Session G

Tuesday, May 5, 2:00 – 5:00 pm, Exhibit Hall C

G1 Decreased engagement of cognitive control networks is associated with greater music and better reading in children

Rola Farah, Educational Neuroimaging Center- Technion, Ola Ozernov-Palchik, Gabrieli Laboratory-Massachusetts Institute of Technology, John D. E. Gabrieli, Gabrieli Laboratory- Massachusetts Institute of Technology, Tzipi Horowitz-Kraus, Educational Neuroimaging Center- Technion

Introduction: Music experience/training engages various neural circuits and employs several cognitive capabilities, amongst them are executive functions. Existing data suggest that children with reading difficulties share challenges in executive functions. While music training has been related to improvement in cognitive and language abilities both underlie reading, the relationship between music training, reading and executive functions is still scarce. The current study was designed to explore the involvement of executive functions networks in children with and without music experience as related to their reading abilities.

Methods: Resting-state functional MRI data was acquired from children with (N=30, mean age: 9.9 ± 1.24 years) and without music experience (N=25, mean age: 9.72 ± 1.56 years). Reading and executive functions abilities were assessed and functional connectivity within executive functions networks was examined between the groups in relations to their reading ability.

Results: Children with no music experience demonstrated lower reading, speed of processing and executive functions abilities compared to children with music experience. Furthermore, those children exhibited increased correlations between reading ability and functional connectivity between seeds of executive functions networks and visual and auditory regions compared to children with music experience.

Conclusions: Our results suggest that children without music experience utilize neural circuits supporting executive functions more than children with music experience, thus providing a neurobiological account for the relative challenges in reading and executive functions in these children. Furthermore, our results suggest that music training could potentially be associated with modulation of cognitive control networks, which might be related to better reading.

Topic Line: EXECUTIVE PROCESSES: Other

G2 Neural corelates of schema encoding and the role of behavioral flexibility in children with autism spectrum disorder.

Kevin Cook, Georgetown University, Bradley Cherry, Georgetown University, Xiaozhen You, Georgetown University, Junaid Merchant, University of Maryland, Mary Skapek, Children's National, Meredith Powers, University of Virginia, Cara Pugliese, Children's National, Lauren Kenworthy, Children's National, Chandan Vaidya, Georgetown University

Goals: Schemas are a flexible memory representation based on pre-existing knowledge that are posited to promote flexible behavior. Use of schemas depends on the recruitment of both the medial prefrontal cortex (mPFC) and the medial temporal lobe (MTL). Children with autism spectrum disorder (ASD) exhibit pronounced inflexibility and have known atypicalities in the MTL and mPFC. This project aimed to use schema deficits as explanatory mechanism for inflexibility in ASD.

Methods: Children aged 8-16 years with ASD (n=12) and typically developing-TD (n=19) performed an associative encoding task on object-scene image pairs varying in schema congruency (Congruent=snorkel+reef; Intermediate=flowers+playroom; Incongruent=cabinet+canyon) during fMRI. They were subsequently tested out-of-scanner for recognition following a 20-minute delay. Activation for subsequently remembered pairs was examined for congruency differences within masks for MTL and mPFC. Parents also completed a scale of behavioral flexibility.

Results: In a GroupxCongruency ANOVA, groups didn't differ in memory performance. In TD children, a main effect of congruency emerged in one cluster in mPFC and one in left MTL; with greater mPFC and reduced MTL activation for intermediate pairs and the opposite pattern for congruent pairs $F(2,57)= 15.9, p<0.001$. ASD children exhibited no significant clusters responsive to congruency. However, children with ASD who were more flexible exhibited more typical mPFC activation $r=-0.61, p=0.03$ and recruited an additional left rostrolateral prefrontal (BA9/44/46) cluster. Conclusion: In ASD, children with fewer flexibility problems exhibited more typical mPFC activation, suggesting a link between behavioral inflexibility and aberrant schema use at encoding.

Topic Line: EXECUTIVE PROCESSES: Other

G3 Functional correlates of verbal and nonverbal memory in patients with temporal lobe epilepsy

Anna Doll, Bielefeld University, Germany, Martin Wegrzyn, Bielefeld University, Germany, Markus Mertens, Mara Hospital, Bielefeld, Germany, Friedrich G. Woermann, Mara Hospital, Bielefeld, Germany, Kirsten Labudda, Bielefeld University, Germany, Christian G. Bien, Mara Hospital, Bielefeld, Germany, Johanna Kissler, Bielefeld University, Germany

Temporal lobe epilepsy is a disease that affects brain regions assumed to subserve memory formation. In order to elucidate the underlying mechanisms and consequences, we compared the neural correlates of verbal and nonverbal memory in patients with mesial temporal lobe epilepsy (mTLE) and healthy controls (HC). We studied 22 left-sided and 20 right-sided mTLE-patients and 21 HC performing an event-related fMRI task of learning words, faces and pictures. Recognition performance was measured after scanning.

Compared to the HC, recognition accuracy for words was lower in both left- and right-sided mTLE-patients and for faces and scenes only in right-sided mTLE-patients.

All groups demonstrated characteristic modality-specific activations for learning words, faces, and pictures. However, compared to HC, both left- and right-sided mTLE-patients showed reduced activation in the epileptogenic mTL for learning scenes and faces. Compared to HC increased activation was found in left-sided mTLE-patients for learning scenes in right temporo-lateral regions.

Overall, the correlation between cerebral activations during learning and the subsequent recognition accuracy as well as the activations for subsequently remembered versus forgotten stimuli showed little group difference between HC and mTLE-patients. Only left-sided mTL-patients exhibited a significantly stronger subsequent memory effect for faces in the left Amygdala.

Taken together, we found impaired recognition accuracy in mTLE-patients and lower activations in the epileptogenic mTL during learning. Moreover, at least at the group level, similar brain regions appear to subserve recognition performance and subsequent memory formation in both mTLE and HC, with little evidence for systematic plasticity in mTLE.

Topic Line: LONG-TERM MEMORY: Episodic

G4 Functional connectivity at infancy distinguishes familial risk of dyslexia and predicts school-age phonological skills

Xi Yu, Beijing Normal University/Boston Children's Hospital, Ferradal Silvina, Indiana University, Danielle Sliva, Boston Children's Hospital/Brown University, Jade Dunstan, Boston Children's Hospital, Clarisa Carruthers, Boston Children's Hospital, Joseph Sanfilippo, Boston Children's Hospital, Jennifer Zuk, Boston Children's Hospital, Lilla Zöllei, Massachusetts General Hospital, Emma Boyd, Massachusetts General Hospital, Borjan Gagoski, Boston Children's Hospital, Ellen Grant, Boston Children's Hospital, Nadine Gaab, Boston Children's Hospital/Harvard Medical School

Dyslexia has a familial prevalence of 0.4-0.6, compared to a general prevalence of below 0.1. Several dyslexia-susceptibility genes have been identified that play an important role in brain development in utero. Infants with a familial risk (FHD+) have shown alterations in white matter structure important for reading, as well as atypical auditory processing that shapes subsequent phonological and reading skills. However, it is unknown whether and how a familial risk for dyslexia impacts the functional architecture of the infant brain critical for subsequent literacy skills. To address this question, 105 infants (42 FHD+/63 FHD-, 272 ± 102 days) were selected from our ongoing longitudinal project. Their structural and resting-state functional MRI data were collected during natural sleep. Among them, 42 participants were assessed longitudinally on their pre-literacy skills in kindergarten (5.3 ± 1.0 years old). Utilizing the machine learning techniques, three regions located in the temporal lobes were identified that exhibited distinctive functional connectivity fingerprints (FCF)s between FHD+ and FHD- infants, namely, the bilateral inferior temporal gyri (LITG and RITG) and the middle portion of the left temporal pole (midLTP). Moreover, the FCF patterns of these identified regions were further associated with phonological processing skills at the school-age (LITG: r = 0.28; RITG: r = 0.31; midLTP: r = 0.43). These findings suggest that a familial risk of dyslexia might be associated with alterations in the early emergence of the functional network critical for the development of phonological processing, a key precursor for subsequent reading achievement.

Topic Line: LANGUAGE: Development & aging

G5 Withdrawn

G6 Feedback Processing in Declarative Learning - an ERP study

Sneha Karthikeyan, UC Berkeley, Calais Larson, MGH Institute of Health Professions, Yael Arbel, MGH Institute of Health Professions

Learning is often achieved through trial and error guided by feedback. The ability to process performance feedback is, therefore, an important part of the learning process. The purpose of the present study was to evaluate at the electrophysiological level the processing of positive and negative feedback during the learning process. Twenty healthy young adults completed a declarative paired-associate learning task while their electrophysiological (EEG) data were recorded. Participants were tasked with learning nonsense names of novel objects by choosing the correct name out of two possible options. Each response was followed by performance feedback to indicate the correctness of the choice. EEG was time-locked to the presentation of the feedback, and three event related potentials, the feedback relate negativity (FRN), a fronto-central positivity (FCP) and the P300, were examined. Trials were divided into three to evaluate the feedback related ERPs at different stages of the learning process. The results indicated that the FRN to negative feedback decreased with learning, while the FCP to negative feedback increased with learning. The P300 associated with positive feedback decreased with learning, while the P300 to negative feedback increased with learning. These results add to the growing evidence that the amplitudes of the FRN and FCP are modulated by learning. The P300 findings can be interpreted within the framework of violation of expectancy, with positive feedback violating learners' expectancy at the beginning of the learning process, and negative feedback violating expectations when learning is established.

Topic Line: EXECUTIVE PROCESSES: Monitoring & inhibitory control

G7 Age-related differences in the effects of autistic traits on processing a linguistic operator of interpersonal relation

Sachiko Kiyama, Tohoku University, Shingo Tokimoto, Mejiro University, Kanae Ito, Tohoku University, Taiga Naoe, Tohoku University, Min Wang, Tohoku University, Qiong Ma, Tohoku University, Takashi Ueno, Tohoku University, Masatoshi Koizumi, Tohoku University

Emotional reactions to the other's linguistic expressions change with age and could cause intergenerational miscommunication. In East Asian languages, a sentence-final particle such as Japanese'-ne' indicates the speaker's attitude towards the proposition of the sentence. Ending a sentence with '-ne' typically indicates empathy towards the other. This electroencephalographic (EEG) study compared how younger (aged 19-27 years) and older (aged 65-82 years) typically-developed native Japanese speakers perceive the Japanese '-ne' with a focus on their individual autistic traits. During EEG recording, participants were asked to briefly reply to auditorily-presented sentences, either with or without '-ne,' spoken by hypothetical conversational partners appearing on a computer screen. They also completed the standardized screening test for autism (Autism-Spectrum Quotient: AQ). Analysis of event-related potentials (ERPs) revealed an age-related difference in the late positive potential (LPP), a robust component reflecting emotional perception, arising between 300 and 480 ms after sentence end within the occipito-parietal region. Compared to younger adults, older adults yielded a greater LPP for sentences with '-ne' than for those without '-ne' ($p < .05$ with permutation test). The linear mixed effects modeling including each participant's LPP value, AQ score, and sex indicated that older men with more autistic traits generated a greater LPP (beta =1.000, $p < .001$). These findings suggest that an emotional reaction to a linguistic operator of interpersonal relation depends on an individual's autistic traits among the native speakers with typical development, and that such individual differences are further intensified in later life.

Topic Line: LANGUAGE: Development & aging

G8 Withdrawn

G9 Electrophysiological responses to audiovisual-words and pictures in hearing and deaf children using cochlear implants.

Elizabeth Pierotti, University of California, Davis, Sharon Coffey-Corina, University of California, Davis, Tristan Schaefer, University of California, Davis, Kayla Vodacek, University of California, Davis, Lee Miller, University of California, Davis, David Corina, University of California, Davis

The development of lexical representations depends on the ability to associate word forms to semantic knowledge. However, semantic integration might be affected by a lack of spoken-language input early in life, as in the case of children with hearing-loss who later receive cochlear implants (CIs). In this study we measured event-related potentials (ERPs) during a word-picture priming task in normal-hearing (n = 18) (mean age = 77 mos, SD = 28.7) and CI-using deaf children (n = 25) (mean age = 82 mos, SD = 18.4). Participants saw pairs of audiovisual word primes and picture targets that were either semantically related or unrelated, while EEG activity was recorded in 21 channels (Biosemi Active-Two system). In hearing children, semantic relatedness modulated ERP amplitude in a window of 300-500ms after picture onset. More negative responses were elicited to unrelated word-picture pairs than related pairs ($p = .0175$). This effect was mirrored in deaf children with

CIs ($p < .001$). In both groups, negativity was greatest in anterior channels, consistent with previous findings reporting N400-like responses to pictorial stimuli. Importantly, the deaf children's responses to unrelated pairs were significantly more negative than hearing children's responses ($p = .008$). We relate these findings to deaf children auditory experience as measured by Time-in-Sound. These results suggest greater processing costs for the integration of verbal and nonverbal semantic information in deaf children using Cis. This study informs our understanding of the development of cognitive and linguistic abilities in deaf children.

