168 – B172, Sunday, April 3, 8:00 - 10:00 am
D172 – D176, Monday, April 4, 8:00 - 10:00 am

Author Index

A

Abad-Hernando, S 70
Abdi, H 140, 171
Abdollahi, F 55, 244
Abdollahi, R 179
Abdus-Sabur, F 192
Abel, C 256
Abosch, A 212
Aboseria, M 258
Aboud, K 79
Abouzari, M 115
Abrahams, BS 57
Abrahamse, E 48
Abram, M 64
Abram, S 145
Abrams, H 254
Abubshait, A 155
Abugel, J 192
Achal, S 115
Acke, F 92
Acosta, MT 51
Adair, D 177, 180
Adamson, K 223, 258
Adams, R 230
Adams, S 112
Aday, J 230
Adcock, RA 59, 211
Addis, DR 58, 136
Adebiyi, O 177
Adeyemo, B 197
Adkins, M 194
Adleman, N 85
Agjayan, S 136
Agnew, Z 80
Aguilar, M 245
Ahmed, R 62
Ahn, J 109
Ahrens, L 116
Ahuja, N 152
Aichele, S 48
Aimola Davies, AM 98
Aisenberg, E 58
Aizenstein, H 84
Akwuole, I 146
Akyürek, E 199
Alain, C 166
Alamia, A 178, 215
Alam, ZM 150
Alarcon, G 231
Alario, F-X 240, 242
Alatorre Cruz, GC 163, 175
Albert, M 132
Albert, N 101
Albohn, D 230
Albonico, A 143
Alday, PM 213
Alexander, EJ 240
Alexander, H 44
Alexander, L 184
Alexander, LM 115, 155
Alexander, W 29
Alfred, K 185
Alhazmi, F 140
Alho, J 166, 202
Allaham, M 156
Al-Loos, R 147
Almeida, J 172
Alm, KH 136
Aloysi, AS 139
Alperin, B 51, 82
Alsemari, A 173
Altmann, G 243
Amir Kassim, A 250
Ammerman, K 244
Amoruso, L 12, 214
Amso, D 189
Anaki, D 184
Ancelle, J 128
Andersen, SK 123
Anderson, A 72, 184, 245
Anderson, AK 171, 192
Anderson, D 73
Anderson, K 150
Anderson, L 80
Anderson, M 235
Anderson, MT 227
Andersson, A 94
Andrade, G 57
Andreatta, M 62, 117, 193
Andric, M 254
Andrzejewski, JA 45
Angell, W 207
Anken, J 258
Ankrett, S 224
Anne-Marie, S 152
Anthonipillai, N 197
Anticevic, A 24
Antoine, S 199
Appelbaum, G 219, 221
Apšvalka, D 106
Arbel, Y 160, 249
Archila, P 92
Archilla-Suerte, P 160
Arciniega, H 125
Arduino, L 143, 151
Arkin, C 205
Armenta, M 118
Armstrong, A 205
Armusewicz, K 235
Arnaez-Telleria, J 208
Arndt, J 172
Aron, A 235
Arrington, C 86
Aruguete, J 156
Arvaneh, M 108, 158
Arzy, S 249
Asan, E 117
Asare, G 232
Asaridou, SS 53
Asarnow, R 103
Ashby, FG 123, 124, 145, 162, 175
Aslin, R 103
Asp, EW 49
Assaneo, MF 255
Assudani Patel, S 211
Astle, D 33, 34, 226
Astur, DR 220
Astur, R 211
Athauda, D 106
Audrain, S 173
Auguste, KI 251
Au, J 34
Auksztulewicz, R 69
Avery, T 55, 121
Aviyente, S 252, 253

B

Babbit, C 103
Babb, J 164
Babikian, T 103
Bacha-Trams, M 166, 232
Bachman, M 213, 214, 230, 253
Bachman, MD 252, 253
Bacigalupo, F 43
Bacopulos, A 171
Badde, S 69
Bader, R 96
Badre, D 51
Baek, Y 63
Baeuchl, C 62
Bagattini, C 143, 216
Bagic, A 66
Baig, A 234
Bailer, C 244
Bailey, S 66
Baker, C 175, 216
Baker, CI 156
Baker, S 170
Baker, SL 12, 158
Baldwin, CL 77
Balhorn, A 68
Banerjee, D 71
Barak, O 22
Barascud, N 113
Barbaro, L 224
Barbaroux, M 202
Barbera, D 153
Barch, DM 260
Bardi, L 151
Barense, M 11, 63, 99, 134, 174, 209, 215
Barker, J 167
Barkley, C 237
Bar, M 202
Baron-Cohen, S 105, 157, 171
Baron, E 202
Barragan, D 77
Barredo, J 227
Barrett, AM 149, 164
Bartel, T 157
Bartoli, E 235
Basak, C 176
Basil, R 157
Bass, DI 60
Bassett, D 101
Bassett, DS 235
Bastin, C 98, 207
Bate, J 235
Batterink, L 59
Bauer, AJ 131
Bauer, A-KR 112, 141
Bauer, P 133
Bauer, Y 12, 189
Baumann, A 113
Baum, SR 252
Baunez, C 229
Baus, C 242
Bayer, M 35, 154, 230
Bays, PM 209
Beach, S 11, 54, 128
Bearden, CE 102
Beaton, D 140, 171
Beaton, EA 112
Beatty, PJ 155, 195
Beauchamp, MS 32
Beaudoin, C 41
Becerra, J 212
Beck, DM 181
Becke, A 197
Becker, B 54, 129, 163, 164
Beck, J 219
Bedny, M 129
Beeman, M 185
Beesley, T 178
Begani, N 197
Behmer Jr., LP 104
Bein, O 137, 210
Beit-Arie, R 234
Bejjani, C 117
Bellebaum, C 235
Belleville, S 38
Bell, M 206, 249
Bell, T 75, 258, 260
Benasich, AA 127
Benavides-Varela, S 188
Bender, HA 139
Bengson, J 77
Bennett, K 228
Bennion, K 168
Benoit, J 42
Benoit, R 235
Bentley, V 102
Benzekri, A 192
Benzell, JA 227
Bercovitz, K 206
Bergstedt, D 102
Bergstrom, Z 172
Berken, JA 53
Bernat, D 230
Bernat, E 190, 214, 230, 252, 253
Bernat, EM 213, 252, 253
Bernstein, M 207
Berntsen, D 97
Berron, D 197
Berry, A 139
Berry, AS 12, 158
Berryhill, M 50, 52, 125
Bertoldo, A 86
Bertossi, E 248
Bertz, Z 256
Besson, M 202
Bestmann, S 214
Bettcher, BM 234
Beversdorf, D 74, 126
Beyer, F 193
Bezdek, M 44, 111
Bezdek, MA 219
Bezgin, G 209
Bhandari, A 51
Bhangal, S 125
Bielecki, M 162
Bielser, M-L 107
Bier, J-C 199
Bijanki, KR 60
Bikson, M 177, 258
Bild-Enkin, H 63
Binder, J 245
Binns, M 85
Binsted, G 175
Biondo, F 160
Birnbaum, A 237
Bisiacchi, P 213
Biswal, B 23
Biswal, S 11, 101
Bjernestedt, A 173
Björnsdotter, M 226
Black, S 141
Black, SE 170
Blais, C 46, 171
Blakely, RD 139
Blanco-Elorrieta, E 203
Blanco, N 219
Blankenburg, F 12, 162, 203
Blanke, O 249, 255
Bleichner, MG 141
Blevins, G 221
Blini, E 188
Bloomquist, T 58
Blumberg, EJ 121
Blum, R 193
Blundon, EG 142
Bobes Leon, MA 194
Boccagno, C 193
Bock, A 132
Boebinger, D 129
Boeke, EA 193
Bogacz, R 109, 249
Boggio, Ps 45
Bo, J 114
Bokeria, L 218
Boldt, A 109
Bolt, N 231
Bolt, T 71
Bonaiuto, J 214
Bonato, M 188, 199
Boncompte, G 187
Bond Chapman, S 198
Bonnefond, M 25
Bontrager, M 94
Boon, P 196
Boran, L 158, 197
Boraxbekk, C-J 161, 233
Borders, J 160
Borg, J 210
Bornkessel-Schlesewsky, I 213
Borowsky, R 130, 255
Borst, G 150
Bortfeld, H 163
Bosnyak, D 40
Botdorf, M 233
Botero, N 181
Bottacin, E 161
Bottini, R 237
Boucher, VJ 241
Boudes, E 115
Boukezzi, S 229
Boukrina, O 164
Boulenger, V 55

Bouten, S 232, 254
Bouvy, C 107
Bowen, H 96
Bowman, C 211
Braem, S 44, 48
Bramão, I 169
Brande-Eilat, N 149
Brang, D 11, 75, 135
Branzi, FM 90
Brashears, B 260
Brashier, NM 99
Brass, M 44, 48
Braun, D 86
Bray, S 115
Breakspear, M 17
Breeden, A 236
Breslin, B.A., C 70
Brewer, G 171
Brewer, GA 46
Brewster, T 250
Brice, H 168
Bricolo, E 143
Bridge, D 30, 31, 171, 245
Bridges, D 47
Brielmann, AA 190
Bright, P 169
Brignoni-Perez, E 242
Brinkmann, L 118
Brinton, R 207
Brito, N 201
Brito, NH 103
Brodar, K 97
Brodbeck, C 203
Brod, G 206
Brooks, H 222
Brooks, S 70
Brosnan, M 115
Brothers, T 53, 164, 165
Brouwer, H 212
Brown, J 29, 218
Bruchmann, M 119
Bruckner, R 183
Brudner, EG 152
Bruening, J 159
Bruett, H 137
Brunec, I 134, 209
Bruss, J 120
Brysbaert, M 92
Brzezicka, A 162
Buades-Rotger, M 193
Buc Calderon, C 73
Buck, C 200
Buckholtz, J 184
Buis, B 90
Bulkes, NZ 94, 205
Bulsing, P 214
Bundt, C 48
Bunge, SA 219
Burak, K 197
Burgio, F 188
Burton, P 226
Burton, PC 254
Buschkuehl, M 34
Busch, NA 217
Butler, EE 105
Butler, J 159
Butler, JS 104
Butterworth, B 188
Buxbaum, LJ 107, 215
Buysse, D 84
Buzsáki, G 33
Buzzell, GA 155, 195
Byrne, K 218, 260
Byrne, KA 148

C

Caballero, MI 212
Cabeza, R 11, 61, 95, 99, 134, 137, 172
Caffarra, S 91
Cai, Q 92
Cairney, S 59
Calcagno, V 210
Calder, A 157
Caldera, C 79
Calhoun, EM 156
Calhoun, V 252
Calhoun, VD 253
Callahan, N 256
Calma, NE 204
Calvo-Merino, B 44, 47, 70, 125, 229
Cam-CAN, 85
Cameron, DJ 68
Campbell, J 237
Campbell, JM 108
Campbell, K 210
Campbell, KL 85
Campbell, RJ 114
Campbell, S 240
Campoverde, G 204
Cannon, TD 210
Canolty, RT 251
Cantlon, J 185
Capanzana, J 191
Caparis, GA 58
Caplan, JB 58, 61
Caple, A 139
Caplovitz, G 144
Cappe, C 255
Cappon, D 213
Caracciolo, C 229
Carbajal Valenzuela, CC 81
Cardenas Sanchez, SY 163
Cárdenas Sánchez, SY 175
Cardullo, S 111
Carlier, MEM 162
Carlson, J 42, 230
Carnevale, F 22
Carota, F 11, 165
Carreiras, M 54, 56, 90, 94, 208
Carter, C 152
Case, F 72
Casey, B 79
Cash, SS 11, 101
Cason, S 178
Castellanos, FX 51, 259
Castro Chavira, SA 163
Cate, A 218
Caulfield, MD 225
Cavanagh, JF 86, 228
Ceballos, N 78, 224, 225
Cercignani, M 102
Cerreta, A 50
Cetron, J 186
Chaire, A 197
Chait, M 113
Chai, X 53
Cha, J 87
Chanales, AJH 211
Chandrasekar, A 230
Chandrasekaran, B 68
Chang, A 40, 137
Chang, E 83, 165
Chang, K-e 92
Chang, M 164
Chan, S-h 202, 239
Chan, VTM 166
Chapman, S 103
Charney, D 113
Chatterjee, A 131, 132
Chaudhury, S 193
Chaumon, M 217
Chauvel, P 240
Chee, M 168
Chein, J 233
Chelazzi, L 36
Chenail, S 122
Chen, C 225
Chen, CP 65
Chen, E 53
Chen, G 85
Cheng, L 61
Cheng, T 50
Chen, H-Y 165
Chen, J 141, 150
Chen, J-K 53
Chen, M-H 205
Chen, P 225
Chen, P-H 122, 205
Chen, Q 145, 172, 217
Chen, R 24, 139
Chen, RH 159
Chen, SHY 79
Chen, X 141
Chen, Y 49, 178
Chen, Y-C 203
Chen, Y-P 159
Chen, YY 61
Cherkassky, V 243, 244
Cherubini, P 111
Cheyne, D 147
Cheyne, DO 196
Cheyne, JA 196
Chiang, H-S 100, 124
Chiang, M-C 100
Chiang, T 68
Chiaravalloti, N 40, 139
Chiaravalloti, ND 248
Chiarello, C 64
Chiew, KS 59
Ching, CRK 102
Chinn, L 39
Chiou, K 139
Chiou, KS 248
Chiu, Y-C 87, 97
Choe, J 102
Cho, I 115
Choi, H 71
Choi, J 100, 173
Chong, SD 77
Chong, TT-J 64, 98
Chou, T-L 205
Chow, C-C 180
Chow, HM 75
Chrastil, E 137
Christakou, A 258, 260
Christensen, JF 47, 229
Christine, S 152
Christman, SD 246
Chrysikou, EG 73, 172, 191
Chua, E 62
Chua, EF 135
Chun, A 169
Church, JA 87, 103, 201
Ciaramelli, E 42, 135, 248
Ciaramitaro, V 75
Ciaramitaro, VM 154, 257
Ciardullo, J 139
Cichinelli, R 11, 95
Cillessen, AHN 259
Cimino, CR 198
Claassen, D 47
Claassen, DO 49
Clancy, K 190
Clark, M 88
Clark, V 111, 118
Clark, VP 201, 219, 258
Cleeremans, A 73, 183
Clement, NJ 59
Clewett, D 116
Cobzas, D 221
Coch, D 93
Coderre, S 197
Coelho, C 128, 130
Coffman, BA 102, 201, 258
Cogliati-Dezza, I 73
Cohen, AB 46
Cohen, JD 45, 222
Cohen, MS 61
Cohen, N 97, 133, 176
Cohen, NJ 169
Cohen, S 76, 77, 140
Cohn, N 144, 204
Cole, M 23, 24, 50, 139
Cole, MW 66, 159
Colflesh, G 88
Colino, F 175
Collignon, O 237
Collins, A 17, 29, 45
Collins, J 222
Combs, A 118, 201, 258
Conant, L 245
Conklin, QC 63
Connelly, JJ 228
Connolly, A 186
Connolly, AC 185
Conte, MM 39
Conway, CM 49
Cook, S 46, 236
Cookson, S 88
Cools, R 43
Cooper, J 148, 191
Cooper, JA 146
Cooper, R 171
Cooper, RA 209
Coppola, M 128
Corbett, B 153
Corona, C 89
Corsi, N 106, 179
Coslett, M.D., HB 70
Cosmelli, D 187
Costa, AS 50
Costa-Faidella, J 67
Coulthard, E 161, 206, 224, 249
Couth, S 69
Cowan, E 138
Cox, C 65
Craddock, C 140, 184
Craddock, M 69
Craighead, B 76
Crain, M 192
Craver, CF 135
Creery, J 11, 59, 135
Cristofori, I 185
Crivelli-Decker, J 170
Crocker, L 83
Crocker, M 212
Croft, K 46
Crone, N 12, 227, 251
Cross, ES 99, 106
Crowther, A 192
Crump, MJC 104
Cunningham, T 96
Cunningham, TJ 49, 246
Cunningham, W 72
Cunningham, WA 86
Curley, WH 39
Curran, T 45, 62, 138
Curtis, C 12, 180, 238
Curtis, CE 217, 236
Cusack, R 215
Cushing, D 215
Cutting, L 66, 79
Czisch, M 190