Topic Line: LANGUAGE: Lexicon

G10 Speech production also involves orthographic representations: Evidence from Spanish adults and children

Alberto Furgoni (BCBL - Basque Center on Cognition, Brain and Language, Antje Stoehr (BCBL - Basque Center on Cognition, Brain and Language), Clara D. Martin (BCBL - Basque Center on Cognition, Brain and Language

Previous research on auditory language processing shows that words like 'claim' or 'flame' are cognitively costlier than words like 'globe' or 'probe'. The co-activation of the rhymes "aim" and "ame" slows lexical access compared to "obe". However, no study succeeded in showing evidence for the Orthographic Consistency Effect (OCE) in language production. This study reinvestigates whether the OCE affects language production in Spanish-speaking adults and children. Another novelty is the focus on a fairly transparent language. Thirty adults and 45 seven-year-olds were tested in a picture naming task (PNT). The name of each picture contained either consistently-spelled phonemes (i.e., phonemes with only one possible spelling, e.g., Spanish "p") or some inconsistently-spelled phonemes (i.e., phonemes with multiple spellings, e.g., Spanish "b"). Adults were expected to show longer naming latencies in inconsistent words. Conversely, due to the instability of the phoneme-to-grapheme mappings,children may not be affected by the OCE in the way adults do. A LME model with 'Consistency', 'Group' and 'Familiarity' as predictors for naming times was employed. Familiarity notoriously impacts lexical access in PNT and was thus included. Results show that the OCE interacts with familiarity ($p=0.024$) in both groups alike: inconsistent words elicited longer naming times than consistent words in the lower familiarity range. Overall, the results imply that speakers might not always access the sublexical route when they produce familiar words, whereas orthography may be a proxy for lexical access of less familiar words. These findings apply to also to early stages of reading.

Topic Line: LANGUAGE: Other

G11 Effects of Openness to Experience on Semantic Memory Use: an ERP Study.

Bing Li, , Bing Li, City University of Hong Kong, Qiduo Lin, City University of Hong Kong, Hsu-Wen Huang, City University of Hong Kong

Openness to experience has been found as a personality trait that is positively associated with creativity and positive thinking. However, the underlying nature of this association remains unclear, in particular, it is not clear whether people with different degrees of openness retrieve and process information differently. The current study examined this question by using semantic categorization judgement task in ERP experiments, to tap into some of the most fundamental cognitive processes and reveal multiple, functionally distinct ERP responses yoked to the core of information processing. Four conditions of category-word pairs are utilized: High-typicality, Low-typicality, Within-category-violation, and Between-category-violation. First of all, yes-members (High/Low typicality) are more positive than no-members (Within/Between Violation) at around 200ms for both groups; in addition, effects for typicality and degrees of violations on N400 are found to be modulated by the participants' openness. Low-Openness group shows graded N400 responses: the amplitude for N400 of low-typicality targets intermediates between that of high-typicality and within-violation conditions, and the items of between-violation condition elicit the largest N400. For the High-Openness group, the high-typicality targets are of the smallest N400, low-typicality targets elicit similar N400 responses as the incongruent items as Within-/Between- Violations. The results thus suggest that openness to experience may lead to different cognitive process when evaluating semantic information.

Topic Line: LONG-TERM MEMORY: Semantic

G12 MULTIMAP: Multilingual visual naming test for the mapping of eloquent areas during awake surgeries.

Sandra Gisbert, BCBL, Ileana Quiñones, BCBL, Lucia Amorouso, Basque Center on Cognition, Brain, and Language - BCBL, Polina Timofeeva, BCBL, Shuang Geng, BCBL, Santiago Gil-Robles, Hospital Universitario Quirón Madrid, Iñigo Pomposo, Hospital Universitario Cruces Bilbao, Manuel Carreiras, Basque Center on Cognition, Brain, and Language - BCBL

Picture naming tasks are currently the gold standard for identifying and preserving language-related areas during awake brain surgery. With multilingual populations increasing worldwide, patients frequently need to be tested in more than one language. There is still no reliable testing instrument, as the available batteries have been developed for specific languages. Heterogeneity in the selection criteria for stimuli leads to differences, for example, in the size, color, image quality, and even names associated with pictures, making direct cross-linguistic comparisons difficult. Here we present MULTIMAP, a new multilingual visual naming test for mapping eloquent areas during awake brain surgery. Recognizing that the distinction between nouns and verbs is necessary for detailed and precise language mapping, MULTIMAP consists of a database of 218 standardized color pictures representing both objects and actions. These images have been tested for name agreement with speakers of Spanish, Basque, Catalan, Italian, French, English, and Chinese, and have been controlled for relevant linguistic features in cross-language combinations. The MULTIMAP test for objects and verbs represents an alternative to the monolingual pictorial sets currently used in language mapping, providing an open-source, standardized set of up-to-date pictures, where relevant linguistic variables across several languages have been taken into account in picture creation and selection.

Topic Line: LANGUAGE: Other

G13 Dynamics of neural oscillations and early sensory processing during voluntary finger tapping

Christopher Gundlach, Leipzig University, Matthias Müller, Leipzig University

Sensory perception forms the basis of motivated behavior and simultaneously functions as feedback for the evaluation and adaptation of motor-programs. How exactly motor- and perception-related neural processing interact, is, however, not well understood.

In our earlier work (Makeig et al., 1996), we reported modulation of task-irrelevant auditory information during voluntary simple finger taps. Here, we examined whether such a finding can be expanded to vision. Participants tapped their right index finger about every 8s while a display of task-irrelevant flickering and randomly moving dots was presented and their EEG recorded. Flicker-driven Steady-State-Visual-Evoked-Potentials (SSVEPs) were analyzed as a marker of early visual stimulus processing. Amplitude-dynamics of neural oscillatory activity in the alpha-, beta- and theta-band time-locked to the finger movement were analyzed and their relation to a potential modulation of SSVEP amplitudes was examined.

We found that somatomotor alpha- and beta-band activity started to decrease from up to 1.5 s before the onset of the movement and then increased in

amplitude for up to 3.5 s thereafter. Parieto-occipital alpha-band activity was increased for up to 1 s before the movement. However, occipital SSVEPs amplitudes were not modulated by the movement.

Our data suggest that motor- as well as visually relevant neural oscillatory activity is modulated by simple voluntary movements while early visual stimulus processing remains unaltered.

Topic Line: PERCEPTION & ACTION: Vision

G14 Involuntary mental replay of music improves memory for musical sequence knowledge

Benjamin Kubit, UC Davis/Princeton University, Petr Janata, UC Davis

Involuntary musical imagery (INMI; more commonly known as 'earworms' or having a song 'stuck in your head') is a common musical phenomenon and one of the most salient examples of spontaneous cognition. Recent research has highlighted the role of spontaneous reactivation in memory consolidation. Despite the ubiquitous nature of INMI in the general population the role of INMI in the consolidation of musical memories remains unknown. In three experiments, we manipulated the probability of experiencing INMI for novel music loops by first exposing participants to these loops during tasks that varied in attentional and sensorimotor demands. We used the Musical Sequence Imagery Recognition (MSIR) task to measure the quality of individual loop memories immediately following exposure and at a subsequent delay of 1 week. Across experiments, participants reliably experienced INMI for loops after repeated exposure and both the initial accuracy of a musical memory and the probability of experiencing a loop as INMI was greatest when attentional and sensorimotor processes were directly engaged with a loop during exposure. In each experiment, the amount of INMI experienced for a loop across the delay period predicted both the stability of loop memory as well as improvements in the accuracy of a loop memory over time. We thus provide evidence for a memory-consolidation role for INMI, in which the spontaneous replay of recently encoded music is related to the quality of incidental encoding and predicts changes in music memory over time.

Topic Line: LONG-TERM MEMORY: Other

G15 Development of the Striatum-mediated Reward Prediction Error Processing from Age Three to Twelve Years

Bin Li, University of California, Berkeley

Reward prediction error (RPE), a type of neural signal that encodes discrepancy between expectation and actual outcome, is a crucial component of human learning supported by the striatal dopaminergic reward system. This study analyzes a large open source dataset from a functional magnetic resonance imaging (fMRI) study to examine the developmental trajectory of the processing of RPE. In this study, we identified five novel events in the experimental stimulus of the original study. These events are characterized by the unique 'anticipation-surprise' narrative structure which is similar to the instrumental learning paradigms commonly used in the studies of RPE. With those events as predictors, a voxel-wise general linear model (GLM) analysis was conducted for each age group in the dataset (3, 4, 5, 7, 8-12 years old, and adult group, with n = 17, 14, 34, 23, 34, and 33 respectively). The results of the GLM analyses show noticeable striatal activation in all age groups except 3 and 4-year-old. The study also finds that children ages 8-12 years old show exaggerated striatal activity compared to the other age groups. The results corroborate the view that the development of the striatal RPE processing follows a quadratic trend with inverse U-shape, and suggest that the enhanced RPE activity can be seen in as early as late schooler. The results also demonstrate the effectiveness of the anticipation-surprise narrative in eliciting RPE-related activity in younger children and affords a novel insight into the development of reward processing mechanisms in early childhood.

Topic Line: THINKING: Development & aging

G16 Competitive queuing state of actions during planning predicts execution accuracy of a motor sequence

Myrto Mantziara, Bangor University, Tsvetoslav Ivanov, Bangor University, George Houghton, Bangor University, Katja Kornysheva, Bangor University

Fluent and accurate production of a movement sequence has been associated with preparatory mechanisms prior to sequence execution, yet the content and structure of sequence preparation are not well understood. Previous computational and neuropsysiological work suggests that actions of a sequence are represented as parallel graded activations and selected for output through competition (competitive queuing; CQ). We set out to address whether this CQ gradient is modulated by the timing structure or the precision of the planned sequence. We used a novel behavioural paradigm to access the competitive activation of constituent actions during the preparation of sequences. In three multi-session experiments, 55 healthy participants were trained to produce 4-element finger sequences from long-term memory. By manipulating preparation duration and sequence timing (speed and temporal structure of movements) we evaluated the activation state of actions as reflected on reaction times and error rates to action probes at the end of the preparation period. Our results demonstrate that longer preparation time produced a steeper competitive activation gradient between adjacent sequence elements, whilst sequence timing showed no consistent effects on the latter. Further, the preparatory CQ gradient correlated with sequence fluency during execution defined by initiation speed and temporal precision. We propose a computational model which predicts the relative activation of actions during preparation via positional tuning, determining sequence order and temporal precision independently of the temporal structure of the sequence. Overall, our data suggests that the CQ gradient during sequence preparation is a marker of subsequent sequence fluency and precision.

Topic Line: PERCEPTION & ACTION: Motor control

G17 Decoding visual spatial attention control

Sreenivasan Meyyappan, University of Florida, Abhijit Rajan, University of Florida, Sungkean Kim, University of Florida, Jesse Bengson, Sonoma State University, George Mangun, University of California Davis, Mingzhou Ding, University of Florida

Deploying anticipatory visual spatial attention in advance of stimulus onset enhances the processing of task-relevant stimuli and suppresses distraction. In this study, we investigated the neural representations of attention control signals in visual cortex by applying machine learning techniques to analyze two fMRI datasets, one recorded at University of Florida (n=13) and the other at University of California, Davis (n=18). In both experiments, the participants performed a cued visual spatial attention task, in which each trial began with a cue, instructing the subject to either attend the left or the right visual hemifield. After a random delay, a grating was presented in one of the two hemifields, and the subject was asked to discriminate the spatial frequency of the grating if it appeared in the attended hemifield and ignore it if it appeared in the un-attended hemifield. Estimating cue-evoked fMRI responses trial-by-trial and applying multi-voxel pattern analysis (MVPA) to multiple retinotopic ROIs within the visual cortex, we found the following results: (1) Accuracy of decoding attend-left versus attend-right was significantly above chance level in all the ROIs within the visual cortex, (2) the decoding accuracy across different visual ROIs was highly correlated, (3) subjects with higher decoding accuracy performed better on the task. These results, consistent across the two datasets, suggest that attention control signals are present in both high-order (e.g., intra-parietal sulcus) as well as low-order visual areas (e.g., primary visual cortex) and the distinctness of the neural representations of attention control explains individual differences in task performance.