D

Daffner, K 51
Dagan, O 235
Dagenbach, D 71
Daini, R 143, 151
Daitch, A 71
Daitch, AL 243
Dambreville, N 234
D'Angelo, M 63
D'Angelo, MC 134
da Ponte Martins Calado, S 177
Darcey, VL 108
D'Argenio, G 157
Darling, WG 228
Das, S 247
Datta, H 142
Daun-Gruhn, S 179
Davachi, L 18, 19, 60, 98, 126, 138, 169, 210
Dave, S 53
David, A 258
Davidesco, I 12, 79
Davidow, J 101
Davidson, P 210
Davidson, PSR 41, 198, 207
Davidson, R 119
Davila, MI 72
Davis, S 11, 95, 134, 172
Davis, T 65, 148, 181, 195, 224, 260
Davranche, K 123
Dawes, H 83
DeAngelis, G 31
De Araújo Andreoli, M 45
Debener, S 112, 141
De Brigard, F 248
de Brito, S 82
Debruille, B 232, 254
Debruille, J 232
Debruille, JB 232
Decety, J 12, 153
de Chastelaine, M 132, 135
Decker, JH 109
Decker, S 236
Deckert, J 193
de Dios, C 149
DeFord, NE 206
DeFreese, JD 88
Dehaene, S 11, 181, 257

Dehmelt, V 148, 256
De Houwer, J 44
Dehzangi, O 131
Deitrick, S 223
DeJesus, SY 206
DeJoseph, M 121
de Lafuente, V 22
DeLaRosa, B 100
DeLaRosa, BL 173
Del Bene, VA 57, 254
De Leenheer, E 92
Deleniv, S 234
Delgado, E 160
Delhaye, E 207
Della Libera, C 36
de los Angeles, C 239
Del Prato, P 203
Del Tufo, S 56, 130
DeLuca, J 40
De Luca, M 151
Demanet, J 44
Demaria, G 115
DeMaster, DM 201
Demeter, E 38
Demir-Lira, ÖE 53, 239
Demos, AP 141
Denburg, N 227
Dennis, EL 103
Dennis, N 137, 138, 211
Dennis, NA 97, 245
Denny, BT 44
DePalma, F 78, 224
DePasque, S 117, 227
Depue, BE 81, 236
Derisso, M 125
De Saedeleer, L 191
Desai, R 236
De Sanctis, P 104, 235
De Santi, S 164
Deschner, L 87, 201
Desender, K 109
D'Esposito, M 24, 41, 181
De Taeye, L 196
Deutsch, MB 139
Devinsky, O 138, 169
Devitt, AL 58
Dewar, C 118
de Water, E 259
Dewey, D 115
de Wit, DH 220
de Wit, MM 107
Dewulf, M 73
Dhooge, I 92
Diamond, N 209
Diamond, S 186
Diana, RA 89
Diaz, M 130
Dichter, G 192
Dickerson, B 222
Dickey, MW 177
Dickson, D 250
DiCostanzo, J 180
DiFrancesco, M 200
Dikker, S 12, 79
Dillon, S 206
Di Luca, S 57
DiMenichi, B 117
Dimond, D 115
D'Imperio, M 202
Di Muro, F 42
Ding, M 12, 79, 149, 190, 237
Di Rosa, E 111, 151
Dittinger, E 202
Di, X 23
D'Mello, AM 104
Dobbins, IG 87
Dobel, C 148, 194
Dobrowolski, P 162
Dobryakova, E 40
Dockree, P 108, 115
Dockree, PM 158
Doelling, K 66
Dogan, I 50
Do, J-r 209, 210
Doko, D 245
Dolcos, F 42, 82
Dollfus, S 150
Donaldson, D 95
Donchin, E 212
Donnelly Adams, K 244
Doole, R 260
Doré, B 43, 193
Dorjee, D 157
Dorman, S 149
Dosamantes, N 84
Doss, M 60
Douglas, D 11, 99, 174
Dowd, EW 88
Dowell, N 102
Downing, PE 157
Downs, E 125
Doyle, C 197
Doyle, OM 87
Doyle, PJ 177
Dratch, L 101
Drew, AR 77
Drury, J 200
Drury, JE 204
Duarte, A 153, 170, 172, 199
Dubarry, A-S 240, 242
Dube, C 212
Dubé, C 186
Dubois, B 64
DuBrow, S 126
Dudley, T 225
Duerksen, K 180
Duff, M 11, 46, 241, 247
Duff, MC 99
Dufford, A 49
Du, J 188
Dulas, M 97, 176
Dunabeitia, JA 56
Dunbar, R 46
Duncan, J 160, 226
Duncan, K 138, 169, 174
Dunsmoor, J 60, 247
DuPre, E 148
Duraiswami, DJ 213
Durbin, J 236
Durisko, C 167, 177
Durlik, J 242
Dussault, O 38
Dutt, S 234
Düzel, E 197
Dwivedi, V 93
Dylan, B 228

E

Ealey, A 79
Earle, FS 130
Easton, J 225
Eaton, B 165
Eberly, L 237
Ebner, NC 79
Eckstein, MK 219
Eddy, M 91
Eddy, MD 56
Edel, M-A 121
Edelmann, A 219, 221
Eden, GF 242
Egan, L 49
Egger, J 174
Eggleston, S 113
Egner, T 87, 88, 145, 211, 219
Ehlers, M 118
Ehritt, A 211
Eichenlaub, J-B 11, 101
Eidelman-Rothman, M 12, 153
Einhorn, P 192
Eisner, F 241
Ekstrand, C 130, 255
Ekves, Z 243
El-Deredy, W 69, 151, 183
Elias, L 180, 231
Eling, P 174
Elke, S 114
Elkin-Frankston, S 111
Ellemberg, D 177
Elliott, B 171
Ellis, DM 46
Ellis, J 230
Ellis, JS 213, 253
Ellis, MU 103
Elmer, S 202
El Qirinawi, I 82, 191
El Sheikh, J 138
Elvio, B 152
Emadi Andani, M 106
Emadi-Andani, M 179
Emberson, L 103
Emerson, R 11, 127
Emmorey, K 89, 166, 240
Engel, AK 198
Engelhardt, LE 103
Engelke, C 193
Engelmann, J 189
Enticott, P 179
Enticott, PG 179
Erez, J 215
Erickson, B 74
Eriksson, E 63
Erlikhman, G 144
Ernst, B 72
Eroh, J 100, 124, 131
Errante, E 211
Escalera, J 140
Escera, C 67
Eskes, G 147
Essoe, JK-Y 63, 107
Euler, F 154, 191
Eustache, F 246
Evans, CL 78
Evans, S 11, 79, 80, 129, 141
Eveland, E 125
Ewbank, M 157
Ewerdwalbesloh, JA 161
Exton, EL 204

F

Fabiani, M 133
Facque, V 64
Failes, EJ 176
Fairchild, G 82
Falk, D 228
Fallon, N 46
Fang, S-Y 200
Fang, Y-W 159
Fan, J 44, 49, 188
Farah, MJ 19, 20
Farah, N 114
Fareri, D 79
Farnè, A 189
Farr, K 85
Fausett, JS 64
Faust, M 184
Favila, SE 135
Fawcett, J 235
Fearon, P 180
Federmeier, K 131
Federmeier, KD 96, 132, 202, 204, 250
Feffer, K 149
Fehlbaum, LV 82, 154, 191
Fei-Fei, L 181
Feigenson, L 129
Feldker, K 193
Feldman, R 12, 153
Fellows, L 146
Fellrath, J 151, 188
Fels, S 44
Felton, A 64
Feng, P-K 182
Fennell, A 156
Ferguson, A 78
Ferguson, B 74
Fernandes, M 253
Fernandes, MA 253
Fernandez, A 168
Fernandez, C 129
Fernandez Cruz, AL 232
Fernandez, E 204
Fernandez Harmony, T 163
Fernández Harmony, T 175
Fernandez, K 183
Fernandez, T 212
Fernandino, L 245
Ferrante, O 36
Ferrari, S 219
Ferreira, F 243
Ferris, C 248
Fiati, M 169
Fidalgo, C 134
Fiedler, L 39, 114
Field, M 46
Fiez, J 167, 220, 259
Fiez, JA 177
Figner, B 259
Figuccio, M 163
Finisguerra, A 12, 214
Fink, G 179
Finn, B 117
Fiorio, M 106, 179
Fischer, H 79
Fischer, M 125
Fishbein, DH 108
Fisher, AV 114
Fitch, R 234
Fitzgerald, L 108
Fleming, S 27
Flinker, A 142, 251
Flohr, EL 153
Flohrschutz, A 73
Flor, H 62
Foerde, K 101, 174
Foggo, M 194
Foltynie, T 106, 109
Fonagy, P 180
Ford, J 133
Forgacs, PB 39
Forgione, M 151
Forster, B 44, 70, 125
Fortgang, R 210
Foster, C 133
Fotachi, A 235
Fowler, AE 191
Foxe, J 159, 235
Foxe, JJ 12, 32, 57, 104, 187, 215, 254
Frackman, A 85
Franklin, N 145
Frank, M 17, 145
Frank, MJ 183
Fratantoni, J 100
Freedberg, M 105
Freigang, C 141
Freitag, C 82
Frenzel, S 213
Friederici, AD 12, 81
Friedland, S 211
Friedman, D 225
Frijters, J 90
Friston, K 69, 113
Frobose, MI 43
Frömer, R 175
Frostig, D 63
Frost, R 168
Frost, S 52, 90, 94
Froud, K 55, 91, 113, 121, 127, 128
Fuelscher, I 179
Fuentemilla, L 19
Fu, F-R 100
Fu, G 225
Fujioka, T 67, 141, 205
Fujiwara, E 221
Fuller, J 180
Funahashi, S 199
Fu, S 149
Fuster, D 193

G

Gaab, N 11, 54, 128, 129, 163, 164
Gaal, ZA 40
Gabard-Durnam, L 79
Gable, P 116
Gabrieli, J 53, 54
Gabrieli, JDE 11, 128, 239
Gagnepain, P 246
Gagnon, E 245
Gagnon, SA 96
Gaigg, SB 47, 229
Gakavian, N 230
Gal, C 113
Galfano, G 168
Galitzer, H 44
Gallagher, N 110
Gallo, D 60
Galvan, A 101, 196, 227
Galvez-Pol, A 125
Galvis, J 49

Gamble, ML 38
Gandy, S 139
Ganis, G 47
Gans, LK 59
Gan, T 155
Gantman, AP 43
Gao, F 170
Gao, W 11, 127
Garagnani, M 126
Garcea, F 145, 172
Garcia, AC 125
Garcia, F 92, 212
Garel, K 53
Garrison, S 133
Garza, G 118
Garzon, L 97
Gaskell, G 59
Gates, K 88
Gathercole, S 34, 161
Gauthier, B 248
Gaynor, AM 135
Gazzaley, A 35
Gee, D 79
Gehring, WJ 66
Geib, B 11, 61, 75, 95, 134
Geib, BR 99, 137
Geiser, E 67
Geisler, MW 125
Gelbard, H 149
Genheimer, H 117
Genova, H 40, 139
Genty, N 207
Georgiev, D 106, 109
Gerger, G 119
Gerraty, R 101
Gerstenecker, A 157
Gess, JL 64
Gevers, W 73, 199
Geweke, F 38
Ghane, M 65
Ghosh, S 140
Ghuman, A 213
Giangrande, E 110
Giannelli, F 91
Giattino, CM 150
Gibb, B 257
Gierstorfer, S 195
Giesbrecht, T 46, 214
Gilbert, AC 56, 241
Gilbert, J 147
Gilbert, PE 206
Gilboa, A 168, 170
Gillam, RB 200
Gillaspy, K 55
Gillon-Dowens, M 56
Giordano, IA 50
Giovanello, K 88, 133
Girard, S 167
Giuseppe, V 152
Giza, CC 103
Glassberg, B 38
Glauser, T 131
Glerean, E 232
Glotzbach-Schoon, E 62
Gluck, M 249
Gluck, MA 147
Glymour, C 140
Glymour, M 140
Gobbini, MI 194
Godfrey, S 194
Godwin, CA 122, 219
Goerger, C 90
Goetz, C 239
Goff, B 79
Goldberg, I 249
Goldenberg, D 196
Goldfarb, EV 43
Goldin-Meadow, S 53, 239
Goldstein, A 12, 153, 234
Golisch, A 124
Goljahani, A 213
Gollwitzer, P 42
Golob, E 39, 113
Golob, EJ 227
Gomes, A 79
Gomes, H 147
Gomila, A 229
Gonçalves Donate, AP 45
Gonzalez-Lima, F 219
Gonzalez Lopez, M 163
Gonzalez, R 97
Goodin, P 238
Goodman, M 44
Goodwin, L 113
Gordon, B 143
Gorina-Careta, N 67
Gorlick, M 191
Gosavi, R 11, 256
Gosseries, O 51
Gottfried, J 116
Gould, L 130, 255
Goupil, L 28
Gowen, E 69
Gowland, PA 98
Gozenman, F 52
Grabenhorst, M 256
Grabowecky, M 75
Gracco, VL 53, 252
Gradone, A 253
Grady, C 229
Grafman, J 130, 185
Graham, R 78, 224, 225
Grahn, JA 68
Grainger, J 165
Granjon, L 40
Grant, A 244
Grant-Villegas, N 140
Grass, A 154, 230
Graß, A 35
Gratton, C 197
Gratton, G 133
Graves, LV 206
Graves, WW 164, 240
Green, A 110
Green, AE 99
Greenberg, T 42
Greene, D 104
Greene, MR 64, 122, 160, 181
Green, H 113
Green, R 113
Green, S 184
Greenshaw, A 42
Greenwood, P 114
Grefkes, C 179
Gregory, M 181
Grey, S 57
Grey, SE 204, 244
Grieco, JA 78
Griffiths, E 137
Grimm, A 230
Griogorenko, E 52
Groessl, EJ 77
Grogan, J 161, 249
Gronau, N 207
Grooms, JK 122
Grosse Wiesmann, C 12, 81
Grossi, G 89
Gross, J 128
Grossmann, T 80
Grossman, T 228
Gross, R 247
Gross, RE 60
Grot, S 89
Gruber, M 172
Grulke, Z 81
Grzenda, M 216
Guarino, S 111
Gudi-Mindermann, H 198
Guedj, E 229
Guerra, P 194
Guggisberg, AG 188
Guigelaar, E 200
Guignebert, A 64
Guillaume, A 180
Guillory, S 75
Guiraud, H 55
Guldner, S 79
Guleria, A 241
Guliyeva, D 257
Gullberg, M 94
Guntinas-Lichius, O 194
Guo, T 221
Gupta, RS 96
Gurariy, G 144
Gu, S 235
Guskiewicz, K 88
Gutchess, AH 134
Gutierez-Sigut, E 238
Gutierrez, A 185
Gutiérrez, CC 112
Gutierrez-Sigut, E 91
Gutman, BA 102
Gutwin, C 180
Guyon, V 229
Gvirts, H 149
Gwilliams, L 143, 203