Topic Line: ATTENTION: Spatial

G18 Mechanisms of overt attention in visual search: Eye tracking, hemifield bias, and willed attention

John Nadra, Center for Mind and Brain, Aastha Mittal, Center for Mind and Brain, Jesse Bengson, Center for Mind and Brain, George R. Mangun, Center for Mind and Brain

In real world vision, eye movements can be driven by either bottom up (saliency) or top down factors (goals). Prior studies of eye movements in complex stimulus arrays have revealed an upper-left visual field bias in first saccades (Durgin et al., 2008). In a visual search task, we investigated whether such biases existed when subjects were given no instructions about where targets were likely to occur, and there was no information in the array to bias their gaze. Participants were instructed to maintain fixation at the center of the screen until the unpredictable onset of an array (of 112 'T's), and to saccade until they found the target (an inverted 'T'). The task was designed so that covert attention alone was not sufficient to find the target. We found a systematic bias in the location of first saccades, with the left visual field preferred over the right, and upper left preferred over upper right. Comparing mean dwell times of the first fixation run, we found a statistically significant difference between interest areas in the left and right ($p < 0.001$), which was also found in reaction time data ($p < 0.05$). Because we actively dissuaded participants from utilizing any form of explicit strategy (e.g. scanning clockwise) and the experiment focused on volitionally-generated saccades, the bias is unlikely to result from explicit strategies, but is more likely related to phenomenon such as pseudoneglect, or learned oculomotor responses resulting from left to right reading in English.

Topic Line: ATTENTION: Spatial

G19 Neural Mechanisms of Attention to Objects

Sean Noah, University of California, Davis, Travis Powell, University of California, Davis, Natalia Khodayari, University of California, Davis, Diana Olivan, University of California, Davis, Mingzhou Ding, University of Florida, George Mangun, University of California, Davis

The neural mechanisms of selective visual attention have been investigated for spatial, feature, and object-based attention. One proposed selection mechanism in cortex is the change in oscillatory activity in the electroencephalography (EEG) alpha band (8 to 12 Hz), with decreased alpha power indicating focal cortical enhancement and increased alpha indicating focal cortical suppression. This pattern is most commonly observed during spatial attention but has also been observed during selective attention to stimulus features, such as color and motion. Here, we test the hypothesis that attention to specific object categories involves similar alpha-mediated changes in focal cortical excitability. Twenty volunteers performed an anticipatory attention task with three categories of objects. In analyzing EEG data with support vector machine (SVM) decoding, we found that alpha patterns differed according to the to-be-attended target object category. This difference between attention conditions was greatest more than 500 msec after the onset of the preparatory cue. We conducted two additional experiments to undermine two alternative explanations of our SVM results. Twenty-five volunteers underwent a control experiment in which the cue shape was not predictive of the upcoming object category; we found that bottom-up, sensory-evoked activity related to the physical cue properties could only be decoded up to 200 msec after cue onset. Ten volunteers underwent an experiment similar to our first experiment, but with the behavioral task equated across object attention conditions; here we replicated the findings of our first experiment, ruling out the possibility that task set differences were driving our original SVM results.

Topic Line: ATTENTION: Other

G20 Targeted memory reactivation in REM, but not in SWS, facilitates rule abstraction

Sofia Pereira, Cardiff University, Ralph Andrews, Cardiff University, Elena Schmidt, Cardiff University, Mark van Rossum, University of Nottingham, Penelope Lewis, Cardiff University

Sleep facilitates abstraction, but the exact mechanisms underpinning this facilitation are unknown. Here, we aimed to determine which sleep stage provides this benefit. We paired abstraction problems with sounds, then replayed these during slow wave sleep (SWS) or rapid eye movement (REM) sleep to trigger memory reactivation. Participants were retested the next morning and again a week later and performance was assessed by the accuracy score. SVRT performance change was compared between sleep stages, cueing conditions and testing sessions (overnight and across a week). We found a significant sleep stage*cueing interaction ($F(1,26) = 6.091$, $p = 0.020$, $?2 = 0.013$), indicating that cueing had different effect when applied to SWS and REM. Separate analyses in each sleep stage further revealed a significant cueing effect in REM ($F(1,26) = 7.930$, $p = 0.009$, $?2 = 0.019$), but not is SWS ($F(1,26) = 1.748$, $p = 0.198$). Furthermore, the event related potentials evoked by our auditory cues differed between memory linked sounds (used in the task) and new, control sounds, in REM, but not in SWS. These differences were found within the 200-400 ms window, which has been associated with the P300 component and they suggest a deeper level of processing in REM. Overall our findings suggest that memory reactivation in REM, but not SWS, facilitates visual rule abstraction.

Topic Line: THINKING: Reasoning

G21 Phase difference of bilateral brain stimulation modulates interhemispheric connectivity during binaural integration

Basil Preisig, University of Zurich, Lars Riecke, Maastricht University, the Netherlands, Matthias Sjerps, Donders Institute, Nijmegen, the Netherlands, Anne Kösem, Lyon Neuroscience Research Center (CRNL), Benjamin Kop, Donders Institute, Nijmegen, the Netherlands, Bob Bramson, Donders Institute, Nijmegen, the Netherlands, Peter Hagoort, Max Planck Institute for Psycholinguistics, Nijmegen, NL, Alexis Hervais-Adelman, University of Zurich

Functional connectivity in the brain plays a major role for information encoding, transfer, and integration. Interregional synchronization of neural oscillations in the gamma frequency band has been suggested as a key mechanism underlying the integration of sensory features. In a recent study, we found evidence for this hypothesis showing that the modulation of interhemispheric oscillatory synchrony by means of bilateral high-density transcranial alternating current stimulation (TACS) modulates inter-aural integration of dichotic acoustic features. Here, we aim to establish a direct link between oscillatory synchrony, effective functional connectivity, and inter-aural integration by applying bilateral TACS during functional magnetic resonance imaging (fMRI). We found that the modulation of interhemispheric oscillatory synchrony by TACS influences the effective connectivity from the right and left auditory cortex in a phase lag-specific way: while in-phase TACS (0° interhemispheric phase lag) decreased effective connectivity, anti-phase TACS (180° phase lag) enhanced effective connectivity. We further found that interhemispheric effective connectivity is linked to sensory integration: stronger perturbation of connectivity induced by in-phase TACS was associated with reduction in a behavioral measure of acoustic feature integration. Our results indicate a causal role for gamma band oscillatory activity in interhemispheric acoustic feature integration, supporting the proposed role of interregional oscillatory synchrony in perceptual integration.

Topic Line: PERCEPTION & ACTION: Audition

G22 Linguistic input drives brain network configuration during language comprehension.

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Assessing the synchrony and interplay between distributed neural regions is critical to understanding how language is processed. Here, we investigated possible neuro-functional links between form and meaning during sentence comprehension combining a classical whole-brain approach to characterize patterns of brain activation resulting from our experimental manipulation with a novel multivariate network-based approach where the combination of graph-theory measures allow us to unravel the architectonic configuration of the language system. Capitalizing on the Spanish gender agreement system, we experimentally manipulated formal and conceptual factors: whether the noun-adjective grammatical gender relationship was congruent or not and whether the noun gender type was conceptual or strictly formal. Left inferior and middle frontal gyri, as well as left MTG/STG emerged as critical areas for the computation of grammatical relations. However, critically, we demonstrate how the interface between formal and conceptual features depends on the synergic articulation of brain areas divided in three subnetworks and extends beyond this classical left-lateralized perisylvian language circuit. Critically, we isolated a subregion of the left angular gyrus showing a significant interaction between gender congruency and gender type. The functional interplay between the angular gyrus and left perisylvian language-specific circuit was identified as crucial for constructing coherent and meaningful messages. Importantly, using graph theory we show the functional malleability of this complex system, so that the role each node play within the network changes depending on the available linguistic cues.

Topic Line: LANGUAGE: Semantic

G23 Boosting creativity through targeted memory reactivation during slow-wave up sates

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Sleep facilitates the transformation of recent acquired memories into stable long-term memories. The consolidation of this memories has been demonstrated to be critically dependent of the nested oscillatory brain mechanisms. Slow oscillations (SOs) are thought to be crucial for active memory consolidation during sleep. Despite many studies showing that inducing reactivation processes experimentally (targeted memory reactivation ?TMR) improves the consolidation, the mechanisms by which SOs impact upon memory reactivation during sleep remains unclear. We hypothesized that experimentally aligning the TMR cues to the SO-up-state should enhance the benefit while, aligning e cues to the SO-down-state should block the memory benefit of the TMR. We first trained participants on three implicit hierarchies. Each item in the hierarchy was associated with a sound during training. After learning, participants slept around 7 hours in the laboratory. During SO sleep we delivered the learned sound cues either during the up-state or during the down-state. Next morning, participants were tested again on the learned pairs (e.g. A>B, B>C, C>D) and on non-learned inference pairs such as B>D. Up-state-TMR increased participants' ability to infer the new pairs compared with the down-state ($t=4.21$, $p<0.001$). By contrast, down-state-TMR not only performed worse than up-state but also than non-cued ($t=-2.46$, $p=0.028$) in the new pairs. In sum, our data show that TMR facilitates the generalization of previously learned structure to new pairs. Fascinatingly, this is only true when applied in the up-state. Down-state TMR actually causes a deficit in this.

Topic Line: THINKING: Problem solving

G24 Computational model of attentional set-shifting with CANTAB IED

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Background: The CANTAB Intra Extra Dimensional Set Shift Task (IED) is a cognitive task which probes reversal learning and attentional set shifting. Individuals with psychiatric diagnoses, such as OCD, schizophrenia, and MDD, produce more errors than control participants on the extra-dimensional set shift stage of the IED task, indicating impaired set-shifting ability. Here we present a computational model of the task, which elucidates how attention and learning mechanisms interact to produce variations in set-shifting ability in these populations.

Methods: 731 healthy participants completed the CANTAB IED task online via Prolific Academic. Computational models were fit to trial-by-trial choice data and maximum likelihood estimation was used to extract participant-specific model parameters. Model fit was assessed qualitatively and quantitatively.

Results: The final model (presented here) uses reinforcement learning on a network structure to learn weights for stimulus features and dimensions. Participants who failed the extra-dimensional set shift stage of the task had lower learning rates for stimulus dimensions (passed: 0.36 ± 0.24; failed: 0.01 ± 0.03, $t = 34.01$, $p < 0.01$), and showed higher attentional bias to a specific stimulus dimension at early stages (passed: 1.66 ± 6.63; failed: 7.09 ± 5.94, $t = 5.65$, $p < 0.01$).

Conclusions: Our findings indicate that participants who fail the extra-dimensional shift stage of the IED do so because they are initially highly biased towards a specific stimulus dimension, and their learning rate is too low for them to shift this attention to another dimension. This provides a possible mechanism by which patients from psychiatric populations exhibit difficulties in attentional set shifting.

Topic Line: EXECUTIVE PROCESSES: Goal maintenance & switching

G25 The role of the Cerebellum in Social Action Sequences

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Social neuroscience has made significant progress in understanding the neural correlates of social cognition, including our ability to read other persons' mental states such as beliefs and traits. However, this research has focused predominantly on the cerebral cortex subserving mentalizing processes. In a recent meta-analysis, Van Overwalle et al. (2014) demonstrated that the posterior cerebellum is also implicated in mind reading. What is the cerebellum doing for mind reading? At a general level, the primary function of the cerebellum is to support sequence learning of movement by internal models which automate motor execution after practice. During evolution, a more advanced function developed which allowed the cerebellum to construct internal models of purely mental processes in which event sequences play a role, without overt movements. These internal models allow humans to better anticipate action sequences during social interaction in an intuitive way, to continuously check whether an anticipated action sequence aligns with current behavior, and where necessary, to adjust these actions rapidly and

continuously. Across 4 studies we tested whether sequential processes subserve social mind reading using a variety of novel tasks involving sequences of social actions. The results of these studies confirm that the posterior cerebellum is involved in sequencing of actions with respect to explicit and implicit learning of sequencing of social actions in healthy and patient groups, involving beliefs and traits. This highlights the neglected contribution of adequate story understanding and sequencing in efficient social cognition and interaction.

Topic Line: EMOTION & SOCIAL: Person perception

G26 The vulnerability of working memory to distraction is rhythmic

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Recent research posits that the cognitive system samples target stimuli in a rhythmic fashion, characterized by target detection fluctuating at frequencies of ~3?8 Hz. Besides prioritized encoding of targets, a key cognitive function is the protection of working memory from distractor intrusion. Here, we test to which degree the vulnerability of working memory to distraction is rhythmic. In an Irrelevant-Speech Task, N = 23 human participants had to retain the serial order of nine numbers in working memory while being distracted by task-irrelevant speech with variable temporal onsets. The magnitude of the distractor-evoked N1 component in the event-related potential as well as behavioural recall accuracy, both measures of memory distraction, were periodically modulated by distractor onset time in approximately 2?4 cycles per second (Hz). Critically, an underlying 2.5-Hz rhythm explained variation in both measures of distraction such that stronger phasic distractor encoding mediated lower phasic memory recall accuracy. In a behavioural follow-up experiment, we tested whether these results would replicate in a task design without rhythmic presentation of target items. Participants (N = 6 with on average >2,500 trials, each) retained two line-figures in memory while being distracted by acoustic noise of varying onset across trials. In agreement with the main experiment, the temporal onset of the distractor periodically modulated memory performance. Together, these results suggest that during working memory retention, the human cognitive system implements distractor suppression in a temporally dynamic fashion, reflected in ~400-ms long cycles of high versus low distractibility.