H

Habeck, C 233
Habekost, T 78
Haberman, A 150
Haffar, M 232
Haffey, S 70
Haggerty, TK 198
Hagoort, P 208
Hakun, J 126
Halchenko, YO 99
Halderman, L 117
Halfmann, K 227
Halgren, E 11, 101
Halje, P 255
Hall, S 97
Halt, A 74
Halverson, K 239
Hämäläinen, JA 127
Hamann, S 60, 248
Hambrook, D 38
Hamilton, N 155
Hamm, AO 82
Hammerschmidt, W 154, 190
Hampshire, A 226
Hampton, W 81
Hampton Wray, A 75, 127
Hancock, A 108, 237, 257
Hancock, AS 200
Handy, TC 36
Hanelli, A 121
Hanke, M 67
Han, M 53, 239
Hanna-Pladdy, B 70, 71
Han, S 87, 109, 117, 139, 171, 220
Hansen, M 185
Hansen, N 229
Hansen, S 93
Han, S-M 149
Han, YC 68
Harbaugh, W 120
Harden, KP 103
Hardy, KK 51
Harmony Baillet, T 81
Harmony, T 112, 162, 212
Harms, V 231
Harnad, S 181
Harrell, D 105
Harris, D 257
Harris, DA 154
Harrison, A 239
Harrison, N 102
Hart, J 100
Hart Jr., J 100, 124, 131, 173
Hartley, CA 109, 193
Hartley, CN 206
Hartmann, L 187
Harwood, A 114
Hasbroucq, T 123
Hashemi, J 59
Hasher, L 85
Hassall, C 147
Hassevoort, KM 169
Hasson, U 166
Hatzifilalithis, S 245
Haufler, AJ 72
Haustein, M 227
Hawkes, T 125
Haxby, JV 99
Haxhar, E 68
Hayashi, T 242
Hayden, B 28
Hayes, SM 60
Hazeltine, DB 192
Hazeltine, E 105, 126
Heath, AC 260
Heatherton, T 122
He, B 27
Hebscher, M 168
Hedges, J 226
Hegarty II, J 126
Heideman, SG 187
Heim, S 50
Heitmann, C 193
Hejazi, Z 68
Heller, NE 59
Heller, W 83
Henin, S 76, 77
Henry, B 101
Henson, R 134, 217
Herbert, C 120
Herbst, S 114
Herde, L 182
Herlitz, A 133
Herman, A 105
Herman, B 70
Hernandez, A 92
Hernandez, AE 64, 122, 160
Her, O-S 203
Herpertz-Dahlmann, B 82
Herrera-Díaz, A 212
Herriott, B 74
Herrmann, C 216
Herrmann, CS 142, 177
Herrmann, M 118
Herzmann, G 45, 194
Hestvik, A 142
Heusser, A 66
Heverly-Fitt, S 146
He, W 147
He, Y 40
Hibar, DP 123
Hickey, C 224
Higby, E 204
Hilgetag, CC 226
Hilliard, C 11, 241
Hillman, CH 169
Hill, PF 89
Hillyard, SA 150
Himes, L 140
Hincapié, A-S 55
Hird, E 183
Hiroya, S 129
Hirst, EM 54
Hoagey, D 221
Hoagey, DA 157
Ho, E 184
Hoegler, K 149
Ho, EJ 115, 155
Hogan, TP 54
Ho, H 169
Holcomb, P 51, 89, 165, 166
Holcomb, PJ 56, 91, 205, 240
Holden, HM 206
Holling, H 148
Holmes, J 113, 161
Holt, H 234
Hong, T 225
Honjo, K 141
Hopf, J-M 151
Hoppstädter, M 62
Ho, P-S 260
Horecka, K 176
Horne, E 135
Horowitz-Kraus, T 200
Horvath, J 40
Hot, P 207
Ho, T-Y 124
Houde, J 105
Houde, JF 90
Houdé, O 150
Hoversten, LJ 165
Howard, DV 191
Howard Jr., JH 191
Howard, M 120, 136
Howse, A 49
Hreha, K 225
Hsieh, L-T 170
Hsieh, S-K 205
Hsieh, Y-T 124
Hsu, C-H 128, 251
Hsu, C-W 47
Hsu, KC-H 92
Hsu, W 166
Hsu, W-C 54
Hsu, Y-F 40
Huang, A 198

Huang, C-M 159, 260
Huang, C-Y 124
Huang, H-W 159, 238, 260
Huang, P-S 238
Huang, R 116
Huang, S-T 83
Huang, S-TT 82
Huang, X 141
Huang, Y-T 106
Hubbard, E 11, 81, 256
Hubbard, EM 185
Hubbard, J 120, 218
Hubbard, N 140
Hubbard, RJ 96, 132
Huberth, M 67
Hudd, E 220
Huettel, S 87, 219, 221
Huettig, F 241, 244
Hughes, AJ 176
Hughes, GM 63
Hughes, L 195
Hultman, CM 210
Humphries, C 180, 245
Hung, Y-H 90, 202
Hunter, LE 109
Hunter, M 111, 118
Hunter, MA 201, 219, 258
Hunter, RG 154
Huo, Y 79
Hupbach, A 30, 31
Huppert, T 167
Huppert, TJ 114
Hu, S 47
Husain, M 64, 98
Huskey, R 72, 76
Hussain, S 105
Hwang, K 41
Hwang, W-h 124
Hyde, C 179, 223, 258
Hyun, J 164

I

Iacoboni, M 198
Iannotta, JA 147
Iglesias, J 256
Iiro, J 202
Illecki, K 156
Im, HY 230
Infantolino, Z 83
Inman, C 60, 248
Inyang, C 147
Ionta, S 255
Iordan, MC 181
Irani, SR 98
Irving, K 158
Isabella, S 196
Ishag, A 244
Ito, T 24, 139, 159
Itzhak, I 56
Ives-Louter, C 260
Iyer, J 67

J

Jääskeläinen, I 166
Jääskeläinen, IP 232
Jack, C 207
Jackson-Maldonado, D 162
Jacobsen, T 78
Jacobs, J 247
Jacobs, S 215
Jacobs, TL 63
Jaeger, M 112
Jaeggi, S 34
Jaencke, L 233
Jafari, R 131
Jagadeesh, A 41
Jagger, A 124
Jagust, WJ 12, 158
Jahanshad, N 123, 207
Jahanshahi, M 106, 109
Jahn, A 94
Jamal, NI 242
James, GA 64, 248
James, N 156
James, T 172
Jamrozik, A 132
Janacsek, K 100, 101
Jäncke, L 202
Janney, E 179
Janowich, J 86
Janssens, C 196
Jaramillo, J 217
Jasinska, K 52, 163, 202
Jasmin, K 105, 129
Javitt, D 180
Jawdat, M 108
Jemel, B 241
Jenkins, T 128
Jensen, O 25
Jeon, M 209, 210
Jerbi, K 55
Jerde, T 226
Jessen, S 80
Jevtic, I 107
Jeyakumar, N 209
Jeye, B 97
Jeye, BM 168
Jha, AP 152
Jiang, J 145
Jiang, T 40
Jin, J 116
Jinnan, G 256
Jobst, B 247
Jobst, C 147
Jochim, J 199
Joergensen, G 229
Johansson, M 169, 173
Johansson, R 173
Johndro, HA 134
Johns, AR 200
Johns, C 94
Johnson, B 147
Johnson, D 101
Johnson, E 125
Johnson, EL 51
Johnson, J 103, 137
Johnson, JD 98
Johnson, JS 125
Johnson, MR 98
Johnson, PL 198
Joly-Mascheroni, RM 70
Jonas, RK 102
Jonasson, L 233
Jonas, V 136
Jones, A 40, 118
Jones, AP 201, 258
Jones, H 94
Jonides, J 34
Jordan, K 108, 257
Jordan, KE 155, 237
Josef, A 222
Jost, K 78, 182
Jovanovic, T 79
Juhász, D 101
Jung, H 205
Jung, SH 88
Jun, S 220
Juranek, JJ 201
Juravle, G 42
Just, M 243, 244
Just, MA 131

K

Kable, J 235
Kable, JW 192, 221
Kacollja, A 63
Kageyama, T 231
Kaggen, L 12, 79
Kahana, M 117, 247
Kahane, R 174
Kałamała, P 242
Kalisch, R 44
Kam, JWY 251
Kamowski-Shakibai, M 38
Kanai, R 182
Kanayet, FJ 107
Kang, C 221
Kang, H 79
Kanjlia, S 129
Kanoff, KE 49
Karalunas, S 82
Karanian, J 97
Karanian, JM 168
Karim, H 84
Karimi, H 243
Kark, S 250
Karlsson, A 169
Karrer, T 222
Kastner, AK 153
Kastner, S 12, 22, 33, 227
Katz, B 34
Kaufer, D 133
Kauppila, M 202
Kauppinen, R 206
Kawaguchi, J 235
Kawasaki, M 74
Kawashima, R 231
Kawata, KHdS 231
Kay, D 84
Kayser, C 128
Keane, MM 60
Kearney-Ramos, TE 64
Kehagia, AA 87
Keil, A 35
Keilholz, S 44
Keilholz, SD 122
Keller, A 76
Kelley, T 195
Kelley, W 122
Kelly, S 184
Kelly, SP 155
Kenett, Y 184
Kennard, C 98
Kennedy, K 221
Kennedy, KM 157
Kensinger, E 65, 96, 133, 250
Kepecs, A 236
Kerlin, J 256
Kernan, C 103
Kernodle, K 251
Kerr, D 157
Kersey, A 185
Kersten, L 191
Keshabyan, A 63
Kessels, R 174
Ketz, N 62
Khader, P 182
Khader, PH 161
Khalfa, S 229
Khamis-Dakwar, R 55
Khamosia, N 79
Khodayari, N 77
Kidron, R 144
Kiefer, M 239
Kikumoto, A 73, 89, 218
Kilts, CD 64
Kim, H 146
Kim, J 114
Kim, K 210
Kim, S 245
Kim, TH 49
Kimura, Y 224
King, B 47, 48
King, BG 63
King, D 132, 135
King, J-R 11, 181, 257
King, M 70
Kiran, S 57
Kirby, Z 41
Kirkham, T 214
Kirsch, H 251
Kishida, KT 65
Kiyonaga, A 87
Klasen, M 83
Klein, D 53
Kleinschmidt, A 24
Klepousniotou, E 69
Klingbeil, J 93, 242
Klockgether, T 50
Klooster, NB 99
Klöpfer, E 50
Klyszejko, Z 236
Kmech, J 221
Kmiecik, MJ 110
Knaus, TA 45, 222
Knebel, J-F 107, 255, 258
Knight, LK 81
Knight, M 206
Knight, R 12, 21, 227
Knight, RT 51, 118, 251
Knoblich, G 106
Knowlton, B 100
Knowlton, BJ 62, 101
Knutson, B 12, 146
Kóbor, A 100
Koenigsberg, HW 44
Koen, J 64
Kohler, PJ 107
Kohler, S 158
Koleits, N 238
Komes, J 194
Komogortsev, O 225
Kong, S 139
Koolschijn, PCMP 259
Kornilov, S 52
Koslov, S 68, 191
Kossut, M 162
Kostakoglu, L 139
Kotecha, R 193
Kothare, S 138
Kotz, S 11, 113
Kouider, S 28
Koun, E 189
Kounios, J 74
Kourtis, D 106
Kovacs, M 140
Kowalczyk, N 162
Koyama, MS 115, 155
Krabbendam, L 233
Kraemer, D 186
Kraemer, DJM 99, 185
Kramer, AF 233
Kramer, JH 234
Krämer, UM 106, 193
Kranjec, A 201
Krause, K 156
Kraut, M 100
Kraut, MA 124, 131
Krawczyk, D 103
Krawczyk, DC 110
Krebs, C 205
Kreysa, H 194
Kriegeskorte, N 11, 165
Krigolson, O 49, 147, 175, 197
Krishan, S 11, 141
Krishnan, S 79, 129
Krizan, J 137
Kroes, M 247
Kroll, JF 94
Krueger, F 130
Ksander, JC 134
Kuerbis, A 42
Kuhl, B 245
Kuhl, BA 135, 211
Kuhnen, C 183
Kuhney, F 211
Kuhn, J-T 148
Kühn, S 66
Ku, L-C 239
Kulkarni, K 24, 139
Kumar, U 241
Kuo, W-J 121
Kuperman, RA 251
Kurczek, J 247
Kurian, A 197
Kurkela, KA 245
Kürten, J 118
Kurylo, D 144
Kushan, L 102
Kush, D 94
Kutas, M 144
Kveraga, K 230
Kwan, D 135

L

L'Abbate, F 168
Lacey, EA 158
lackey, J 137
La Corte, V 64
Lage, A 194, 256
Lahnakoski, J 166, 232
Lai, P 52
Lake, J 83
Lambert, K 178
Lambon Ralph, M 65
Lametti, D 214
Lamm, C 112
Lamphere, M 118
Landi, N 52, 163, 202
Landman, B 79
Lane, A 89
Lane, C 129
Lane, S 88
Langdon, A 260