Topic Line: ATTENTION: Auditory

G27 No distinction between 'capacity' and 'precision': Continuous memory strength explains visual memory errors

Timothy Brady, UC San Diego, Mark Schurgin, UC San Diego, John Wixted, UC San Diego

Over the past decade, many studies have used mixture models to interpret memory data, drawing a distinction between the number of items represented the precision of those representations (Zhang&Luck,2008). The results have led to hundreds of influential claims about the nature of working memory and long-term memory. Here we show that this entire class of models relies on erroneous assumptions about psychological similarity; and once this is considered, a simple generalization of signal detection theory (termed TCC ? target confusability competition model) accurately accounts for response distributions in much more parsimonious terms, and makes many novel predictions that are inconsistent with mixture-based theories. For example, TCC shows that measuring how accurately people can make discriminations between extremely dissimilar items (study red; then report whether studied item is red vs. green) is completely sufficient to predict, with no free parameters, the entire distribution of errors that arises in a continuous report task (report what color you saw on a color wheel). Because this is completely inconsistent with claims that the continuous report distribution arises from multiple distinct parameters, like guessing and precision, TCC is preferred to mixture models in fitting this data by huge margins: group BIC preference for TCC > 650:1, individual subjects: $t(51)=7.64$, $p<0.001$. Although derived from signal detection theory, TCC is also strongly related to models of population coding in visual cortex (see https://bradylab.ucsd.edu/tcc/). Overall, then, TCC suggests a major revision of previous research, as it shows that the distinction between capacity and resolution is illusory.

Topic Line: EXECUTIVE PROCESSES: Working memory

G28 Contextual information modulates speech-aligned neural activity

Nicola Molinaro, BCBL, Mikel Lizarazu, BCBL, Veronica Baldin, BCBL, Jose Pérez-Navarro, BCBL, Paula Ríos-López, BCBL

Predictive processing implies the balanced interaction between internal expectations and external perceptual evidence. Nonetheless, it is not clear how the neurocognitive system integrates these two sources of information. Here we evaluated the neurocognitive correlates of perceptual processing during speech listening by analyzing the amount of synchronization between electrophysiological neural activity and the temporal modulations (i.e., the envelope) of the predicted word. Thirty Spanish native speakers listened to a 14-minute-long passage in which the same words could be either predictable (cloze-probability: â?¥ 0.5) based on context or not (c.p.: < 0.5). We measured EEG activity while participants were attending to the speech. We first analyzed the evoked neural activity time-locked to the target words. A larger negative deflection (N400) was evident for the unpredictable compared to the predictable stimuli in the time interval between 150 and 450 ms. Then we (i) evaluated the inter-trial phase locking value to analyze the phase consistency of the brain response to target words and, (ii) we evaluated the phase alignment between the target word envelope and the brain activity. Both inter-trial phase locking and speech-brain coherence were higher for the unpredictable condition in the time interval between 350 and 500 ms. The present results indicate that the increased contextual predictability of a word reduces the perceptual processing on the temporal structure of the speech input. In addition, the present findings indicate that speech-brain coupling mechanisms could be modulated based on the needs of the cognitive system to comprehend speech.

Topic Line: LANGUAGE: Semantic

G29 Revealing the structure of affective schematic representations in medial prefrontal cortex

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The medial prefrontal cortex (mPFC) has been associated with valuation and supporting memory schemas. Schemas (e.g., of a social network) emerge by extracting commonalities across overlapping experiences and can be understood as network graphs comprising nodes (e.g., individual people) and edges (e.g., their relationships). Here, we propose that the mPFC encodes representations of both the nodes and edges. Specifically, we hypothesize that the strength of the edges is determined by (i) the degree of one's experience with the respective nodes, (ii) their centrality to the schema, and (iii) their affective value. We derived these three features (i.e., experience, centrality, and affective value) for people and places that were personally familiar to the

participants, and extracted a common principal component that quantifies the overall importance of the individual nodes. During fMRI scanning, participants imagined interacting with each person and place, thereby reinstating their unique neural representations. We demonstrate that parts of the mPFC code for the individual nodes. Critically, we then show that the strength of the edges connecting these nodes is best explained by their combined importance. We thus provide novel evidence that the mPFC encodes affective schematic representations, and, importantly, account for the involvement of this region in many seemingly disparate functions.

Topic Line: LONG-TERM MEMORY: Other

G30 Sex differences in episodic memory performance in healthy older adults with family history of Alzheimer's disease

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Declines in episodic memory are among the most common and disabling corollaries of aging, and represent one of the earliest symptoms of Alzheimer's disease (AD). Despite the prevalence and burden of age- and AD-related episodic memory declines, the biological mechanisms underlying such changes remain unclear. Notably, biological sex appears to influence episodic memory in healthy aging, as well as AD risk and progression. Here we examined sex differences in episodic memory performance and related brain activity in 82 age- and education-matched healthy older adults (Mage=63.02±3.74; Meducation=15.62±3.45) with elevated risk of AD due to family history. Compared to men, women exhibited slightly greater neuropsychological performance and more rapid responses despite comparable accuracy on the episodic memory task. Our analyses further revealed different brain activation patterns and brain-behavior relationships for object recognition and contextual recall in men compared to women. These results suggest measurable sex differences in the neural correlates of episodic memory.

Topic Line: LONG-TERM MEMORY: Development & aging

G31 Detecting cued memory reactivation during Slow-Wave Sleep and Rapid Eye Movement Sleep using EEG classifiers

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We developed EEG classifiers to examine neural replay of left and right hand movements after Targeted Memory Reactivation (TMR) during REM and SWS. Participants first spent an adaptation night in the lab, where they heard a series of tones which would subsequently be paired with a serial reaction time task (SRTT). Next, they performed the SRTT, learning two 12-item sequences of button presses cued by pictures and tones. That night, during REM (n=15) or SWS (n=15), the same tones that had been played in the adaptation night were re-presented to trigger reactivation. These tones were now linked to one learned sequence. Behaviourally, TMR facilitated overnight improvement in sequence skill (p=0.04) for the SWS group, but not the REM group (p>0.05). To determine whether TMR triggered reactivation, we built an EEG classifier to detect movement of right vs. left hand during wake. This classifier was applied after each tone during sleep to determine whether the appropriate hand movement was reactivated. In SWS, but not REM, two clusters classified significantly higher for experimental than control night. An early cluster occurred directly after cue onset and a late cluster ~1 sec. later. Interestingly, most cues have only one classification peak (early or late). We were able to detect reactivation throughout the SWS stimulation period, furthermore, reactivation was more likely after TMR sounds on the down-to-up transition of the slow oscillation (SO) than the up-to-down (P=0.018). An additional classifier analysis showed that SO features before the tones could predict subsequent reactivation (P=0.04 vs. control).

Topic Line: LONG-TERM MEMORY: Other

G32 Decoding social knowledge in the human brain

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This fMRI study investigated the representation of abstract concepts in the human brain. It remains largely unexplored how the brain maps different aspects of social information. We asked how social concepts relating to the attitudes, beliefs, or emotions of other people are represented. Thirty participants were presented with audio definitions of social concepts, half referring to affective states (e.g. empathetic) and the other half to non-affective mental concepts (e.g. intelligent). Orthogonally to this, half of the concepts were socially desirable (e.g. sincere) and the other half socially undesirable (e.g. liar). We used a support vector machine to delineate how the affect and likableness dimensions of social concepts were represented in a set of 9 a priori brain regions defined from previous meta-analyses on semantic and social cognition. We show that putative semantic regions, such as the lateral temporal lobe, inferior frontal gyrus and precuneus, outperformed on average canonical social ROIs including the insula and anterior cingulate, with the lateral temporal lobe containing the most information about the affect and likableness of the concepts. However, we also found evidence that the insula shows a bias towards the affect, and the anterior cingulate towards the likableness, of social concepts. Clearly, our results do not support a modular view of the representation of social concepts and are rather consistent with the view that socially-relevant knowledge relies on a widely distributed brain network.

Topic Line: EMOTION & SOCIAL: Person perception

G33 Electrophysiological Consequences of Binge Drinking in Adolescents and Young Adults: A systematic Review

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Research on binge drinking (BD), an excessive but episodic alcohol consumption pattern, has significantly increased in the last decade, mainly due to its major implications in cognitive and brain functioning. The present work is the first to systematically review studies concerned with the effects of BD in the neural activity ?assessed by electroencephalography- of adolescents and young adults (12-30 years old) following the PRISMA guidelines. The literature search was conducted in PsycINFO, Web of Science, and PubMed for 2000-2019 period. After the independent screening of 133 papers by two authors, 32 studies met the inclusion criteria. Results (22 out of 27 studies) indicated that young binge drinkers showed similar behavioral performance as non/low drinkers; however, they exhibited electrophysiological abnormalities. Specifically, enlarged neural activity during alcohol-related information processing, response inhibition, working memory. Also showing increased power in slow and fast frequency bands during resting state. Future studies should be concerned with the need for third-party replication of contradictory studies here reviewed to clarify some inconclusive results. Longitudinal approaches are also required to understand the extent of the neural impairments caused by BD.

Topic Line: METHODS: Electrophysiology

G34 Differences in brain activation in holistic and analytical thinkers elicited by watching a movie on moral dilemma

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Individuals exhibit different thinking styles when perceiving time or objects as well as social situations. Analytical thinkers view themselves as separate from social others with focusing on self-direction, autonomy, and self-expression. In contrast, holistic thinking is characterized by context-dependent categorization and emphasis on relationships and similarities, with focusing on harmony and connection. As culture shapes how we perceive reality, holistic and analytical thinking have been associated with different surroundings: Eastern-culture people view objects more holistically, whereas Western-culture people view objects more analytically. However, these modes are not mutually exclusive, as each individual has these styles to varying degrees. Therefore, we studied whether participants, who have different thinking styles but live within the same culture, exhibit differential brain activity when viewing a drama movie. Based on self-report questionnaire scores, 26 Finnish participants were divided into holistic and analytical thinkers and watched a movie depicting a moral dilemma during functional magnetic resonance imaging. Comparing inter-subject correlations (ISC) of brain hemodynamic activity, holistic thinkers showed significant ISC in more extensive cortical areas than analytical thinkers, suggesting that they perceived the movie more similarly. Particularly, holistic thinkers' ISC were higher in occipital, prefrontal and temporal cortices, whereas higher ISC in analytical thinkers was observed in right-hemisphere fusiform gyrus, temporoparietal junction and frontal cortex. Since these results were obtained in participants with similar cultural background, they are less prone to confounds by other possible cultural differences. Overall, our results point out that there were robust differences in how analytical and holistic participants processed the movie.

Topic Line: EMOTION & SOCIAL: Person perception

G35 Laughter and Light: A Near- Infrared Window into Social Behaviour

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Human perception of non-verbal stimuli is the root of basic behavioural patterns. These sounds convey the internal status of the individual by attaching emotional meaning to the conversation. A prime example a non-verbal vocalisation is laughter, which is universally recognised and allows for a rare cross-culture investigation of social behaviour. 'Volitional laughter' is produced socially, while 'spontaneous laughter' is internally generated and uncontrolled. Our current work seeks to investigate the relationship between a participant's conscious perception of, and the neural process underlying, the detection and processing of volitional and spontaneous laughter sounds. This study uses fNIRS (functional Near-Infrared Spectroscopy), which is a new technology which is silent and can be applied in almost any environment, including while subjects naturally interact with one another. Existing tools for analysing social interactions are either subjective, physically confining, or have limited ecological validity. As a result, fNIRS is uniquely suited to the study of social interaction. Using an array that covered a portion of the temporal and frontal lobes, we were able to determine the differences in neural responses to volitional and spontaneous laughter in adults. Results from this study were utilised for the creation of a similar paradigm to study social behaviour development in infants.

Topic Line: EMOTION & SOCIAL: Person perception

G36 EEG Decoding of Emotional States: Neural Substrate Revealed by Simultaneous EEG-fMRI

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Multivariate pattern analysis (MVPA) has been applied to both EEG and fMRI data. Relative to MVPA decoding of fMRI data, MVPA decoding of EEG data offers the advantage of being able to temporally resolve the formation and evolution of different brain states, but it has the limitation of not being able to provide information on the relevant neuroanatomical substrate. We hypothesized that appropriate fusion of the two recording modalities holds the key to solving this problem. Simultaneous EEG-fMRI was recorded from healthy human subjects viewing unpleasant (mutilation, human violence, attacking animals) and neutral (house hold scenes, people) pictures selected from the International Affective Picture System (IAPS). On each trial the picture was shown for 3000ms. The inter-trial interval (ITI) varied randomly from 2800 to 4300ms. Applying the support vector machine (SVM) technique to single-trial EEG and BOLD responses, we spatially and temporally decoded unpleasant versus neutral brain states. The following results were found. First, starting at ~200ms after picture onset, EEG decoding became significantly above chance level, which lasted until ~1800ms. Second, pleasant pictures are decoded earlier than unpleasant pictures. Third, the decoded neural pattern can generalize over a long time interval. Fourth, the generalization ability can predict the decoding of visual cortex from fMRI data. These results suggest that emotional states elicited by affective pictures can be decoded from EEG data and the formation and development of the neural representations of these emotional states could relate to the sustained enhancement effect on visual cortex.