Langer, N 155, 184
Lapate, R 119
LaPoint, M 136
Lapp, HE 154
Large, E 251
LaRocque, J 51
LaRocque, KF 65
Larson, C 228
Larsson, E-M 133
Laszlo, S 52, 54, 177
Latimer, WW 195
Latzke, CP 69
Lau, A 163
Laube, I 189
Lau, H 27
Laumann, T 197
Laurent, P 259
Laurienti, P 71
Lavan, N 80
Lawrence, A 206
Layher, E 59, 110
Leach, L 85
Leal, S 169
Leal, SL 246
Leckey, M 204
Leder, H 119
LeDoux, JE 193
Lee, A 134
Lee, ACH 150
Lee, C-L 205, 238
Lee, C-Y 128, 251
Lee, H 210, 245
Lee, H-J 121
Lee, JH-C 231
Lee, M 52, 83
Lee, M-C 82, 83
Lee, RR-W 92
Lee, S-C 109
Lee, S-K 117, 171, 220
Lee, T 100
Lee, T-H 116
Lee, WH 88
Lee, Y 209
Lee, Y-C 260
Lee, YS 99
Lega, B 247
Legault, J 200
Leibenluft, E 85
Leiker, EK 98
Leimbach, F 109
Lempert, KM 192
Leong, J 12, 146
Lerebours, L 59, 211
Lerman, C 235
Lerma-Usabiaga, G 54, 208
Lerner, I 249
Lessov-Schlaggar, CN 260
Leung, H-C 198
Levenson, RW 118
Leventon, J 133
Levine, B 85, 168, 171, 209, 210
Levine, SC 239
Levinson, L 91
Levy, B 156
Levy, D 207
Lewis, G 66
Lewis, GF 72
Lewis-Peacock, JA 58
Leynes, PA 137
Ley, P 69
Liang, J 215
Libertus, M 220
Li, C 139
Li, C-s 47
Liddane, R 207
Lieberman, G 111, 219
Liebrand, M 106
Liégeois-Chauvel, C 240
Lighthall, N 183
Lima, C 11, 79, 80, 105, 129, 141
Limousin, P 106, 109
Lim, S-J 38, 39
Lin, C-H 100
Lin, C-P 159
Lindner, M 260
Lindsey, A 130
Lindsey, H 112
Lin, JJ 51
Lin, K-Y 202
Lin, L 199
Lin, Q 247
Lin, S-K 92
Lin, T 79
Lin, W 11, 127
Lin, WM 67
Lin, Z 66, 139
Linzen, T 143
Li, P 200, 244
Lipp, O 89
Lisi, M 188
Lissek, S 124
Li, T 204
Litcofsky, KA 200
Litvak, V 109
Liu, A 138, 220
Liu, C 155
Liu, H 141
Liu, H-L 260
Liu, H-M 54, 166
Liu, J 126
Liu, L 179
Liu, R 220
Liu, X 246
Liu, Y 254
Li, W 120, 180, 190
LI, Y 161
Llorens, A 240
Lloyd, D 69
Lloyd, W 258
Lockrow, AW 148, 192
Lockwood, JR 117
Loebach, J 68
Loew, A 78
Lohnas, L 169
Lohrenz, T 259
Lohse, K 116
Lo, J 168
Long, N 117
Looi, A 153
Lopas, R 78, 224
Lopez, FV 206
López, V 76
Lorentz, E 130, 255
Loui, P 67, 68, 205
Love, T 205
Löw, A 82
Lowe, MR 70
Low, K 133
Lu, C 205
Lucas, HD 96
Luck, D 89, 218
Luck, S 43
Luck, SJ 150
Ludwig, VU 159
Luh, W-M 148, 192
Luisa, G 152
Lum, J 179
Luna-Rodriguez, A 78
Luo, Y-j 155
Lupkin, S 249
Lurie, DJ 51
Lustig, C 139
Lutz, K 70
Lu, X 155
Lu, Y-T 124
Lwi, SJ 118
Lyday, R 71
Lynch, C 236
Lynn, P 237

M

Macarini Gonçalves Vieira, S 45
MacDonald III, A 145
Machac, J 139
MacKay, A 70
Mackey, AP 20
Mackey, W 12, 238
Mackie, M-A 49, 188
MacLean, K 48
MacSweeney, M 91, 238
Madan, C 65, 178
Madan, CR 58
Madden, PAF 260
Madden, S 192
Maddox, T 191, 219
Maddox, WT 68, 146, 148
Madore, KP 136
Maes, R 174
Magnotta, VA 228
Magnuson, J 90
Magreehan, D 195
Maguire, MJ 124
Mahamane, S 237, 257
Mahon, B 92, 145
Mahon, BZ 172, 217
Maier, ME 123
Maki, K 114
Makin, A 214
Makris, S 12, 214
Malaspina, M 143
Malcolm, BR 104
Malekian, S 84
Malins, J 90
Malmberg Gavelin, H 161
Maloney, T 131
Ma, M 93
Mandera, P 242
Manfredi, M 45
Manganotti, P 143
Mangun, G 77
Mangun, GR 150
Mangus, JM 72
Man, L 11, 99, 174
Manly, T 11, 141, 226
Mann, J 193
Manns, JR 60
Mannstadt, S 191
Man, V 86
Mapelli, D 111, 151
Marantz, A 143
Marcelle, E 184
Marchewka, A 162
Marcinkowski, N 121
Maril, A 137, 210
Marin, B-M 171
Marin-Garcia, E 130
Marino, S 237
Marinsek, N 110
Marion, SD 103
Markant, J 189
Markello, R 192
Markovic, D 33
Marroquin, JL 162
Marshall, PJ 76, 77
Marsh, EJ 99
Marson, DC 157
Martelli, M 143, 151
Martignetti, C 101
Martin, A 12, 213, 227
Martín-Arévalo, E 189
Martin, B 248
Martin, BA 147
Martin Braunstein, L 42
Martin, C 90, 91, 99, 136
Martínez Briones, B 175
Martinez, D 103, 110
Martinez, JE 87, 201
Martín-Gómez, C 250
Martin, J 139
Martin, L 167
Martin, N 111
Martin, R 116
Martsberger, C 132
Masayda, L 211
Masina, F 111, 151
Masset, P 236
Massey, A 230, 253
Massey, V 201, 258
Mastrorilli, E 86
Mata, M 232
Mata, R 222
Mather, M 116
Matheson, H 99
Mathew, M 254
Mathewson, KE 43
Mathiak, K 83
Mathias, B 66, 141
Matias, B 217
Matijevic, S 221
Mattarella-Micke, A 74, 107
Mattheiss, SR 240
Mattioni, S 237
Matusz, PJ 252, 255
Mauer, M 11, 54, 128, 129, 164
Mauro, P 152
Mauro, PM 195
Maves, K 67
Mayr, U 73, 89, 120, 218
May, V 186
Mazaheri, A 25, 26
Mazzi, C 143, 216
McAndrews, MP 173, 208, 247
McBride, J 87
McCandliss, B 74
McCandliss, BD 107
McCarthy, G 144
McClelland, J 93
McClelland, JL 107
McClintock, J 12, 79
McCue, M 177
McCullough, A 170
McCullough, AM 61
McDonald, CG 195
McEwen, BS 20
McFarland, B 194
McGarrigle, L 158
McGhee, AK 98
McGuire, JT 192
McGuirk, W 73
McIntosh, AR 209
McLaren, D 136
McLaughlin, JL 167
McMaster, A 44
McQuade, C 220
McQueen, JM 57
McQuiggan, D 63
McTeague, LM 213
Meade, G 93, 181, 240
Meadows, C 116
Mecklinger, A 96, 211
Medaglia, J 235
Medina, J 178, 216, 254
Medrano, P 138
Meekings, S 105
Mega, LF 73
Mehndiratta, A 211
Mehta, E 80
Mehta, N 152
Mehta, PS 63
Melara, R 161, 234
Mele, S 143
Mellem, M 213
Mellinger, TJ 12, 158
Melloni, L 69
Melo, H 72
Meltzoff, AN 77
Melvin, S 158
Melvin, SA 55
Melzer, N 118
Mencl, E 52, 202
Mencl, WE 90
Mendelsohn, A 46
Mende-Siedlecki, P 43
Mendoza-Montoya, O 162
Mendrek, A 122
Meneghello, F 188
Menks, WM 82, 154, 191
Mercuri, G 112
Mérillat, S 233
Merkel, C 151
Merz, E 158
Merzenich, M 83, 154
Merz, M 183
Metcalfe, J 225
Meurs, A 196
Mevel, K 150
Meyering, E 11, 256
Meyer, J 158
Meyer, P 62
M. Frick, K 211
Mian, F 138
Michon, A 64
Mickleborough, M 130, 255
Middlebrooks, P 71
Middleton, E 90
Midgely, KJ 240
Midgley, K 89, 165, 166
Midgley, KJ 91, 205
Mies, GW 259
Mifsud, N 178
Milham, M 140, 184
Milham, MP 51, 115, 155
Miller, G 83

Miller, M 59, 76, 116
Miller, MB 110
Miller, NM 203
Miller, TD 98
Mill, RD 66, 159
Miltner, W 118, 119
Miltner, WHR 118
Mingino, F 68
Mink, R 103
Minor, G 194
Mirrione, MM 223
Mirzabekov, J 83
Mirzazade, S 50
Mishra, R 241
Miskovich, T 228
Miskovic, V 229, 257
Mitchell, DJ 160
Mitis, E 139
Mitra, P 56
Mittone, D 53
Miyauchi, E 74
Mizokami, S 231
Mock, J 113
Moens, V 183
Mohamed Ali, O 232
Mohammed, A 51
Mohan, R 239
Mohanty, A 84, 116
Mok, B 137
Molfese, P 52, 90
Molholm, S 12, 32, 57, 104, 187, 215, 235, 254
Molinaro, N 91
Mollaei, F 252
Momen, A 156
Monge, Z 172
Montague, PR 259
Montague, R 17
Montal, V 222
Montchal, ME 247
Monti, M 79
Moody, J 219, 221
Mooneyham, B 40
Moore, M 167
Moore, RD 177
Moraczewski, D 80
Morales, A 77
Morales, M 201
Morales, P 218
Morand, A 207
Moran, R 18, 147
Morgan, A 71
Morgan, J 219
Morgan, JH 221
Morgan, L 199
Morgan, O 166
Morgan, R 181
Morgenstern, J 42
Morita, D 131
Morris, E 222
Morris, JP 228
Morris, K 260
Morris, L 102
Morrison, R 84
Morrison, RG 132
Morris, R 90
Morrow, HM 73, 172
Morsella, E 125, 215
Morton, NW 173
Moscarello, JM 193
Moscovitch, M 97, 208, 209, 210, 247
Moses, TEH 195
Motes, M 100
Motes, MA 173
Mothes-Lasch, M 119
Mottarella, M 113
Mottaz, A 188
Mott, M 240
Moya Sepulveda, D 128
Mrazek, A 40
Mrazek, K 40
Mrazek, M 40
Mruczek, R 144
Mucci, MA 223
Mudar, RA 124
Muehlberger, A 62
Mueller, AA 228
Mujica-Parodi, L 42
Mulckhuyse, M 189
Muller, AM 233
Müller-Bardorff, M 119
Müller, DJ 171
Müller, R-A 65
Mumford, JA 65, 201
Muñoz, M 163
Munro, C 136
Munson, B 64, 122, 160
Murphy, A 235
Murphy, K 85
Murray, E 169, 251
Murray, J 24, 95
Murray, M 252, 255
Murray, MM 67, 107, 258
Murty, V 60
Mutai, S 146
Muyingo, L 41
Myers, E 56
Myers, EB 130, 200
Myers, N 41, 87
Myuz, H 122

N

Naaz, F 81, 236
Nagarajan, S 105
Nagarajan, SS 90
Nagel, BJ 231
Nahum, M 83, 154
Nah, Y 87, 109, 139, 171
Naish, KR 178
Nandur, V 186
Napan, J 150
Narayan, D 145
Nashiro, K 176
Nassar, M 183
Nastase, SA 99
Nauer, R 137
Nauvel, TN 39
Nayak, S 53
Nazarian, B 229
Neary, J 118
Neill, J 151
Neimat, J 47
Neimat, JS 49
Nemeth, D 100, 101
Neophytou, K 143
Neueder, D 62, 193
Neuhas, JM 234
Neuling, T 142
Neumeister, P 193
Neville, H 75, 127
New, AS 44
Newhouse, P 211
Newman, S 184
Newman, SD 185
Newsome, R 11, 99, 174
Newson, A 59
Newson, M 206
Ng, TWC 98
Nguyen, LT 124
Nguyen, T 257
Nicolas, F 229
Nielsen, A 104
Niemeier, M 150
Niezrecki, R 211
Niklaus, M 41
Nilakantan, A 245
Nili, H 11, 165
Nir, T 207
Nishimura, R 224
Nizzi, M-C 231
Noble, K 158, 201
Noble, KG 20, 55, 103
Nobre, AC 41, 69, 87, 187, 189, 226
Noche, J 169, 251
Noh, S 146
Nolte, G 198
Noonan, MP 12, 189
Noppeney, U 31, 32
Norcia, AM 107
Nordin, K 95, 133
Norman, KA 65
Norton, E 54
Norton, ES 11, 128
Notbohm, A 216
Notebaert, W 48
Notter, MP 67
Nouchi, R 231
Nour, J 255
Novak, L 120, 180
Nowak, R 65
Nugiel, T 136
Nussenbaum, K 189
Nyberg, L 233
Nyhus, E 138

O

Oakes, TR 119, 222
Oberg, S 115
Obhi, SS 178
Obler, L 164
Obler, LK 204
Obleser, J 38, 39, 114
O'Brien, C 68
O'Bryan, S 195
Ochsner, K 42, 43, 116, 193, 231
O'Connell, M 176
O'Connor, D 115, 140
Oettingen, G 42
Ofen, N 207
O'Hagan, M 229
O'Hare, AJ 153
O'Hearn, K 80
Oh, H 219, 233
Ohno, AA 63
Oliva, A 136
Oliver, M 94
Olivier, E 107, 178, 215
Olsen, R 63
Olson, I 81
Olson, IR 136
Olthof, M 38
O'Neil, EB 150
O'Neil, JT 60
Ontiveiro, M 194, 256
Oostrik, M 12, 79
Oostwoud Wijdenes, L 214
Orban, L 210
Orederu, T 46
O'Reilly, R 62
Orliac, F 150
Ortiz-Mantilla, S 127
Orvis, P 229
Oser, M 231
Osman, A 152
Osman, Y 140
Ostarek, M 129, 244
Osterhout, L 167
Ostrovskaya, I 239
Oswal, U 65
Otero, G 212
Otten, LJ 245
Owen, LLW 176
Ozernov-Palchik, O 11, 54, 128
Ozubko, J 209

P

Paap, K 122
Pacheco, J 119
Pachur, T 182
Packer, RJ 51
Paczynski, M 120, 144, 152
Padmala, S 154
Paget, M 197
Paige, LE 134
Pajkossy, P 160
Pakhomov, S 237
Pakulak, E 75, 127
Palacios-García, I 76
Paller, K 11, 19, 59, 61, 135
Paller, KA 61
Palmer, C 66, 141
Palmisano, A 220
Palombo, D 60
Palombo, DJ 171
Palva, S 161
Paneto, A 184
Pang, B 148, 218
Paniukov, D 181
Pantecouteau, H 232, 254
Papp, K 136
Parasuraman, R 120, 121
Pardilla-Delgado, E 49
Parga, N 22
Parikh, N 248
Park, H 128
Park, J 171
Park, S 209, 210
Park, SY 117
Pärnamets, P 173
Parra, L 76, 77, 140
Parsons, K 115
Parsons, O 105
Parthasarathi, T 221
Parvisi, J 12, 227
Parvizi, J 33, 71, 243, 251
Paschke, LM 159
Pascual-Leone, A 136
Pasqualetti, F 235
Passarini, L 188
Patai, EZ 189, 226
Patel, N 246
Pater, J 163
Patil, A 60, 138
Patrianakos, J 233
Patricia, B 208
Patrick, CJ 218
Patterson, TK 62
Patti, M 223
Pauker, C 39
Paul, H 229
Pauli, P 62, 116, 117, 153, 193
Payne, B 131
Payne, H 91, 238
Payne, JD 49, 96, 246
Payne, L 76
Paz-Alonso, P 90, 94, 243
Paz-Alonso, PM 54, 130, 208
Pearce, A 85
Pearson, JM 88
Pedrazzini, E 151
Pedro, C 58
Peelen, M 224
Peer, M 249
Peers, P 226
Pein, I 106
Pelli, DG 119, 190
Pell, P 157
Peng, C 80
Penolazzi, B 168
Peperkamp, S 92
Peretz, I 38
Pérez, A 56
Perez Gay Juarez, F 181
Perez-Rodriguez, M 44
Perez, S 204
Perfetti, CA 241
Perrachione, TK 239
Perry, A 118
Persson, J 63, 95
Persson, N 79
Persuh, M 160, 161, 217, 257
Pesaran, B 66
Pescetelli, N 11, 257
Peschanski, D 246
Pessoa, L 154
Pestke, K 248
Peterburs, J 235
Petersen, A 78, 115
Petersen, S 104, 197
Peterse, Y 190
Peters, G 215, 235
Peterson, D 125
Peterson, E 26
Peterson, KM 60
Petrican, R 229
Petrie, R 232
Peyrin, C 150
Peysakhovich, B 129
Pezanko, LR 153
Phan, A 154
Phelps, E 60, 247
Phelps, EA 43, 192, 193
Phillips, D 40
Phillips, H 195
Phillips, ME 102
Phillips, R 152
Picart, J 60
Piccolo, LR 103
Pierce, GL 228
Pilcher, W 92

Pineau, A 150
Pine, D 85
Piolino, P 64
Pisella, L 189
Pishdadian, S 97
Pitteri, M 188
Placek, K 58
Plaisted-Grant, K 171
Poeppel, D 12, 66, 79, 93, 142, 143, 251, 255, 256
Poikonen, H 70
Poirel, N 150
Poissant, H 122
Poldrack, RA 65
Poliakoff, E 69, 151
Polidura, C 197
Poline, J-B 24
Poller, H 118
Polnaszek, K 84
Poncin, A 167
Popovych, S 179
Poppenk, J 30, 31
Porges, S 72
Porter, A 108, 237, 257
Postle, B 11, 26, 51, 256
Potts, G 149, 186
Potts, GF 198
Pourtois, G 35, 182, 191, 196
Powell, T 157
Powers, C 47, 77
Powers, J 87
Pradat-Diehl, P 226
Prather, R 146
Prätzlich, M 191
Prentiss, E 217
Preston, AR 173
Price, GR 220
Price, J 250
Price, M 137
Prickett, C 78
Prieto Corona, B 175
Priftis, K 188
Primativo, S 151
Propper, RE 246
Przysinda, E 68
Ptak, R 151, 188
Pugh, K 52, 90, 163
Pu, H 91
Puigvert, L 250
Pulsifer, MB 78
Pulvermüller, F 11, 126, 165, 203
Purcell, JB 70
Pylkkanen, L 240
Pylkkänen, L 95, 203

Q

Qi, Z 53, 239
Quandt, L 132
Quinn, A 226
Quin, S 176
Quirarte, GL 81

R

Rabinovich, EL 191
Rabinovitz, E 251
Rabipour, S 198
Rabovsky, M 93
Race, E 250
Racionero-Plaza, S 250
Racki, A 211
Racsmány, M 160
Raddatz, J 148
Raedt, R 196
Rahman, M 197
Rahmati, M 217
Rahnev, D 181
Raizada, R 103, 245
Rajagovindan, R 149
Rajaram, S 84
Rajendran, S 127
Ramachandran, V 258
Ramdani, C 123
Ramdeen, K 41
Ramdeen, KT 207
Ramey, CH 156
Ramic, M 236
Ramirez, W 204
Ramos Nunez, AI 64
Ramos-Nuñez, AI 122, 160
Ramsey, JD 140
Ramsey, R 105, 106
Randazzo, M 127
Raney, T 129, 163
Ranganath, C 61, 170, 172
Ranzini, M 199
Rao, A 254
Rao, L 250
Rao, V 83
Rapin, L 122
Raschle, N 164
Raschle, NM 82, 154, 191
Rashid, F 103
Raskin, S 58
Rasmussen, EC 191
Rastelli, F 226
Rauch, L 70
Rau, MS 125
Rauss, K 182
Ravizza, S 126
Ray, N 176
Razdan, V 85
Razlighi, Q 233
Reagh, Z 169
Realpe-Bonilla, T 127
Reber, J 46
Reber, P 108
Reber, PJ 61, 174, 260
Redcay, E 12, 80, 156
Reder, L 246
Redick, T 34
Reetz, K 50
Reggente, N 63, 107
Reggev, N 137, 210
Reicherts, P 42
Reidy, GR 119
Reier, CC 58
Reif, A 116
Reilly, J 52
Reilly, KT 189
Reiman, K 86
Reina, A 73
Reininger, BP 58
Rendell, P 238
Renoult, L 210
Retsa, C 252
Reuveni, B 108, 260
Reverberi, C 111
Reyes, A 205
Reynolds, R 85
Rhodes, LJ 257
Ribary, U 54
Ricardo-Garcell, J 162
Rice, J 167
Rice, K 12, 80, 156
Richey, JA 65
Richter, F 245
Richter, FR 209
Ricther, FR 211
Ridderinkhof, KR 183
Riedel, B 207
Riedy, G 222
Riggall, A 51
Rigon, A 46
Riklund, K 233
Rimeikyte, V 184
Rimmele, J 198
Rinker, DA 123
Rinker, T 239
Rìos, M 257
Rishiq, D 254
Rissman, J 63, 107
Ritchey, M 61
Rivas, D 181
Rivera-Morales, C 235
Rivilis, N 11, 101
Rizio, A 130
Rizzuto, D 247
Robbins, TW 87
Roberts, DM 77, 195
Roberts, J 251
Robertson, I 115
Robertson, IH 158
Robin, J 97
Robinson, B 108, 155
Robinson, C 118
Robinson, CS 201, 258
Robles, D 77, 234
Roca Stappung, AM 175
Röder, B 69, 198
Rodrigue, K 221
Rodríguez, E 76
Rodriguez, MdC 212
Rodriguez, N 225
Rodriguez, V 212
Roeder, J 145
Roelofs, K 189
Roe, MA 201
Roeske, T 179
Rogers, T 65
Rohe, T 32
Rohr, C 115
Rohrig, S 180
Rojas Méndez, M 175
Rolma, G 188
Roman, I 205
Romanzetti, S 50
Romeo, Z 188
Romero, K 209
Romero, V 111
Rommers, J 132
Romo, R 22
Root, N 258
Roque, J 212
Rosburg, T 211
Rose, EJ 108
Rose, G 124
Rose, JJ 195
Rose, N 11, 51, 238, 256
Rosenbaum, G 233
Rosenbaum, RS 134, 135, 170
Rosen, DS 196
Rosenthal, CR 64, 98
Rosjat, N 179
Ross, B 141
Rossi, V 35, 182
Ross, J 183
Ross, LA 32, 57, 254
Ross, R 138
Rothwell, J 214
Roüast, NM 189
Rousseau, P-F 229
Rowe, G 85
Rowe, J 195
Rowe, JB 87
Rowe, ML 239
Rowland, B 71
Rowland, J 12, 79
Royston, A 150
Rubin, D 97
Rueckl, J 90
Rugg, M 59, 64, 132, 135
Ruglass, L 234
Ruiz, A 257
Ruiz-Blondet, M 177
Rumak, SP 142
Rutherford, BJ 176
Ruzic, L 248
Ryals, AJ 60
Ryan, E 51
Ryan, J 63, 229
Ryan, JD 134, 209
Ryan, L 206
Ryherd, K 202
Rypma, B 24, 140
Ryyppö, VE 232

S

Saalasti, S 166, 202
Saalmann, Y 12, 227
Sabatino DiCriscio, A 188
Saber, G 217
Sabri, H 181
Saby, JN 76
Sacchi, E 54
Sack, A 25
Sadaghiani, S 24
Sadikova, E 12, 156
Saemann, P 190
Sagui, E 123
Sahadevan, SS 61
Sakaki, K 231
Sakraney, N 219
Sakraney, NJ 221
Sakurai, Y 242
Salem, H 53
Sallard, E 187
Salomon, R 249
Saloner, R 234
Salvi, C 185
Samaha, J 25, 26
Samanez-Larkin, G 12, 146, 222
Samejima, T 73, 89
Samide, R 135, 245
Samra, JK 101
Sams, M 166, 202, 232
Samson, R 78, 224, 225
Samu, D 85
Samuel, DL 152
Sanchez-Adam, A 194
Sanchez Lopez, J 143
Sanchez Moguel, SM 163
Sanchez-Romero, R 140
Sandberg, C 56
Sanders, LD 163
Sandry, J 139, 248
San Martin, R 75
Sano, M 139
Santander, T 228
Santandrea, E 36
Santhanam, P 119, 222
Santiago Rodríguez, E 81
Santillan, J 75
Sapiro, G 59
Sapuram, V 191
Saron, C 47, 48, 77
Saron, CD 63
Sarraf, S 229
Sarter, M 139
Saur, D 93, 242
Savazzi, S 143, 216
Sawczak, C 247
Sawi, O 122
Sazma, M 170
Scanlon, G 197
Schacht, A 35, 154, 190, 230
Schacter, DL 58, 136
Schäfer, TAS 73
Schall, J 71
Schauer, GF 110
Schechtman Belham, F 245
Schelenz, P 83
Scheres, A 259
Scheuerman, J 227
Schiff, ND 39
Schiller, D 46
Schiltz, C 57, 167
Schlaggar, B 104
Schlaggar, BL 260
Schlesewsky, M 213
Schlotz, W 256
Schmalzl, L 77
Schmidt, B 213
Schmidt, M 144
Schmidt, NB 190
Schmidt, TT 12, 162, 203
Schneiderman, I 12, 153
Schneider, W 66
Schnupp, J 252
Schoenfeld, MA 151
Schomers, MR 126
Schooler, J 40
Schoomer, E 70
Schreiber, J 12, 81
Schröder, O 118
Schroeder, C 251
Schroeder, CE 69
Schröger, E 11, 113
Schubel, LC 57
Schuchard, J 90
Schuller, A-M 57
Schultz, D 24, 50
Schultz, DH 159
Schulz, JB 50
Schumacher, E 44, 88, 111
Schumacher, EH 122, 219
Schunn, C 220
Schuster, K 184
Schutter, D 189
Schwartz, MF 90
Schweinberger, S 194
Schwenk, C 148
Scott, S 11, 79, 80, 105, 141
Scott, SK 129

Scroggins, K 206
Seabury, RD 260
Seaman, K 12, 146
Sebanz, N 106
Sebrechts, M 156
Sebti, M 107
Seeck, M 255
Sefranek, M 146
Segal, J 232
Segev, A 149
Sehatpour, P 180
Seiss, E 259
Sekuler, R 76
Sel, A 44
Selarka, D 85
Selvam, R 209
Semenza, C 188
Semick, S 214
Seng, K 229
Serra, M 195
Serra, MJ 195
Seth, A 182
Sevcikova Sehyr, Z 89, 166
Sevcik, R 90
Sevinc, G 83
Sewell, M 139
S. Ferreira, V 203
Shafer, A 207
Shafer, AT 42
Shafer, V 38, 127, 142, 239, 240
Shafer, VL 68, 147, 204
Shafto, MA 85
Shahin, A 256
Shah, N 131
Shah, VD 12, 158
Shakal, S 173
Shallice, T 188
Shams, T 115
Shantz, K 205
Shapiro, LP 205
Sharan, A 247
Shari, B 56
Sharma, K 224
Sharma, R 152
Sharp, M 174
Sharp, ME 176
Shattuck, KF 218
Shaver, PR 63
Shaw, A 147
Shaw, T 114
Shears , C 155
Sheffield, J 180
Shehzad, Z 144
Sheldon, S 208
Shen, G 76
Shen, GM 55
Shen, K 209
Shen, S 256
Sheppard, S 205
Sheridan, M 84
Sherman, B 126
Sherman, M 182
Shestyuk, A 12, 227
Shevorykin, A 234
Shiller, DM 252
Shimin, F 41
Shimizu, RE 101
Shing, YL 206
Shin, N-Y 117, 171, 220
Shi, TC 109
Shohamy, D 18, 101, 174, 176
Shuai, L 163
Sicard, V 177
Sideridis, G 11, 128
Siegel, J 135
Siegel, LS 54
Siever, LJ 44
Sievers, C 210
Sigurjonsson, J 197
Silson, E 175, 216
Silva Pereyra, J 175
Silva-Pereyra, J 163
Silverstein, SM 144
Simionsmeier, V 200
Simone, P 206, 249
Simon, G 150
Simons, J 134, 171, 172
Simons, JS 209
Sine, S 211
Singer, T 12, 81
Singer, W 69
Singhal, A 42, 178
Singh, I 136
Singh, JP 241
Singh, T 193
Sirbu, M 154
Skoe, E 56
Skorko, M 162
Slama, H 199
Sliva, D 129
Slotnick, S 97, 250
Slotnick, SD 168
Slunga Järvholm, L 161
Small, SL 53, 239
Smayda, K 148
Smeaton, A 197
Smith, A 180
Smith, C 82, 202
Smith, DJ 210
Smith, DM 122
Smith, E 176
Smith, GNL 49
Smith, J 112
Smith, LL 215
Smith, S 92
Smith, T 45
Smolen, A 138
Smoski, M 192
Snyder, J 84
Soder, HE 198
Söderlund, H 63, 95, 133
Soehnchen, B 153
Sohal, V 83
Sojitra, RB 147
Solinger, LA 135
Solis-Vivanco, R 25
Solomyak, LI 159
Solopchuk, O 107, 178
Solway, A 259
Somandepalli, K 51
Sommer, M 219
Sommer, W 175
Song, X 63
Soni, S 39
Son, L 28
Sonnenburg, S 121
Soria Bauser, D 107
Sosson, C 57
Soulières, I 89, 218
Southwell, R 113
Spaak, E 199
Spagna, A 188
Spaniol, J 42
Spector, F 69, 173, 256
Speed, M 56, 130
Speekenbrink, M 106
Spence, J 100, 198
Sperling, M 247
Sperling, R 136
Spiegel, K 110
Spielberg, J 83
Spierer, L 187
Spironelli, C 188
Sponheim, S 237
Spoormaker, V 190
Spreng, N 83
Spreng, RN 148, 192, 248
Stabile, M 90
Stadler, C 82, 154, 191
Stagg, C 175
Stahl, J 44
Stancak, A 46, 214
Stanek, J 211
Stanley, B 193
Stanley, M 134, 172
Stanley, ML 99, 137
Stark-Inbar, A 83, 154
Starrett, M 51
Starr, G 44
Steel, A 175, 216
Steele, B 43
Steele, K 159
Steele, V 252
Stein, B 71
Steinbeis, N 12, 81
Steinberg, L 233
Stein, D 70
Steinhauser, M 72, 123
Stein, J 247
Stelzel, C 159
Stening, E 63, 95
Stenlund, T 161
Stenson, A 133
Stephens, J 50
Stepien, D 137
Stern, C 137
Stern, E 253
Stern, Y 43, 233
Sterr, A 259
Steueterman, K 201
Steuterman, K 258
Stevens, C 113
Stevenson, J 194
Stewart, GW 248
Stigsdotter Neely, A 161
Stillman, CM 191
Stites, MC 52
Stockert, A 93, 242
Stodola, D 119
Stoica, T 236
Stokes, M 21, 199, 234
Stokes, MG 87
Stokes, MS 12, 189
Stoodley, CJ 104
Stout, D 228
Stramaccia, DF 168
Strang, A 125
Straube, T 118, 119, 193, 235
Struiksma, M 243
Strunk, J 170, 172, 199
Stürmer, B 175
Suchan, B 107, 121
Sugiura, M 231
Su, LI-w 205
Summerfield, C 12, 145, 189
Sun, D 102
Sung, K 143
Sung, Y-T 92
Sun, H 197, 221
Sun, Y 92
Sussman, T 84
Sutterer, M 120
Suvisaari, J 210
Suzuki, S 75
Swaab, T 53, 243
Swaab, TY 164, 165
Swinnerton, KN 12, 158
Sword, K 221
Szczepanski, SM 251
Szekely, A 84
Szewczyk, J 242
Szőllősi, Á 160
Szpunar, KK 136