Topic Line: EMOTION & SOCIAL: Emotional responding

G37 Image Reconstruction Reveals How Aging Impacts Face Perception

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Extensive work has demonstrated a decline in face recognition abilities associated with healthy aging. To date, however, there has been limited insight into the nature and the extent of aging-related alterations in face representations. Here, we sought to address these issues by using a data-driven image reconstruction approach that capitalizes on the structure of behavioral data to reveal the pictorial content of visual representations. To this end, healthy young and older adults provided pairwise similarity judgments for face images, with participant-specific ratings then used to construct a corresponding face space. Facial shape and surface features were subsequently derived from the face space of every participant and combined into image reconstructions of facial appearance. Reconstructed images were then evaluated both objectively via an Euclidean metric and experimentally by an independent group of validators. Our results revealed that reconstructions were successful for every participant. However, reconstruction accuracies were lower for older adults than young adults. Importantly, shape and surface properties diagnostic for face perception, such as eye shape and skin tone, were less accurately represented in older than young individuals. Yet, aging-related differences, though significant, accounted for less proportion of individual variability in face representations compared to those due to differences in visual discrimination ability. Thus, our findings provide novel insights into the impact of aging on face perception. Further, they validate the applicability of image reconstruction to a wider population and demonstrate its

utility of elucidating both group-level and individual differences in visual perception.

Topic Line: PERCEPTION & ACTION: Vision

G38 The impact of momentary lapses in attention during encoding on spatial context memory performance

Abdel Elshiekh, McGill University, Maria Rajah, McGill University

Episodic memory and attention interact in fundamental ways. Yet, the components of attention and memory are primarily examined in isolation and questions about the behavioural consequences of their interaction remain relatively underexplored. Previous studies have mostly relied on divided attention paradigms where attention is divided at encoding by asking participants to study items while engaging in a concurrent task. Under these conditions, memory performance is impaired especially for the contextual details surrounding items. It remains unclear how the natural fluctuations in attentional state or momentary lapses in attention at encoding may impact memory performance at retrieval. In this study, we examined how lapses in attention predict item and spatial context memory performance in 30 younger adults (21-35 years old). We utilized a novel hybrid task of spatial context memory and attention. On each trial, participants were asked to encode a picture of an object and its spatial location. Subsequently, a fixation cross that increased in size after a variable duration appeared and participants were instructed to respond to the change in size as quickly as possibly. Response times (RTs) were used to gauge attention levels during encoding and lapses in attention were operationalized as relatively longer RTs to the variable fixation cross. Memory for the items and their location were subsequently tested at retrieval. Results reveal that lapses in attention at encoding were associated with context memory failures, but intact item memory performance. Findings from this study will inform our current understanding on the interaction between attention and memory systems.

Topic Line: LONG-TERM MEMORY: Episodic

G39 The effects of contextual diversity on reading measures in foreign and native language vocabulary learning

Candice Frances, BCBL, Jon Andoni Duñabeitia, Nebrija University & Arctic University of Norway

Recent studies have suggested that contextual diversity is responsible for some of the effects claimed by word frequency. The current study consists of an eye-tracking experiment in which participants read 30 short stories while their ocular movements were tracked. These were either in their native (Spanish) or foreign (English) language. They included pseudowords that each participant saw eight times. Contextual diversity was manipulated by presenting these in different numbers of texts (8, 4, 2, or 1). After reading these texts, participants did a recall-fill-in-the-blank-task and a recognition task. The behavioral data showed improvements in recognition accuracy and reaction times for pseudowords presented with higher contextual diversity, but no effects of language and no interaction. Only a subset of the participants have been analyzed so far. Initial eye tracking results suggest effects of language in reading time for the whole text and marginal effects of diversity in some fixation measures. Preliminary tests showed that second pass duration interacted with diversity and language in predicting correct trials and several eye-tracking measures (first fixation, first pass, and fixation count) interacted with language in predicting response times. Results so far suggest that contextual diversity aids vocabulary learning and that, although we have not found direct differences in fixation measures between language conditions, these measures may interact in the prediction of response times. This experiment has practical applications for foreign language vocabulary learning.

Topic Line: LANGUAGE: Lexicon

G40 Functional and structural biomarkers of cognitive outcomes after brain tumor resection

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Diffuse low-grade glioma (DLGG) is a primary brain tumor that affects an individual's cognitive faculties. The slow growth of this type of lesion allows the brain to reorganize its structure and functions, delaying the onset of cognitive symptoms. Nevertheless, DLGG evolves to become a more invasive type of tumor, at the expense of both survival and the prognosis for healthy cognitive function. Surgical resection of these tumors can damage the neural substrates of critical cognitive functions, as DLGG frequently invades putative areas of language, motor, visuospatial, or memory functions. By applying machine learning algorithms to a compendium of clinical, behavioral, and neuro-anatomical feature sets from a sample of 17 individuals with DLGG, we aimed to identify behavioral and structural biomarkers that predict an individual patient's postsurgical cognitive outcomes (i.e., language, working memory, cognitive control, and overall cognitive status). Specifically, we contrasted the predictive performance of different models to classify cognitive outcomes when trained on one or more of the above mentioned feature sets. Our results indicated that a subset of features from clinical, behavioral and structural imaging measures better predicted patient's prognosis over features from each separate measure. Moreover, Logistic Regression classification yielded the highest performance when predicting cognitive status and working memory outcomes. This study provides a proof-of-concept for classifying patient's cognitive prognosis. Further development of these tools are essential for both clinicians and patients, as they can aid in planning surgeries and promote longer life expectancy and better quality of life for patients.

Topic Line: METHODS: Other

G41 Spatio-temporal dynamics of noun and verb naming in early bilinguals

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Despite decades of research, there is still an ongoing debate on whether words representing objects (nouns) and words representing actions (verbs) recruit different or similar functional networks in the brain. Furthermore, little is known about how these linguistic representations are processed in the bilingual brain. To shed light on these aspects, we recorded neuromagnetic signals while 20 early high-proficient Spanish-Basque bilinguals performed a noun and verb picture-naming task. We performed time-frequency analysis to examine how power varied based on category and language. Differences between conditions were assessed using cluster-based permutation tests and sensor-level effects were source-reconstructed using Beamforming. Overall, we found increased power for verbs as compared to nouns in low frequencies in a time-window classically associated to lexico-semantic processing (200-400ms). When comparing categories across languages no differences were observed neither for noun nor verb naming. Source reconstruction of the category effects showed the involvement of partially different networks for nouns and verbs. Specifically, similar networks comprising bilateral occipito-temporal regions observed in theta (4-8Hz) and alpha (8-12Hz) bands. However, in the beta band (13-28Hz), noun and verb processing engaged different regions in the left hemisphere, including inferior temporal and frontal

areas in the case of nouns and the dorsal fronto-parietal network, in the case of verbs. Our results suggest noun and verb processing recruit partially non-overlapping networks during speech production. Interestingly, they underscore the existence of common oscillatory dynamics across languages, suggesting that principles governing the organization of lexico-semantic representations is similar in highly proficient bilinguals.

Topic Line: LANGUAGE: Semantic

G42 Variability in Executive Control Performance is Predicted by Physical Activity

Geoffrey Gooderham, University of British Columbia, Simon Ho, University of British Columbia, Todd Handy, University of British Columbia

Physical activity (PA) promotes neurogenesis and has neuroprotective effects on the brain, bolstering the structural and functional resources available for improved cognitive functioning. Neuropsychological structure and functional ability are linked to intraindividual variability (IIV) in cognitive performance. Despite this evidence, there have been few investigations into the link between PA and IIV. Across three studies we investigate the effect of PA on young adult's IIV in reaction time (RT) on three modified Flanker Tasks. The International PA Questionnaire was used to evaluate PA while the Attention Network Test (ANT) and two modified Flanker Tasks assessed executive control and attention. Participant RT coefficients of variation (RTCV) were calculated by dividing the standard deviation by the mean RT for each stimulus. Analysis revealed that PA was not associated with basic RT nor IIV on the modified Flanker Tasks. However, three findings emerged from analysis of the ANT. First, RTCV and moderate PA were positively related, with more moderate PA associated with greater IIV. Conversely, RTCV and vigorous PA were negatively related. Finally, when controlling for the effects of PA, variability decreased as age increased. Together, PA is predictive of IIV on attentional and executive control tasks, though only at particular intensities and on certain tasks, indicating that task type and cognitive load are important determinants of the PA-cognition relationship. These findings, and other studies, suggest that the effects of PA on young adults is reliant on specific interventions and measures to detect effects found more readily in other age groups.

Topic Line: EXECUTIVE PROCESSES: Monitoring & inhibitory control

G43 The effects of wearing an Eye Mask on cognitive functions and sleep architecture

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Study Objectives: In this study, we aimed to explore whether wearing an eye mask while sleeping, therefore minimizing light exposure, would affect the quality and the macrostructure of sleep, and improve cognitive performance.

Methods: Ninety-five healthy participants were tested in a within-subject design. In counterbalanced order, ambient light was blocked during sleep with an eye mask for one week during the summer months (experimental condition) or not-blocked (control condition). After five habituation nights, participants were tested on three cognitive tasks: word pairs memory, Psychomotor vigilance task (PVT), and motor-skill learning (MSL) on two consecutive days. Overnight consolidation was also examined on word pairs and MSL.

On the last testing days of both weeks, participant wore a wearable EEG devise in order to measure sleep architecture.

Results: Our analysis revealed superior word pairs encoding in the blocked light condition ($p = 0.024$). We also found faster performance on the second day of PVT in the blocked light condition ($p = 0.002$). The eye mask didn't provide a better performance on MSL (Blocked-light: $p < 0.001$ vs. No blocked-light: $p < 0.001$) or overnight consolidation of word pairs ($p = 0.363$).

The blocking light exposure increased the percentage of time spent in NREM stage 2 ($p = 0.023$) and REM sleep ($p = 0.025$).

Conclusion: We conclude that wearing an eye mask during the summer do not only contributes to optimize learning ability and vigilance, but also provides beneficial effect in terms on sleep quality and sleep architecture. No effect was found on motor performance on a finger-tapping task.

Topic Line: LONG-TERM MEMORY: Other

G44 The Role of Maternal Education on Executive Functions in Children with Reading Difficulties and Typical Readers

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Five to 15% of school age children have reading difficulties (RD, or dyslexia), defined by deficits in phonological processing, fluency, and executive functions (EF) difficulties. Although dyslexia is referred to as a genetic disorder, reading ability may also be affected by environmental factors such as inadequate exposure to literacy and a lack of parental involvement. These environmental components are a part of the socioeconomic status (SES) measure, which is defined by parental occupation, educational attainment and household income and is positively correlated to reading ability. The goal of the current study was to relate maternal education, a construct of SES, to EFs and reading in 25 children with RD compared to 21 typical readers (TRs) using behavioral and neurobiological resting state fMRI data. The results show that higher maternal education was related to better phonemic fluency for children with RD ($r = -.448$, $P < .05$) and decreased impulsivity for TRs ($r = -.646$, $P < .05$). Higher maternal education was also related to decreased functional connectivity between the orienting attention and executive control networks and parts of the left cerebellum (Crus 1) and lobule 6, left occipital fusiform gyrus, and left lingual gyrus in children with RD greater than TRs ($P < .05$, FDR corrected). These results may suggest that higher maternal education may have different roles in the involvement of cognitive control in reading for children with RD and TRs. We conclude that higher maternal education may mediate the synchronization of cognitive control networks important for reading acquisition especially in children with RD.

Topic Line: METHODS: Neuroimaging

G45 Role of magnocellular and parvocellular visual pathways in object and word recognition

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The magnocellular dorsal stream is involved in detecting spatial relationships and rapid changes, being highly sensitive to motion; the parvocellular ventral stream is responsible for visual resolution and chromatic processing. The magnocellular pathway appears to be involved in text perception and reading, and deficits in both the magnocellular and parvocellular pathways have been observed in children with dyslexia. Nevertheless, there is limited neuroimaging evidence on the specific contributions of the magnocellular and parvocellular pathways to typical object recognition and reading. To further unravel these contributions, we designed a fMRI study in which a total of 34 healthy adults aged 18-35 years made natural/artificial judgments on object images and words that were either (i) magno-biased: low-luminance contrast and

achromatic; (ii) parvo-biased: isoluminant (red-green) and chromatically defined; or (iii) neutral: not sensitive to low-luminance-contrasts and achromatic or red-green. Our behavioral results revealed better accuracy and faster reaction times for parvocellular-biased and neutral non-biased stimuli than magnocellular-biased stimuli. Differential recruitment of posterior versus anterior brain regions as a function of our experimental conditions was observed in visual regions, ventral occipitotemporal cortex (vOTC), and inferior frontal gyrus. Significant functional coupling was also observed between anterior and posterior temporal regions for magnocellular-biased stimuli. Results will be discussed in the context of current neuroanatomical reading models.