T

Tager-Flusberg, H 45, 222, 239
Tagliabue, CF 216
Takács, Á 100
Takashima, A 208
Tal, I 251
Talloni, M 89
Talmi, D 183
Tamez, ER 196
Tan, D 246
Tandon, N 235
Tang, H 147, 155
Tang, L 207
Tang, R 48
Tanguay, A 41
Tang, Y-Y 48
Tanigawa, N 90
Tanner, D 94, 204, 205
Tao, J 11, 75, 135
Tark, K 209, 210
Tarullo, A 53
Tata, M 38, 115
Tata, MS 39
Tavakoli, P 210
Tavano, A 11, 113
Tavares, R 46
Taylar, G 153
Tegenthoff, M 124
Teghipco, A 92
Teng, X 93
Tenney, J 131
ten Oever, S 25
Tervaniemi, M 70
Teslovich, T 119, 222
Thakral, P 59
't Hart, B 243
Thelen, A 255
Therien, VD 218
Therman, S 210
Thesen, T 169
Thiessen, E 167
Thiessen, ED 114
Thoma, P 121
Thomas, A 46, 214
Thompson, J 41, 46, 157, 212
Thompson, K 45
Thompson, KR 174
Thompson, M 105
Thompson, P 207
Thompson, PM 102, 103, 123
Thompson-Schill, SL 99, 196
Thompson, T 53
Thorne, JD 112
Thut, G 128
Tian, X 93
Tian, Y 188
Tibon, R 207, 217
Timman-Braun, D 50
Tinazzi, M 106, 179
Tippett, LJ 58
Tivarus, M 92
Toba, MN 226
Tobin, H 250
Tobyne, S 137
Todd, R 35, 50, 118
Todd, RM 36, 171
Toepel, U 107
Toiviainen, P 70
Tomer, R 149
Tompary, A 98, 210
Toneatto, C 151
Toomarian, EY 185
Tootell, A 230, 252, 253
Torrence, RD 45
Tottenham, N 79
Tountas, AM 112
Tousch, A 199
Towle, V 11, 135
Towle, VL 75
Tozzi, L 119
Traffalls, J 225
Trainor, LJ 40
Tranel, D 120
Traxler, M 53
Traxler, MJ 164, 165
Treffalls, J 78, 225
Trelle, A 134
Tremel, J 259
Tricomi, E 117
Trinh, S 131
Tripathi, VN 241
Troiani, V 188, 223, 258
Troup, LJ 45
Troyer, A 85
Truelove-Hill, M 74
Trumbo, M 118
Trumbo, MC 201, 258
Truong, D 177
Truong, G 35, 36
Tsai, A 249
Tsai, M-H 166
Tsai, Y-T 238
Tsakiris, M 44
Tsao, F-M 54, 166
Tsivos, D 206, 249
Tsuji, S 242
Tucker-Drob, EM 103
Tulk, S 261
Tune, S 53
Turkeltaub, P 110, 236
Turkeltaub, PE 104
Turner, B 59
Turner, BO 110
Turner, M 140
Turney, I 138
Tusch, E 51

Tychinsky, R 173
Tyler, LK 85
Tyshynsky, R 68
Tzeng, OJ-L 92, 159, 238
Tzeng, Y-L 128
Tzvi, E 106

U

Ugalde, L 250
Ugolini, M 163
Umiltà, C 188
Umiltà, CA 151
Unger, A 81, 136
Unger, K 48, 227
Urbain, C 196
Urgesi, C 12, 157, 214
Ursache, A 158
Usrey, WM 150

V

Vaidya, A 146
Vaidya, C 85, 236
Valdes Sosa, M 256
Valdes-Sosa, M 194
Valdez, GE 49
Vale, L 119
Valentin, V 175
Valentin, VV 124, 162
Valero, A 212
Valero-Cabre, A 226
Vallée, T 246
Vallesi, A 86
Vallila-Rohter, S 57, 160
van Aalderen-Smeets, S 233
van Atteveldt, N 233
Van Bavel, J 12, 79
Van Bavel, JJ 43
van Berkum, J 243
van Boxtel, A 243
van Boxtel, M 158
van Dam, W 236
van den Berg, B 75
van den Bos, W 259
Vandenbroucke, A 181
van den Wildenberg, W 47
Van der Haegen, L 92
Vanderwal, T 140
van Dijck, J-P 199
Van Dyke, J 94
van Ede, F 41
Van Gerven, PWM 115
van Hell, J 204
Van Hell, J 244
van Hell, JG 55, 57, 94, 129, 244
van Lamsweerde, AE 125
Vanlangendonck, F 208
Vanlessen, N 35
VanMeter, JW 108, 218
Vannest, J 131, 200
Vannini, P 136
Van-Opstal, F 73
Van Rinsveld, A 167
Van Roost, D 196
Van Vleet, T 83, 154
van Wassenhove, V 248
van Wouwe, N 47
van Wouwe, NC 49
Varangis, E 88
Varela, E 204
Vargas, I 61, 204
Vargas, Jr., R 145
Varvaris, M 119, 222
Vasquez, A 224
Vasquez, D 92
Vassena, E 28, 29, 196
Vaughan, JW 71
Vaughn, KA 64, 122, 160
Vazquez, D 64
Vega Potler, N 140
Velasco, R 116
Velasquez, AG 125
Velenosi, LA 12, 162
Veloso, A 137
Venable, KB 227
Vendemia, J 236
Venhuizen, N 212
Ventura-Bort, C 82
Venza, E 198
Verbos, J 201
Vercammen, A 238
Verfaellie, M 60
Verguts, T 73, 86, 196
Verhaeghen, P 88
Verhey, F 158
Verstaen, A 118
Vessel, E 44
Viader, F 246
Victorino, CG 259
Vidal, F 123
Vidal, J 150
Vidal, N 239
Viehman, RW 210
Vieweg, P 170
Vila, J 194
Villena-González, M 76, 187
Vincent, A 98
Vinette, S 115
Vingerhoets, G 92
Visconti di Oleggio Castello, M 194
Visscher, K 157
Vissers, C 174
Viswanathan, S 179
Voegler, R 235
Voelbel, G 112
Vogel, JW 12, 158
Vogelsang, DA 172
Vohra, S 42
Volk, F 194
Volosin, M 40
Volz, KG 73
von dem Hagen, E 157
Von Der Heide, R 81
Von Lautz, AH 12, 189
von Leupoldt, A 42
von Meer, SS 124
Voon, V 102
Voss, J 31, 171, 245
Voss, JL 60
Vosskuhl, J 177
Voss, M 120
Voss, MW 228
Voytek, B 26
Vucovich, LE 123, 162
Vu, M-A 211
Vu, M-AT 59

W

Wagner, AD 65, 96
Wagner Cook, S 11, 241
Wagner, D 122
Wagner, M 38, 68, 127
Wahlund, L-O 63
Wakeman, D 217
Walden, E 195
Walker, J 133
Wallace, D 83
Wallace, G 80
Wallace, M 32
Wallace, S 201
Walpolla, I 232
Walsh, E 192
Walter, H 159
Walzak, A 49
Wanetick, R 154
Wang, B 179
Wang, C 149
Wang, E 141
Wang, H 149
Wang, J 243, 244, 245
Wang, J-T 124
Wang, K 188
Wang, L 12, 227, 253
Wang, T 59
Wang, TH 58
Wang, W-C 99
Wang, X 245
Wang, X-J 33
Wang, Y 129, 163, 164
Wang, Y-W 175
Wang, Y-Y 238
Wan, L 12, 79
Wan, NJ 155
Wan, NJA 108, 200, 237, 257
Ward, L 50
Ward, LM 142
Warner, KA 49
Warnke, L 143
Waskom, ML 96
Waszak, F 40
Watanabe, K 199
Watkins, K 226
Watrous, A 247
Watson, CE 215
Watson, P 97
Waugh, R 48, 227
Wawrzyniak, M 93, 242
Waxman, R 144
Wayne, R 91
Weaver, LK 119, 222
Weaver, S 40, 86
Webb, CE 97
Weber, C 127, 239
Weber, D 126
Weber, J 43, 116, 193
Weber, L 182
Weber, R 72, 76, 83
Weigl, M 211
Weinberger, A 110
Weinberg, L 153
Weiner, M 207
Weisberg, S 131
Weisman, O 12, 153
Weis, P 120
Weissman, D 85
Welles, R 229
Welsh-Bohmer, K 133
Wendt, J 82
Wendt, M 78
Wenger, E 66
Weng, H 119
Weng, TB 228
Wenzel, M 55
Werner, CJ 50
Westerberg, CE 58
Westerberg, J 68, 71
Westover, B 11, 101
Westwater, M 157
Westwater-Wozniak, M 41
Wexler, K 239
Weymar, M 82
Wheeler, K 194
Wheeler, M 259
Whitaker, G 151
White, M.S., NC 70
Whitford, T 178
Whitman, J 50
Whone, A 249
Whyte, M 232
Widdowson, C 176
Wiebe, SA 61, 114
Wiegand, I 78, 115
Wiener, M 157
Wiese, E 121, 155, 261
Wiese, H 194
Wieser, M 116
Wieser, MJ 42, 153
Wiggins, E 113
Wiggin, T 194
Wilckens, K 84
Wilhelm, C 193
Wilkey, E 220
Wilkinson, L 100
Willems, R 208
Willems, S 98
Williams, A 240
Williams, C 197
Williams, J 223
Willie, JT 60
Wills, K 126
Wilman, A 221
Wilmer, H 233
Wilsch, A 142
Wilson, T 12, 187
Wilton, M 214
Wineberg, K 47
Wing, E 61
Wingert, KM 46
Winsler, K 165
Winter, M 212
Winter, S 70
Wirth, MM 96
Witkiewitz, K 111, 118, 219
Wodniecka, Z 242
Wohltjen, S 213
Wokke, ME 183
Wolbers, T 170, 197
Woldorff, M 11, 75, 95, 137
Woldorff, MG 38, 150
Wolf, D 83
Wolfe, J 118
Wolfe, S 113
Wolff, M 199
Wolf, M 11, 128
Wolk, D 259
Woll, B 238
Wood, B 206
Woodruff, C 156
Woodruff, CC 153, 228
Wood, S 40
Woolrich, M 226
Woo, YJ 57
Worden, M 48, 227
Worrell, G 247
Worthy, D 146, 181, 260
Worthy, DA 148, 218
Wöstmann, M 38, 39
Wrede, K 93, 242
Wright, B 49, 197
Wright, E 137
Wu, A 100
Wu, AD 101, 198
Wu, C 12, 146
Wu, C-T 260
Wu, D 165
Wu, DH 92, 168, 203
Wunderlich, K 219
Wurm, F 72
Wu, S 11, 75, 135
Wu, S-W 109, 110, 182
Wu, T 49
Wylie, G 40, 86
Wylie, S 47
Wylie, SA 49
Wynn, M 234

X

Xavier, Z 229
Xia, W 41
Xu, A 208
Xu, J 225
Xu, X 221

Y

Yacoby, A 210
Yamada, Y 127
Yamamoto, Y 231
Yamazaki, S 231
Yanar, J 132
Yang, CL 241
Yang, G 24
Yang, H-C 100
Yang, J 166, 254
Yang, R 41
Yang, X 71
Yang, Y 244
Yang, Y-Y 110
Yan, N 141
Yao, B 40
Yao, D 256
Yassa, M 169, 251
Yassa, MA 246, 247
Yee, C 83
Yee, E 229
Yeff, H 11, 141
Yeh, C-I 124
Yeh, P-H 222
Yeldesbay, A 179
Yendiki, A 53
Yen, N-S 203
Ye, R 87
Yetz, N 77
Yeung, L-k 134
Yeung, L-K 63
Yeung, N 109
Yi, D-J 209, 210
Ying, J 241
Yock, TI 78

Yoncheva, Y 51, 259
Yonelinas, A 170
Yonelinas, AP 61
Yoshida, M 242
Yoshizaki, K 224
You, Y 120, 180
Yox, R 163
Yu, A 168
Yue, G 40
Yuen, K 44
Yu, L 254
Yun, S 117
Yu, Q 207
Yu Villa, J 63
Yu, X 163, 212
Yu, Y 38, 127
Yu, YH 239

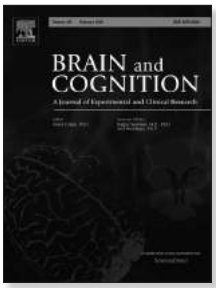
Z

Zabel, C 34
Zagoory-Sharon, O 12, 153
Zamm, A 141
Zane, E 240
Zanesco, A 47, 48, 77
Zanesco, AP 63
Zarate, D 197
Zarnowiec, K 67
Zavaglia, M 226
Zavaliangos-Petropulu, A 102, 207
Zborowski, A 78, 224, 225
Zeithamova, D 30, 31
Zeitlin, M 167
Zelano, C 116
Zendel, BR 38
Zénon, A 107, 178, 183, 215
Zepf, F 83
Zerubavel, N 231
Zetterberg, H 63
Zevin, JD 90
Zhang, F 215
Zhang, H 223
Zhang, HR 136
Zhang, J 195
Zhang, L 95
Zhang, S 47
Zhang, Y 246, 254
Zheng, A 87
Zheng, Y 260
Zheutlin, A 210
Zhu, D 126
Zinser, J 231
Zinszer, B 103
Zion Golumbic, E 251
Zippi, EL 173
Zipse, L 160, 249
Zirnstein, M 94
Zola, SE 169
Zorzi, M 188
Zozulinsky, P 149
Zuk, J 54, 164
Zuppichini, M 139
Zuppichini, MD 248
Zvyagintsev, M 83
Zwart, F 174
Zweig, LJ 75

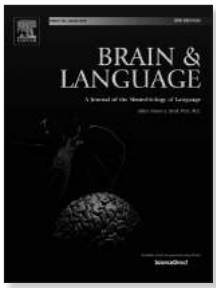
Discover top journals and books in cognitive neuroscience

ELSEVIER

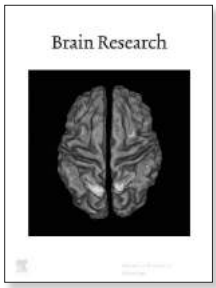
JOURNALS



Brain and Cognition



Brain and Language



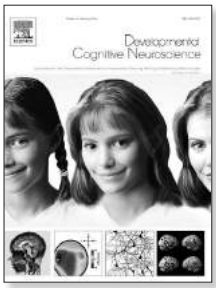
Brain Research

Biological Psychology

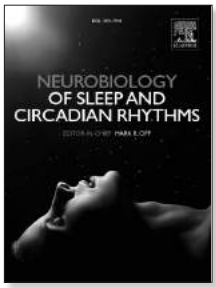
Cognition

Cortex

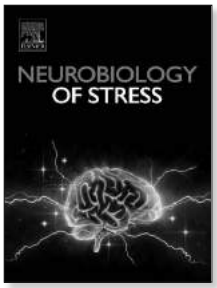
Current Opinion in Behavioral Sciences



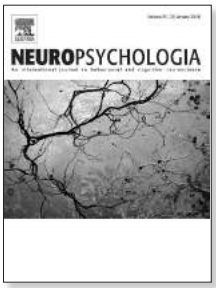
Developmental and Cognitive Neuroscience



Neurobiology of Sleep and Circadian Rhythms

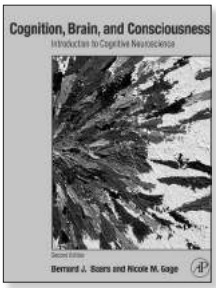


Neurobiology of Stress

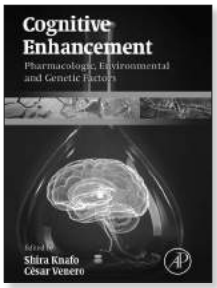


Neuropsychologia

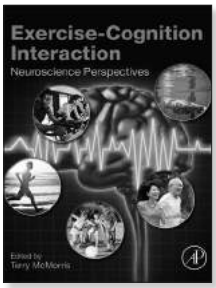
BOOKS



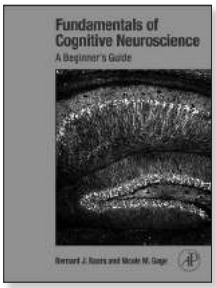
Cognition, Brain, and Consciousness 2e



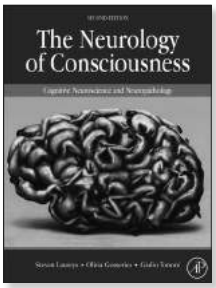
Cognitive Enhancement



Exercise-Cognition Interaction



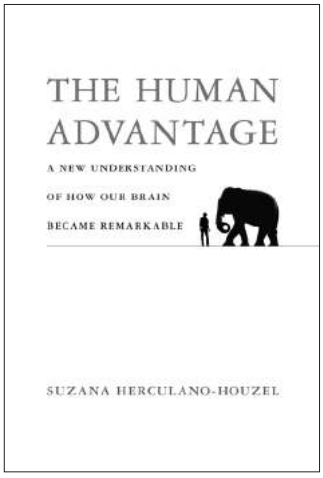
Fundamentals of Cognitive Neuroscience

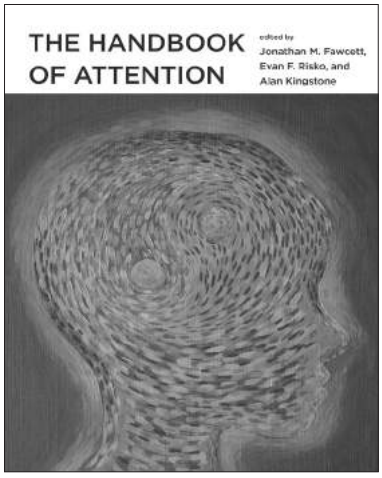


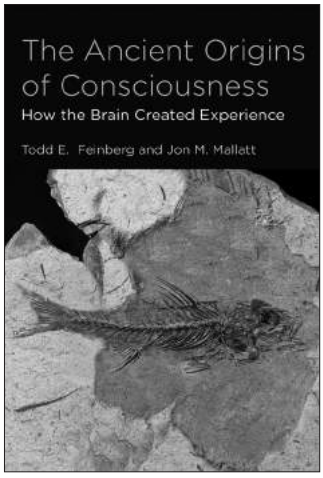
The Neurology of Consciousness

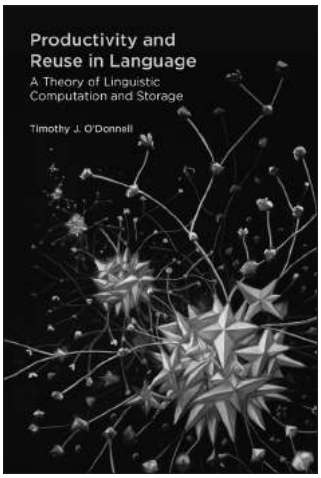
Find out more: **www.elsevier.com/neuroscience**

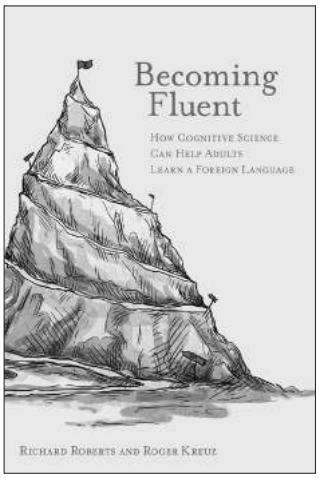
The MIT Press

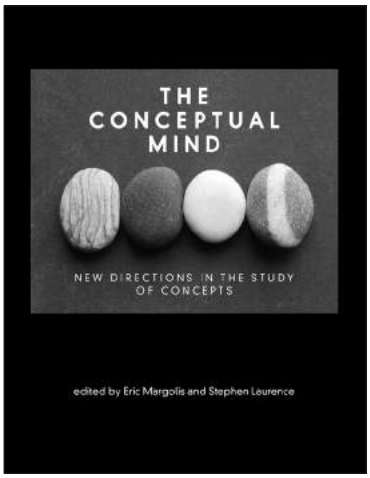


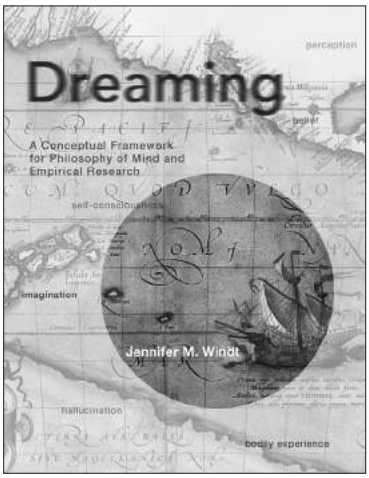












THE HUMAN ADVANTAGE

A New Understanding of How Our Brain Became Remarkable

Suzana Herculano-Houzel

Why our human brains are awesome, and how we left our cousins, the great apes, behind: a tale of neurons and calories, and cooking.

Hardcover | $29.95 | £19.95

PRODUCTIVITY AND REUSE IN LANGUAGE

A Theory of Linguistic Computation and Storage

Timothy J. O'Donnell

A proposal for a formal model, Fragment Grammars, that treats productivity and reuse as the target of inference in a probabilistic framework.

Hardcover | $45 | £31.95

MEMORY AND MOVIES

What Films Can Teach Us about Memory

John Seamon

How popular films from Memento to Slumdog Millionaire can help us understand how memory works.

Hardcover | $29.95 | £20.95

THE HANDBOOK OF ATTENTION

edited by Jonathan M. Fawcett, Evan F. Risko, and Alan Kingstone

An authoritative overview of current research on human attention, emphasizing the relation between cognitive phenomena observed in the laboratory and in the real world.

Hardcover | $65 | £44.95

BECOMING FLUENT

How Cognitive Science Can Help Adults Learn a Foreign Language

Richard Roberts and Roger Kreuz

How adult learners can draw upon skills and knowledge honed over a lifetime to master a foreign language.

Hardcover | $24.95 | £17.95

COGNITIVE UNCONSCIOUS AND HUMAN RATIONALITY

edited by Laura Macchi, Maria Bagassi, and Riccardo Viale

foreword by Keith Frankish

Examining the role of implicit, unconscious thinking on reasoning, decision making, problem solving, creativity, and its neurocognitive basis, for a genuinely psychological conception of rationality.

Hardcover | $54 | £37.95

CREATING LANGUAGE

Integrating Evolution, Acquisition, and Processing

Morten H. Christiansen and Nick Chater

foreword by Peter W. Culicover

A work that reveals the profound links between the evolution, acquisition, and processing of language, and proposes a new integrative framework for the language sciences.

Hardcover | $40 | £27.95

THE CONCEPTUAL MIND

New Directions in the Study of Concepts

edited by Eric Margolis and Stephen Laurence

New essays by leading philosophers and cognitive scientists that present recent findings and theoretical developments in the study of concepts.

Hardcover
$58 | £39.95

ANCIENT ORIGINS OF CONSCIOUSNESS

How the Brain Created Experience

Todd E. Feinberg and Jon M. Mallatt

How consciousness appeared much earlier in evolutionary history than is commonly assumed, and why all vertebrates and perhaps even some invertebrates are conscious.

Hardcover | $35 | £24.95

DREAMING

A Conceptual Framework for Philosophy of Mind and Empirical Research

Jennifer M. Windt

A comprehensive proposal for a conceptual framework for describing conscious experience in dreams, integrating philosophy of mind, sleep and dream research, and interdisciplinary consciousness studies.

Hardcover | $65 | £44.95

Visit the MIT PRESS BOOTH for a 30% DISCOUNT

mitpress.mit.edu

Neuroscience
from the Royal Society

The Royal Society journal portfolio offers a range of publishing options within neuroscience

Reasons to choose the Royal Society for your work:

- Articles handled by active, expert neuroscientists
- Efficient and rapid processing
- Rigorous, constructive peer review
- Open access options
- Theme issue opportunities

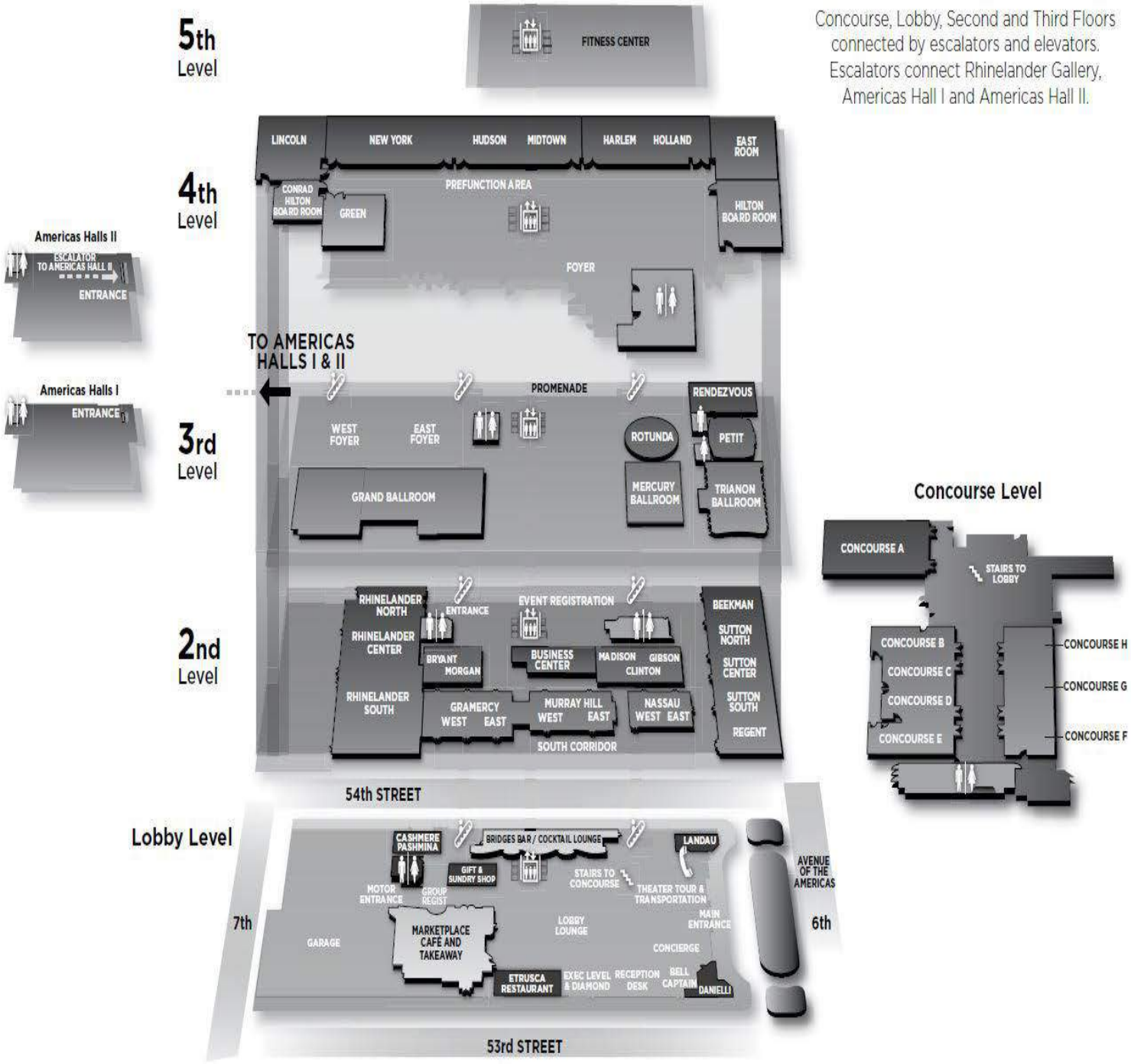
To read articles and to submit your research or theme issue proposal visit **royalsociety.org/journals**

Image: *A baboon gets lost in his thoughts*, by Davide Giglio. Royal Society Publishing photography competition 2015, special commendation.