Topic Line: LANGUAGE: Other

G46 The effects of orthographic consistency at different levels of speech processing in Spanish beginning readers

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Words with consistent spellings are recognized faster than words with inconsistent spellings. This orthographic consistency effect (OCE) has been shown across different opaque orthographies. However, little is known about this effect in languages with less complex grapheme-to-phoneme conversion rules (e.g., Spanish) or if it can be observed even at the early stages of reading acquisition. Therefore the aim of this study was to investigate the presence of the OCE in Spanish beginning readers. Furthermore, the study investigated possible effects at a more fine-grained level, namely the phonemic level. A total of 60 Spanish second graders (7years) completed a word-pseudoword reading task with consistently-spelled and inconsistently-spelled items (consistent versus inconsistent grapheme-to-phoneme correspondences). Next, they performed an oddball-like phoneme monitoring task in which one consistent and one inconsistent phoneme acted as infrequent deviant stimuli embedded in the auditory stream consisting of one repetitive standard phoneme. Results from the reading task show a clear effect of consistency on both accuracy and speech onset time measures. Importantly, these effects were present even on the lower, phonemic level, as indicated by both longer response times and more errors when responding to inconsistent compared to consistent phonemes in the phoneme monitoring task. The observed pattern of results reveals the presence of the OCE at both word and phonemic levels in a highly consistent language such as Spanish, further supporting that orthography affects language processing beyond reading. Future research will focus on the developmental trajectory of these effects by testing a group of more advanced Spanish readers.

Topic Line: LANGUAGE: Other

G47 Cortical distance between category-selective visual areas determines the representation of multi-category scenes

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A well-established feature of primate's high-level visual cortex is the functional organization of category-selective regions that reside in adjacent locations. Nevertheless, the functional significance of this organization is still unknown. It has been recently shown that the representation of pairs of multi-category stimuli in category-selective areas are biased towards the preferred category. This bias is formed by a normalization mechanism acting locally in an area with homogeneous category-selective neurons. Accordingly, we hypothesized that cortical proximity between category-selective areas determines the relative contribution of each category to the representation of multi-category scenes. To test this hypothesis, we measured the fMRI response to multi-category scenes composed of a person and a chair in a room as well as to the isolated face, body, chair and room. To assess the contribution of each of the isolated categories to the representation of the scene, we fitted a linear model predicting the response to the scene based on the responses to the isolated categories. Consistent with our hypothesis we found that when category-selective areas reside in adjacent locations, the relative contribution of their preferred categories to the scene representation is determined by their cortical proximity. When category-selective areas reside in distant locations, the preferred category dominated the representation of the scene and the contribution of the non-preferred categories was negligible. These findings provide for the first time a functional account for the well-established organization of category-selective areas showing the effect of their relative locations on the representation of multi-category visual scenes.

Topic Line: PERCEPTION & ACTION: Vision

G48 A neural code for egocentric spatial maps in the human medial temporal lobe

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Spatial navigation is vital for the survival of humans and animals (Kunz et al., Trends Cogn Sci, 2019). The ability to navigate relies on neural systems that encode information about places, distances, and directions relative to the external world or relative to the navigating organism (Burgess, Trends Cogn Sci, 2006). Ever since the proposal of cognitive maps (Tolman, Psychol Rev, 1948), the neuroscience of navigation has focused on allocentric (world-referenced) neural representations including place cells (O'Keefe & Dostrovsky, Brain Res, 1971), grid cells (Hafting et al., Nature, 2005), and head-direction cells (Taube et al., J Neurosci, 1990). However, little is known about the neural basis of egocentric (self-centered) representations-despite abundant evidence for egocentric navigation strategies in spatial behavior (Coughlan et al., Nat Rev Neurol, 2018). Here, using single-neuron recordings in epilepsy patients performing virtual navigation tasks (Kunz et al., Science, 2015), we identify 'anchor cells' in the human brain as a neural code for egocentric spatial information: Anchor cells represent egocentric directions towards 'anchor points' located in the environmental center or periphery. Anchor cells supported full vectorial representations of egocentric space by additionally encoding anchor-point distances. They were abundant in parahippocampal cortex and were integrated into a neural memory network. Neurons encoding allocentric direction complemented anchor-cell activity, potentially assisting anchor cells in transforming sensory input into allocentric representations (Bicanski & Burgess, eLife, 2018). Anchor cells may facilitate egocentric navigation strategies, may support route planning from an egocentric viewpoint, and may underlie the first-person perspective in episodic memories.

Topic Line: OTHER

G49 Testing the reinforcement learning hypothesis of social conformity

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Our preferences are influenced by the opinions of others. The past human neuroimaging studies on social conformity have identified a network of brain regions related to social conformity that includes the posterior medial frontal cortex (pMFC), anterior insula, and striatum. It was hypothesized that since these brain regions are also known to play important roles in reinforcement learning (i.e., processing prediction error), social conformity and reinforcement learning have a common neural mechanism. However, these two processes have previously never been directly compared; therefore, the extent to which they shared a common neural mechanism had remained unclear. This study aimed to formally test the hypothesis. The same group of participants (n = 25) performed social conformity and reinforcement learning tasks inside a functional magnetic resonance imaging (fMRI) scanner. Univariate fMRI data analyses revealed activation overlaps in the pMFC and bilateral insula between social conflict and unsigned prediction error and in the striatum between social conflict and signed prediction error. We further conducted multi-voxel pattern analysis (MVPA) for more direct evidence of a shared neural mechanism. MVPA did not reveal any evidence to support the hypothesis in any of these regions but found that activation patterns between social conflict and prediction error in these regions were largely distinct. Taken together, the present study provides no clear evidence of a common neural mechanism between social conformity and reinforcement learning.

Topic Line: EMOTION & SOCIAL: Other

G50 Attention Orienting in the Neuroligin-3 Mouse Model of Autism

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We investigated attention orienting in mice with and without the autism-associated R451C (arginine to cysteine residue 451 substitution) mutation in neuroligin-3 (NL3) using our newly developed mouse Posner task. Twenty NL3 mice and twenty wild-type (WT) mice were trained and tested in automated touchscreen chambers. Mice were trained to sustain their nose-poke to a central square until the display of a peripheral target (a bright square). The targets were either validly or invalidly cued. In the exogenous tasks, the cue was a flash of light at the sides. In the endogenous tasks, mice were trained to learn a spatially-predictive image presented at the centre. The effects of atomoxetine (ATX), a norepinephrine-modulating medication, on response times and accuracy were assessed. On both tasks, mice showed shorter response times and higher accuracy in the validly versus invalidly cued trials. This effect is consistent with results in the human Posner task, supporting the use of the Posner paradigm in mice. There was no significant difference in performance between NL3 and WT mice on response times or accuracy. In the exogenous task, ATX increased response times and decreased accuracy similarly in NL3 and WT mice. In the endogenous task, ATX increased accuracy more in NL3 mice compared to WT mice, with no differential effects on response times. In conclusion, our study did not find significant differences between NL3 and WT mice in attention orienting. Following the administration of ATX, however, NL3 mice showed better performance relative to WT mice in the endogenous task.

Topic Line: ATTENTION: Spatial

G51 The posterior cerebellum supports implicit learning of true and false belief sequences

Qianying Ma, Vrije Universiteit Brussel, Min Pu, Vrije Universiteit Brussel, Frank Van Overwalle, Vrije Universiteit Brussel

Sequences exist in numerous motor, cognitive and social skills, and learning sequences help people to execute and predict efficient and adaptive behaviors. Besides evidence for cerebellar contribution to motor and cognitive sequence learning, recent studies documented posterior cerebellar activation in multiple social cognition tasks in which sequences play a critical role (e.g. generating the chronological order of a social story). Here, we investigated the function of the cerebellum when people learn regularities in a social context implicitly. In particular, we used a novel social implicit sequence learning task, combining elements from false belief and serial reaction time tasks. Participants learned that protagonists were offered flowers at four locations. The protagonists' beliefs concerning the flowers were true or false, respectively, depending on their orientation towards the scene (true belief: flowers could be seen) or away from it (false belief: protagonists believe that everything was as before). Participants then had to indicate as fast as possible how many flowers were given according to the protagonists' perspective. Unbeknown to the participants, there was a sequence tied to the two protagonists and their belief orientations. As predicted, the results revealed that the posterior cerebellum was activated during belief sequence learning, and was also involved in detecting violations when the learned belief sequence was disrupted by a random sequence. Together, our results highlight contributions of the posterior cerebellum in the implicit formation of internal representations of new belief sequences at the learning phase and in the detection of sequential violations.

Topic Line: EMOTION & SOCIAL: Person perception

G52 Anticipation of food stimuli are related to lifetime depression and obesity

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Background: Anticipation of food stimuli may affect people's eating behavior and overall psychological state. The aim of this study was to determine how brain activation during anticipation and processing of food images was related to lifetime depression symptoms and BMI. Methods: 81 participants (42 healthy controls and 39 with unipolar depression, mean age=29.2±6.7) underwent the fMRI scan during the Cued Encoding task. In this task, participants first anticipated a food or non-food image and then judged the image presented as pleasant/unpleasant. Participants also completed the Eating Disorder Examination questionnaire, a self-report measure of eating disorder symptomatology, and the Mood Spectrum questionnaire, a self-report measure of lifetime depression severity. Results: A significant BMI-by-depression severity interaction was observed in the bilateral fusiform gyrus (p-corrected<0.05) during food stimulus anticipation. More severe depression was associated with an increase in fusiform activation in individuals with normal weight. The opposite pattern was observed in overweight/obese individuals. The BMI-by-depression severity interaction also explained 30% of the variance in eating disorder pathology ($F(3,75)=10.6$, $p<0.001$). Higher eating disorder psychopathology was observed in participants with more severe lifetime depression symptoms, but only among overweight or obese participants. Conclusions: Depression is a risk factor for eating disorders, but only in overweight/obese individuals. Decreased anticipatory activation in the fusiform gyrus during food anticipation in overweight/obese individuals with a history of severe depression may indicate that they suppress thoughts/imagery associated with future food encounters. This might be detrimental to the regulation of appetitive behavior when the food is presented.

Topic Line: OTHER

G53 Social Context-Dependent Role of the Left Medial Prefrontal Cortex in Communicational Exchanges: rTMS Evidence

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The left medial prefrontal cortex (lmPFC) was suggested as one area linked to self-referential
processing in metacognitive decision tasks. We addressed its role in controlling information exchanges with repetitive transcranial magnetic stimulation (rTMS) to assess the involvement of the lmPFC in two different types of social contexts: formal, informal. Three groups of participants received 15 minutes of an offline 1-Hz inhibitory rTMS of either: (1) lmPFC target area, (2) rmPFC active control site, or (3) lmPFC sham (placebo stimulation). Afterwards, participants answered difficult general knowledge questions and rated their confidence in the correctness of their answers. Finally, they decided if they would report or withhold those answers in a formal (job interview) and informal (with friends) contexts. There were more reported than withheld answers for the informal context in all groups. However, for the formal context, the pattern in the lmPFC target group inverted with more withheld than reported answers; furthermore, this context showed no differences between reported and withheld answers in the two control groups. Thus, lmPFC inhibition seems to result in a more rational decision. Research supported by the Russian Science Foundation project (RSF-19-18-00534).

Topic Line: OTHER

G54 The effects of acute high-intensity interval exercise on the temporal dynamics of inhibitory control and ERPs

Caroline Meadows, UNC-Greensboro, Eric Drollette, UNC-Greensboro

Acute aerobic high intensity interval training (HIIT) has demonstrated positive effects on inhibitory control in young adults. However, the evidence is not well established regarding the combination of HIIT aerobic and resistance training in accordance with underlying neural mechanisms following acute exercise. The purpose of the present investigation was to examine the transient effects of HIIT-aerobic and HIIT-aerobic resistance on event-related potentials (ERP's) during an inhibitory control task in 18- 30-year-old adults. All participants (n = 24) completed the flanker task on three separate counterbalanced days (i.e., HIIT-aerobic, HIIT-aerobic resistance, and seated rest). HIIT-aerobic consisted of running bouts on a treadmill at 90% of maximal heart rate with intermittent bouts of walking. HIIT-aerobic resistance consisted of high intensity calisthenics with intermittent resting periods. Task performance and the P3 ERP component were assessed at approximately 30-minutes and 85-minutes following 9-minutes of each condition. Results revealed no improvements or decrements in behavior (i.e., reaction time, response accuracy) and P3 measures of latency and amplitude following the HIIT and rest conditions. Together, these data suggest inhibitory control and neuroelectric underpinnings are not affected by different modalities of HIIT at 30-minutes and 85-minutes following the exercise bouts. Such findings have implications for promoting time-efficient healthy physical activity behaviors without disrupting necessary cognitive functioning throughout the day.