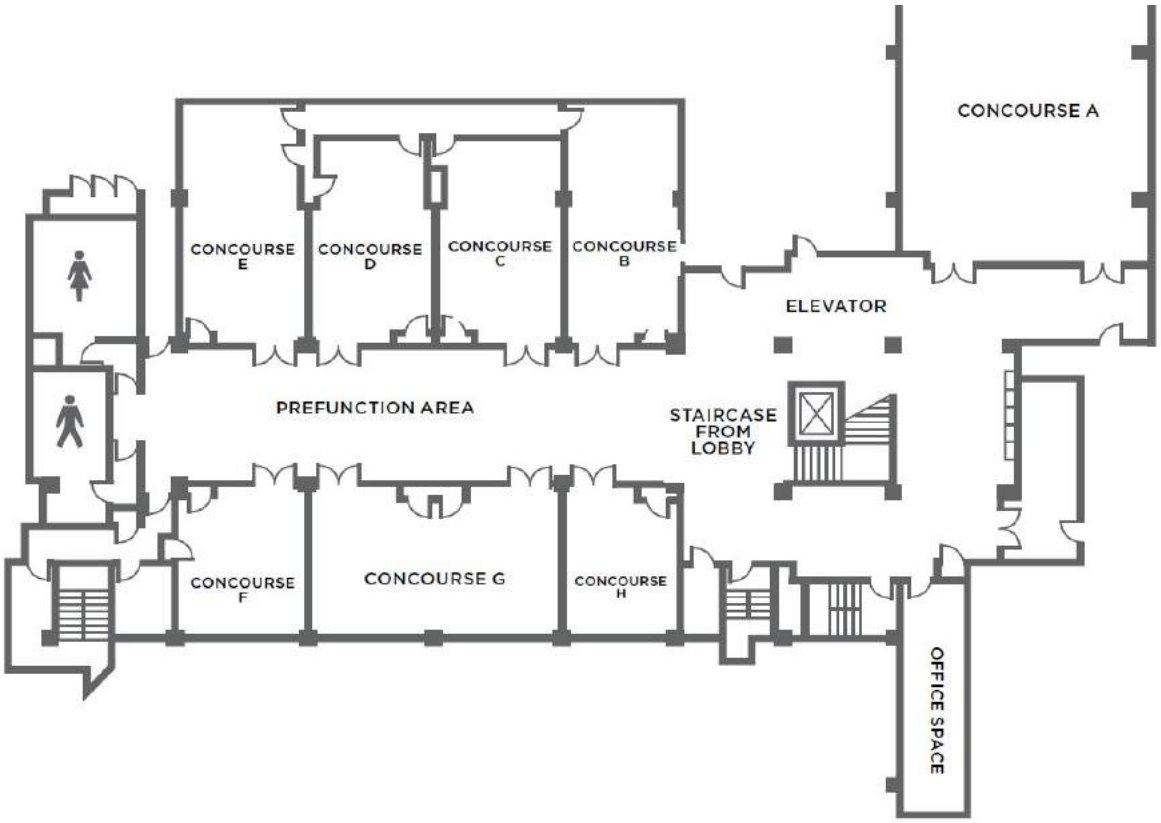
THE ROYAL SOCIETY PUBLISHING

New York Hilton Midtown Hotel Floor plan

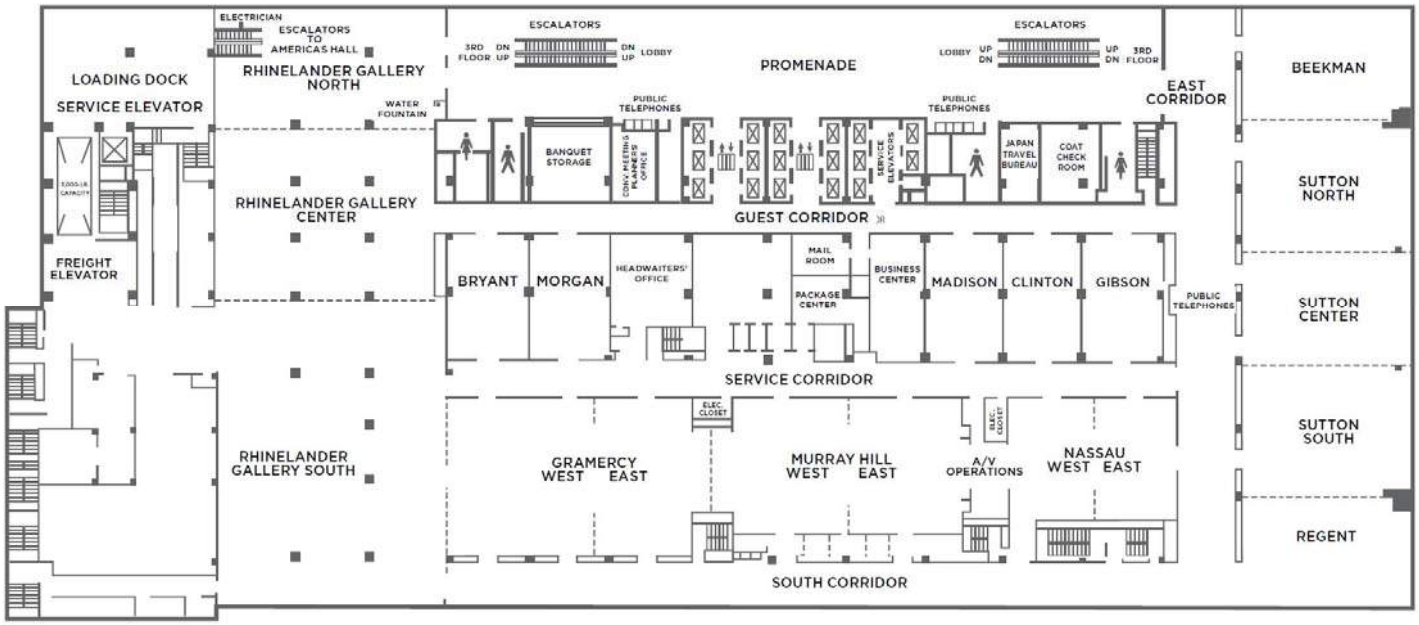
Function Space



Concourse Level: Student Trainee Panel Session



Second Floor: Conference Rooms



Third Floor: CNS Registration Desk and Conference

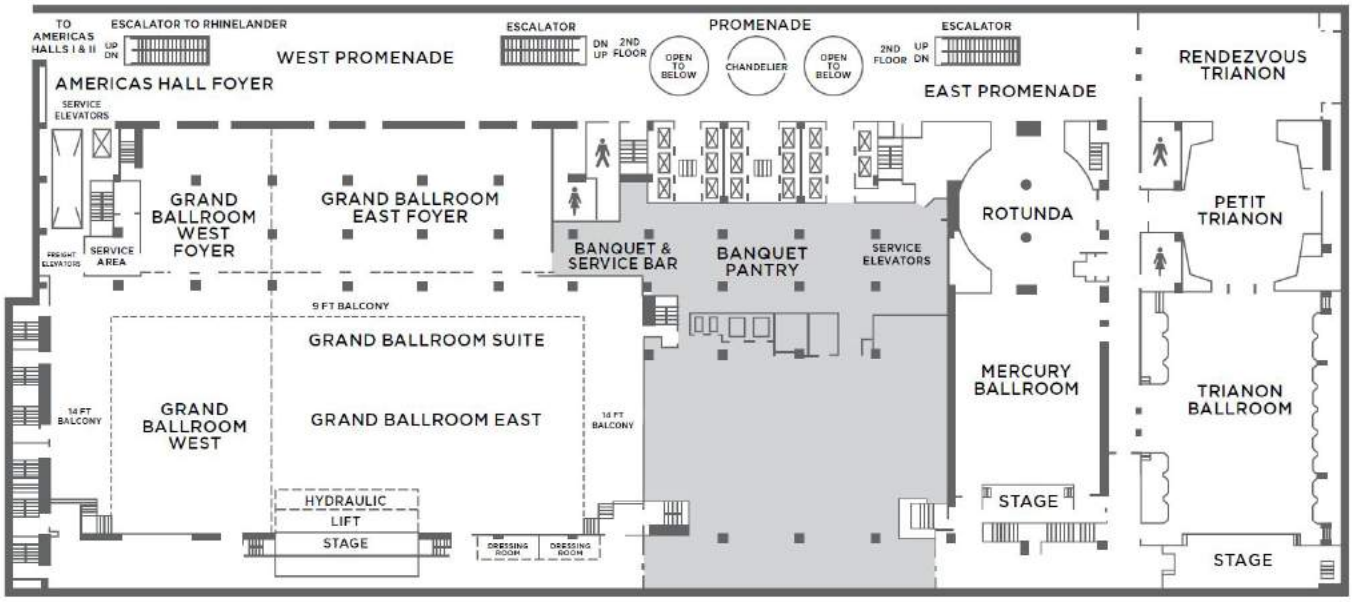
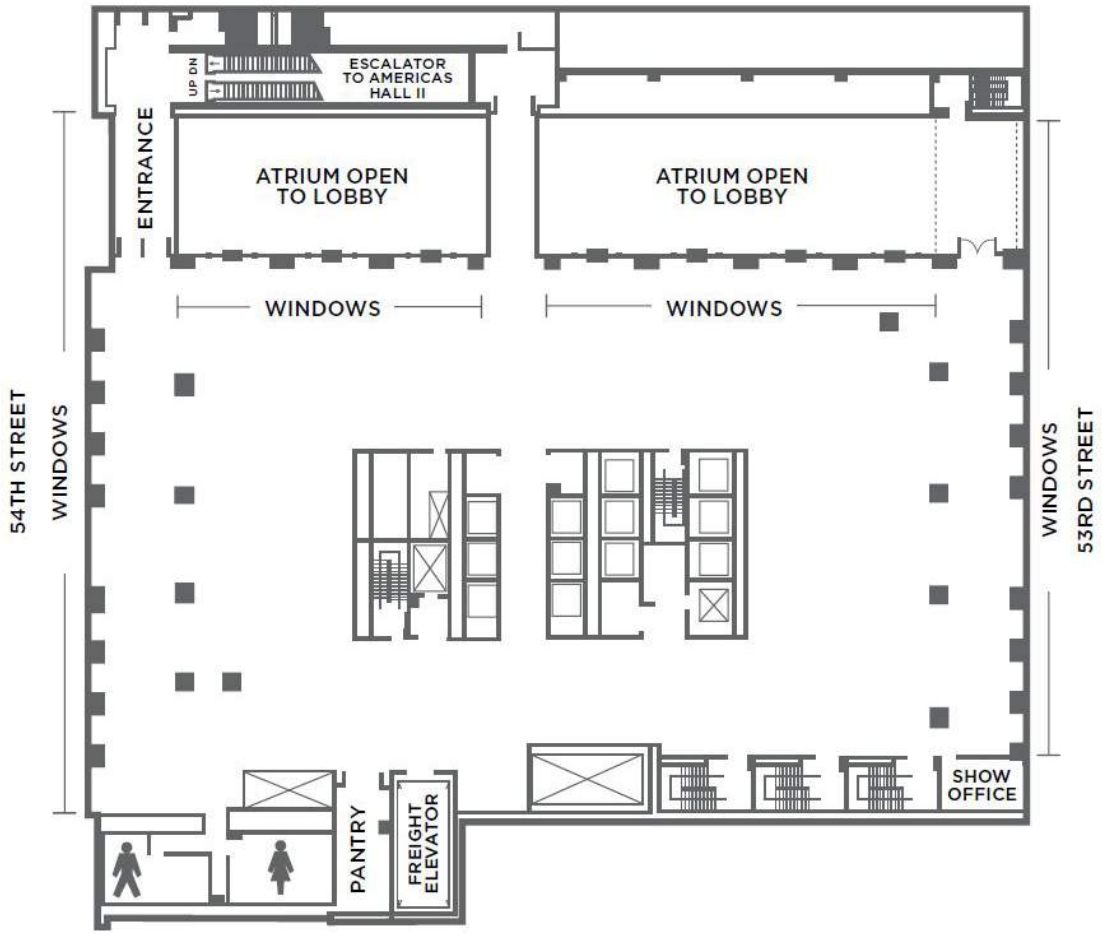
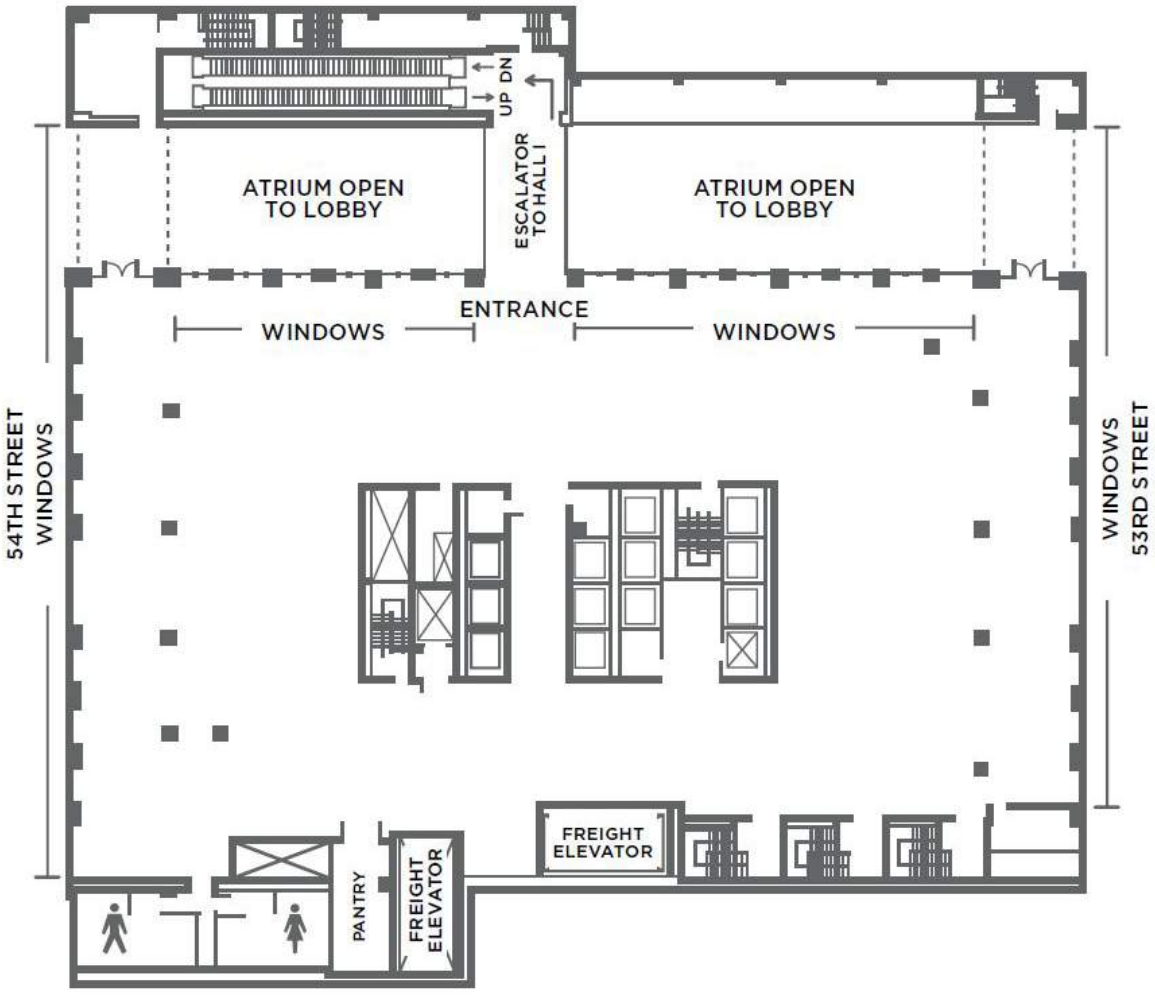


Exhibit Hall - Americas Hall I



Fourth Floor: Exhibit Hall – Americas Hall II