Topic Line: EXECUTIVE PROCESSES: Monitoring & inhibitory control

G55 Visuospatial distribution of endogenous attention

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Visual stimulation has been employed for decades to investigate the neural substrate of attention. However, despite knowing the influence of spatial location of stimuli on perception, its effect on attention has not been systematically studied yet. Therefore, the aim of this study was to perform a detailed description of the modulation of visual ERPs by endogenous attention. To this purpose, electroencephalographic (EEG) activity was measured while participants performed a cued visual spatial attention task. They were asked to shift their attention to one of 24 different spatial locations where they had to detect orientation changes of a Gabor stimulus. Data were analysed using a spatial independent component analysis (sICA) approach that showed a specific distribution of attention as a function of polar angle and eccentricity.

Topic Line: ATTENTION: Spatial

G56 Semantic and perceptual representations mediating object-specific memory encoding: a preregistered fMRI study

Loris Naspi, University of Edinburgh, Paul Hoffman, University of Edinburgh, Alexa Morcom, University of Sussex

Memory is influenced by semantic and perceptual properties that distinguish specific events. We investigated how semantically and perceptually similar objects are encoded into memory with functional magnetic resonance imaging (fMRI) and representational similarity analysis (RSA) (https://osf.io/ypmdj). We used a distributed feature-based model of semantic representation and a coarse categorical (Animal-NonBiological-Plants) model, with a computational model of vision (HMax), to uncover how semantic and perceptual object representations support encoding of specific memories. Participants (N=28) were scanned while making name judgements about pictures of objects, and later had to discriminate studied items from similar objects and novel items. Results revealed that distributed semantic feature representations as well as coarse categorical information represented in the fusiform gyrus were associated with successful object encoding. In left ventrolateral prefrontal cortex (BA44/45), only semantic feature confusability contributed significantly to later memory. Visual perceptual confusability was also critical for memory encoding, with early visual cortex and posterior ventral temporal representations predicting successful object recognition as well as rejection of similar lures. The pattern of distributed representations engaged during object processing regardless of memory also replicated findings of Clarke and Tyler (2014). The data support the view that distinct semantic and perceptual representations contribute to encoding of memories for specific objects, and highlight the role of finer-grained semantic feature information represented in anterior ventral temporal and prefrontal regions in successful memory encoding.

Topic Line: LONG-TERM MEMORY: Episodic

G57 Pupillary responses to arousing verses: The comparison of Japanese aesthetic and comic poetries

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Pupil diameter is known as a robust index of arousal level. While recent studies have tracked pupil dilation for measuring emotional responses to music, it remains unclear how this index reflects other arousing stimuli such as poetry, the art of words. The present study investigated pupillary responses to the world's shortest fixed verses, namely Japanese 'haiku' (aesthetic poetry: AP) and 'senryu' (comic poetry: CP), in comparison with descriptive slogan (non-poetry: NP), all of which share the 5-7-5 syllable structure. Forty-one graduate and undergraduate students (18-28 years old) without literary training listened to those stimuli in random order, each of which was auditorily presented twice

with a stimulus onset asynchrony of 4000ms, while pupil diameter of their right eye was recorded continuously. The results showed that pupil dilation was greater for CP than for NP, between 3000-6000ms after the first stimulus onset (ps < .05). AP also evoked larger dilations than NP (p < .05), but the latency was relatively late (between 5000-6000ms after the onset) compared to the CP-NP contrast. These findings suggest that the layman experiences stronger arousal with funny, humorous words in an earlier stage of exposure. Aesthetic properties of words, on the other hand, may elicit milder changes in the listeners' arousal level, presumably because they evoke more implicit, subtle emotional effects driven by combinations of words. This study provided the first evidence that pupillary responses reflect arousal level changes elicited by poetry appreciation.

Topic Line: EMOTION & SOCIAL: Emotional responding

G58 Neural Substrates of Working Memory Updating

Gal Nir-Cohen, Ben-Gurion University of the Negev, Yoav Kessler, Ben-Gurion University of the Negev, Tobias Egner, Duke University

Working memory (WM) needs to protect current content from interference and simultaneously be amenable to rapid updating with newly relevant information. An influential model suggests these opposing requirements are met via a basal ganglia (BG) - thalamus gating mechanism that allows for selective updating of prefrontal cortex (PFC) WM representations. A large neuroimaging literature supports the general involvement of the PFC, BG, and thalamus, as well as posterior parietal cortex (PPC), in WM. However, the specific functional contributions of these regions to key sub-processes of WM updating, namely gate-opening, content substitution, and gate closing, are still unknown, as common WM tasks conflate these processes. We therefore combined functional MRI with the reference-back task, specifically designed to tease apart these sub-processes. Participants compared externally presented face stimuli to a reference face held in WM, while alternating between updating and maintaining this reference, resulting in opening vs. closing the gate to WM. Gate opening and substitution processes were associated with strong BG, thalamic and fronto-parietal activation, but ? intriguingly - the same activity profile was observed for sensory cortex supporting task stimulus processing (i.e., the fusiform face area). In contrast, gate closing was not reliably associated with any of these regions. These findings provide new support for the involvement of the BG in gate opening as suggested by the gating model, but qualify the model's assumptions by demonstrating that gate closing does not seem to depend on the BG, and that gate opening also involves task-relevant sensory cortex.

Topic Line: EXECUTIVE PROCESSES: Working memory

G59 Cognitive training with and without transcranial direct current stimulation and attention in older persons with HIV

Raymond Ownby, Nova Southeastern University, Amarilis Acevedo, Nova Southeastern University

Antiretroviral therapy has resulted in reduced mortality in persons with HIV infection, however, affected individuals may experience age-related changes in cognition as well as deficits related to chronic HIV infection. To study a possible strategy to address this issue, we did a study of game-based cognitive training with and without anodal transcranial direct current stimulation (tDCS) to the left dorsolateral prefrontal cortex (F3) in 46 persons 50 years of age and older with mild neurocognitive disorder (MND by Frascati criteria). Participants completed a battery of measures, six 20-minute training sessions over two weeks, an immediate post-training assessment and a follow-up assessment 30 days later. They were assigned to (1) cognitive training + active tDCS, (2) cognitive training + sham tDCS, or (3) watching educational videos + sham tDCS (control).

We hypothesized that the cognitive training + active tDCS group would show greater improvements in attention and working memory (Digit Span Forward and Backward) compared to the other groups. Mixed effects repeated measures models showed a significant interaction of group vs time (p = 0.047) for attention. Post hoc analyses showed a significant difference between the training + active tDCS and the other groups at the first follow up visit but not 30 days later. A similar but non-significant effect (p = 0.11) was seen for working memory. These results suggest that cognitive training with tDCS may have positive effects on attention and working memory in older adults with MND, but that they may not be sustained over 30 days.

Topic Line: ATTENTION: Auditory

G60 The posterior cerebellum supports the explicit sequence learning linked to trait attribution

Min Pu, Vrije Universiteit Brussel, qianying ma, Vrije Universiteit Brussel, Frank Van Overwalle, Vrije Universiteit Brussel

Recent research has indicated that the cerebellum is responsible for social judgments such as making trait attributions. The present study investigated the function of the posterior cerebellum in supporting sequence learning linked to trait inferences about persons. We conducted a memory paradigm that required participants to learn a given temporal order of six behavioral sentences that all implied the same personality trait of the protagonist. We then asked participants to infer the trait of the person and to recall the correct order of the sentences and to rate their confidence in their trait judgments and retrieval accuracy. Two control conditions were created: a non-social comparison control, involving six non-social sentences implying a feature of an object, and a non-social non-sequential reading baseline condition. While learning the specific sequence of the sentences, the posterior cerebellum (Crus II) was more activated for social trait-related sequencing than non-social object-related sequencing. Also, given a longer duration to learn the sequences, the precuneus and posterior cingulate cortex were more activated when participants attempted to retrieve the sequences linked to social traits. Level of metacognitive confidence in successfully retrieving the sequences modulated the posterior cerebellum (Crus I) given a longer duration to learn. Our findings highlight the important function of the posterior cerebellum in supporting an active process of sequencing trait-implying actions.

Topic Line: EMOTION & SOCIAL: Person perception

G61 Long term effects of procedural memory cueing during sleep

Martyna Rakowska, Cardiff University, Mahmoud Abdellahi, Cardiff University, Paulina Bagrowska, Cardiff University, Penny Lewis, Cardiff University

Targeted memory reactivation (TMR) has recently emerged as a promising tool to manipulate and study the sleeping brain. Although the technique is developing rapidly, only a few studies examined how the effects of TMR develop over time. Here, we used a serial reaction time task (SRTT) to investigate whether the difference between the cued and un-cued sequence of button presses persists long-term. Participants learned two sequences of 12-item button presses, each associated with a different set of auditory tones. Tones associated with one of the sequences were replayed to the participants during subsequent sleep (both SWS and NREM stage 2). Performance on the task was tested 24 hours, 10 days and 6 weeks post-learning. Surprisingly, sequence specific skill was greater for the cued than the un-cued sequence not only 24 hours after encoding (p = 0.042), but also 10 days later (p = 0.025). When the dominant and non-dominant hand were analysed separately, significant difference between the two sequences was found only for the non-dominant one, 10 days after learning (p = 0.043). None of the sleep characteristics correlated with the behavioural measures. These findings

suggest that TMR during sleep can exhibit its effect up to 10 days post-stimulation - the longest time frame reported in the literature so far.

Topic Line: LONG-TERM MEMORY: Skill Learning

G62 Bayesian models of atypical sensory perception in autism

Roshini Randeniya, Queensland Brain Institute, Iris Vilares, University of Minnesota, Jason Mattingley, The University of Queensland, Marta Garrido, The University of Melbourne

A general consensus persists that sensory-perceptual disruptions in Autism Spectrum Disorder (ASD), such as hypersensitivities to light or sound, result from a strong reliance on new sensory observations. However, conflicting Bayesian theories remain unresolved as to whether such disruptions are caused at the sensory level (likelihood) or in forming a weak model of the sensory environment (priors). We used a decision-under-uncertainty paradigm to understand if sensory learning differences arise at the sensory observation level or the model building level. We recruited adults with a diagnosis of ASD (N=32) and Neurotypical (NT) adults (N=48). The ASD group did not differ from the NT group under low uncertainty conditions, but when the uncertainty of sensory information was higher participants with an ASD showed increased precision in both sensory observations (likelihood) and in their priors, i.e. their subjective model of the world.

Topic Line: PERCEPTION & ACTION: Vision

G63 The impact of modality on temporal linguistic processing: a comparison of spoken and signed languages.

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Language comprehension relies on temporal parsing of incoming information. We investigated the impact of the temporal structure of the language signal on how the cognitive system processes linguistic information by comparing the perception of a signed and a spoken language. In this study, 22 highly proficient bimodal bilinguals of Spanish and Spanish Sign Language (LSE) repeated sentences that had been distorted using local time-reversal: sentences were divided into windows of a set duration, and the signal inside each window was reversed while maintaining the windows' relative order. We manipulated the duration of the reversal window: 0-100 ms for Spanish; 0-399 ms for LSE. Longer reversal windows lower intelligibility, and the window size at which intelligibility substantially drops reveals the temporal integration window for the signal. Locally time-reversed distortion affected language processing differently in each modality. Replicating previous work on other spoken languages, the results showed that in Spanish intelligibility starts dropping at 40 ms reversal window, reaches 50% accuracy at 60-65 ms and is completely lost with a 85 ms window. The visual modality is more resilient to temporal manipulation: intelligibility gradually decreases with longer reversal windows but stays above 50% even in the longest reversal-window (399 ms) and no clear temporal integration window can be identified. This study shows that temporal manipulation affects language intelligibility in different ways depending on the modality, suggesting that the cognitive system employs different mechanisms to process signed and spoken languages.

Topic Line: LANGUAGE: Other

G64 Portuguese Version of the Alcohol Craving Questionnaire ? Short-Form ? Revised: Validation and Reliability Assessmen

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Alcohol craving is defined as a strong subjective desire for alcohol intake. The Alcohol Craving Questionnaire ? Short-Form ? Revised (ACQ-SF-R) is a self-report, 12 Likert-scale items measure widely used to assess the urge for drinking in native English speakers. However, ACQ-SF-R has not been validated into Portuguese despite its potential use in Portuguese populations with alcohol use/misuse. This study aimed to examine the psychometric properties of the Portuguese-translated version of the ACQ-SF-R in a young adult (age 18-30 years; M=20.3) sample. The final sample included 591 students (67% female) of the University of Minho who fulfilled the Portuguese version of the ACQ-SF-R (ACQ-SF-R-PV). Results showed a high degree of internal consistency (Cronbach's ?=.84; mean inter-item correlation=.32), and a good convergent validity with the Penn Alcohol Craving Scale (r=.63, p<0.001). Factorial analysis triggered 3 factors (Expectancy/Emotionality; Predisposition/Opportunity; Compulsivity), which accounted for 60.64% of the total variance of the questionnaire, with a comparative fit index=.92. In conclusion, ACQ-SF-R-PV revealed appropriate psychometric properties, suggesting that this questionnaire can be used by researchers/clinicians to assess alcohol craving in the Portuguese population.

Topic Line: METHODS: Other

G65 Sympathetic hyper-reactivity measures following trauma as predictors of stress vulnerability and resilience

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Early identification of stress vulnerability biomarkers is necessary to optimize treating individuals prone to develop PTSD following a traumatic event. Two highly recognized physiological symptoms of chronic PTSD are heightened sympathetic arousal responses, such as skin conductance, and fMRI amygdala hyperactivity. The objective of this study is to analyze whether early collection of skin conductance response (SCR) hours post-trauma exposure identifies individuals who will show amygdala hyperactivity and higher PCL-5 scores weeks following the trauma. As part of a larger multisite study, 'AURORA', N=108 participants with fMRI and SCR data were assessed. Participants were enrolled in the emergency department (ED) within 72 hours of a traumatic event. ED SC during baseline and a standardized trauma interview was assessed using Mindfield eSense on a mobile tablet. Two weeks post-trauma, fMRI responses were collected during a fearful vs. neutral faces task. Reactivity in basolateral amygdala (BLA) and central amygdala (CeA) nuclei ROIs were analyzed. Self-reported PTSD symptoms were collected 3 months post-trauma (PCL-5). SCR during the trauma interview was positively correlated with fMRI responses to threat (Fear>Neutral) in the left CeA (r=.19, p=.03). Left CeA responses were positively correlated with 3-month PCL-5 scores (r=.22, p=.02). Results provide evidence that SCR following trauma exposure is correlated with threat hyperreactivity in the CeA and supports SCR as an inexpensive and non-invasive biomarker of heightened fear response.

Topic Line: EMOTION & SOCIAL: Emotional responding

G66 Metacognitive processing in early childhood

Ioanna Taouki, Basque Center on Cognition, Brain and Language, Marie Lallier, Basque Center on Cognition, Brain and Language, David Soto, Basque Center on Cognition, Brain and Language

Metacognition refers to the capacity of reflecting on our own cognitive processes. Although there is an ongoing discussion in the literature on the role of metacognition in learning and academic achievement, little is known about its neurodevelopmental trajectories in early childhood, when children begin to receive formal education. Here, we evaluate the metacognitive ability of a cohort of children aged between 6 and 7 (N=60), who performed three two-alternative-forced-choice tasks (lexical decision task, visual attention span task, emotion recognition task) including trial-by-trial confidence judgments. Our study has two aims. First, we investigated whether the relationship between objective task performance (type-1 d') and the metacognitive sensitivity based on confidence ratings (type-2 meta-d'-, i.e., how confidence relates to d', and also their ratio referred to as metacognitive efficiency - meta-d'/d') follows the typical pattern in adults (i.e., positive correlation between type-1 performance and metacognitive performance). Second, we assessed whether or not metacognition in young children is mediated by a domain-general system by examining across domains correlations in metacognitive measures. We found some evidence consistent with domain-generality. There were significant positive correlations between metacognitive efficiency in lexical and emotion recognition task; positive, but non-significant correlations were found between metacognitive performance in the visual attention span and the remaining tasks. Notably, we observed significant negative correlations between Type-1 (d') performance and metacognitive efficiency (meta-d'/d') within each experimental task, indicating that, in early childhood, students with worse Type-1 performance may be better in judging their own performance (i.e. better metacognition).

Topic Line: PERCEPTION & ACTION: Development & aging

G67 A Pilot Investigation of the Dose-Response Relationship Between Executive Function and Cerebral Blood Flow

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A 10-min single-bout of aerobic exercise improves executive function. Previous work by our group has shown that an increase in regional cerebral blood flow (CBF) to frontoparietal executive networks contributes to this benefit. It is, however, unclear, whether a dose-response relationship exists between executive function improvement and increased CBF. To address this issue, participants (N=9) completed four experimental sessions including: a VO2peak test to determine cardiorespiratory fitness and lactate threshold (LT), and 10-min bouts of light (i.e., 40% of LT), moderate (i.e., 80% of LT) and heavy (15% of the difference between LT and VO2peak) intensity aerobic exercise (via cycle ergometer). To provide a measure of CBF, during each exercise manipulation blood flow velocity and hemoglobin deoxygenation were measured via transcranial doppler ultrasound (TCD) and near-infrared spectroscopy (NIRS). Notably, pre- and post-condition executive function was determined via the antisaccade task. Antisaccades are an executive-mediated response requiring a saccade mirror-symmetrical to a target stimulus and are mediated via the same frontoparietal networks that show task-dependent changes following single-bout and chronic aerobic exercise. Results show CBF increased linearly with increasing intensity ($p=.001$), whereas antisaccades elicited a post-exercise improvement during moderate and heavy ($ps<.06$) – but not light ($p=.99$) – exercise intensities. Moreover, two one-sided tests indicated that the magnitude of the post-exercise improvement in antisaccade RTs across moderate and heavy intensities was within an equivalence boundary ($p=.02$). Accordingly, results evince that a minimum exercise intensity and associated increase in CBF is required to elicit a post-exercise benefit to executive function.

Topic Line: EXECUTIVE PROCESSES: Other

G68 Covert sentence production in early bilinguals: A study in left and right handed participants

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Hemispheric specialization (HS) studies the better aptitude of one hemisphere as compared to the other for a given cognitive, sensory, or motor function. In language, the majority of right handers (RH) have their language function co-lateralized in the left hemisphere. Left Handers (LH) generally present language in the left hemisphere, while around 20% of them present ambilateral or strongly-atypical language lateralization in the right hemisphere. But, multiple studies of HS do not consider the role that linguistic competences of the participants plays in HS. In particular, little is yet known about how handedness affects HS in bilinguals. In a fMRI study, we presented drawing pictures to 111 early Basque-Spanish bilingual participants (51 LH). Subjects were presented with cartoons depicting a scene or scrambled pictures and instructed to covertly produce a sentence or recite the months of the year, respectively. Two runs of the task were performed either in Basque or Spanish. The statistical parametric map of sentence production and the corresponding laterality index were computed for each participant and language. We found no significant differences in production among languages. Bilingual subjects showed more bilateral activation in comparison to previous studies in monolinguals. In particular, RH bilinguals exhibited a significantly higher left brain activation in language related areas during covert speech production in comparison to LH, resembling the patterns previously observed in monolinguals, but with an increase in ambilateral connectivity in both RH and LH. This study highlights the importance of considering linguistic profiles in determining hemispheric specialization in single subjects.

Topic Line: LANGUAGE: Other

G69 Linguistic control mechanisms in highly proficient bilinguals: An MEG study.

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Bilingual language control studies propose that highly proficient bilinguals process their two languages similarly, relying on inhibitory mechanisms. These studies have been conducted in different populations and using different paradigms, leading to controversy in the findings. One important question that remains unanswered is whether language control mechanisms differ in the bilingual brain depending on the linguistic context. To test this, we recorded neuromagnetic signals with a 306-sensor MEG system while 20 early highly-proficient Spanish-Basque bilinguals performed a picture-naming task under two different linguistic contexts. In the first context, participants had to switch between languages (i.e., naming in Spanish or in Basque); while in the second one, they had to switch between semantic categories (i.e., naming nouns or verbs) within a given language. We compared event-related fields (ERFs) elicited by switching and repetition trials under the different contexts and estimated the neural sources underlying the scalp-level effects. Overall, we

found significant modulations in the M250 component, with the switching condition evoking stronger responses in right frontocentral sensors as compared to the non-switching one. At the source level, this effect was mainly triggered by the contribution of orbitofrontal and anterior temporal areas. Interestingly, this pattern of activity was similar in both contexts. Overall, these results suggest that similar linguistic control mechanisms might be at play independently on the linguistic context established by the task at hand.

Topic Line: LANGUAGE: Lexicon

G70 Cross-Language Activation in Bimodal Bilinguals

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When accessing the words of one language, bilinguals co-activate the words of their other language. This study investigated language co-activation across modalities ? between a spoken and a signed language ? and examined the role of sub-lexical units in this cross-language, cross-modal lexical access. We ran two eye-tracking experiments on parallel activation in spoken Spanish and in Spanish Sign Language (LSE) in 56 hearing bimodal bilinguals. We used the visual world paradigm with word/sign stimuli and images that included phonological competitors. In Experiment 1, participants saw LSE signs while we measured parallel activation of Spanish words sharing onset or rhyme with the target (revealed by fixations to the corresponding images). In Experiment 2, participants heard Spanish words while we measured parallel activation of LSE signs sharing handshape or location with the target. The results showed co-activation of the spoken language while seeing signs and, vice versa, of the signed language while hearing words. Experiment 1 revealed effects of word onset competition but not rhyme competition. In Experiment 2, location and handshape both showed competition, with location competition preceding handshape competition. These findings demonstrate firstly that bimodal bilinguals experience bidirectional co-activation between languages that have no phonological overlap. Secondly, even though the sub-lexical structure of sign is largely simultaneous, the sign language co-activation effects show a robust temporal ordering (location before handshape). Modality conditions the properties of the linguistic signal but how we process that language input depends on the cognitive system.

Topic Line: LANGUAGE: Lexicon

G71 Sex Difference in Linguistic Processing Network Activation and Lexical Decision Task Performance

Samantha Tze Sum Wong, Educational & Counselling Psychology, McGilll University, Vina Goghari, Department of Psychology, University of Toronto, Todd Woodward, Department of Psychiatry, University of British Columbia

Female performance on verbal tasks (Kimura, 1992), particularly verbal memory tasks (Kramer et al., 2003, Van der Elst et al., 2005) has been found to be consistently higher than male performance. However, investigating sex differences in functional brain imaging in language-specific brain networks associated with attention and response processes has been a challenge (Murphy et al., 2019).

The hypothesis is that sex differences in a linguistic processing network (LPN) underlie higher performance for females on a linguistic task.

Twenty-four healthy males and 35 healthy females performed a lexical decision (LD) task, where they were asked to differentiate 4-letter words and non-words on two difficulty levels in a functional magnetic resonance imaging (fMRI) scanner. Difficulty level was defined by the accuracy in LD associated with stimuli drawn from the English Lexicon Project database (Balota, et al., 2002). Neuroimaging data were analyzed with a multidimensional functional connectivity analysis to extract three functional brain networks.

A linguistic processing network (LPN) was separated from attention and response networks anatomically (LPN included Broca's and Wernicke's areas), and temporally. Relative to males, females showed faster rejections of word-like non-word stimuli (F(1,57) Ã¢â‚¬Â¯=Ã¢â‚¬Â¯4.80, pÃ¢â‚¬Â¯<Ã¢â‚¬Â¯.05, ÃŽÂ·2Ã¢â‚¬Â¯=Ã¢â‚¬Â¯0.08); and showed reduced LPN activity under these conditions (F(1,57)Ã¢â‚¬Â¯=Ã¢â‚¬Â¯4.97, pÃ¢â‚¬Â¯<Ã¢â‚¬Â¯.05)(Wong et al., 2020), suggests an advantage in the suppression of interfering linguistic processes. This suggests females have more efficient use of the LPN under LD conditions, activating in response to real words and suppressing in response to word-like non-words, providing a biological basis to the observed female advantage in verbal tasks.

Topic Line: LANGUAGE: Semantic

G72 Tracking Student Attention During Different Instructional Activities using Mobile EEG

Keye Xu, University of California, Los Angeles, Jennie Grammer, University of California, Los Angeles, Agatha Lenartowicz, University of California, Los Angeles

Attention skills are crucial for academic success in schools. Assessment of attention in real-life contexts is key to understanding how these skills are influenced by contextual factors in academic setting. Using a mobile EEG method, this study aims to measure students' attention in mock classrooms, and to better understand the types of instructional activities that are related to greater attention. The study measured alpha-range (8-12Hz) oscillations of EEG signals over the visual cortex, which are strongly coupled with visual attention. Data were collected from 23 undergraduates (Mage= 20.61 years, N male= 4) during a classroom lesson with 6-9 students. Participants engaged in four types of semi-scripted instructional activities for at least 10 minutes: 1) Listening to a lecture, 2) Watching a video, 3) Discussing a set of questions about the lecture and video in pairs, and lastly 4) Completing a test about the lesson individually. Comparisons of alpha power across activities showed a significant main effect of instructional activity, ?2(3) = 19.43, $p < .001$. Planned contrasts revealed that alpha power was significantly higher in teacher-initiated activities (lecture and video watching) than in student-initiated activities (paired discussion and independent work), $b = -28.48$, $t(58) = -3.95$, $p < .001$. Moreover, alpha power was higher in video watching than in lecture, $b = -35.31$, $t(58) = -2.69$, $p < .01$. This result suggests that students were less attentive during lectures and video watching and indicates the potential different learning outcomes resulted from four instructions.

Topic Line: ATTENTION: Development & aging

G73 Gaze is fixed on eye-contacting faces longer than eye-averting faces in visual search.

Kyosuke Yamamoto, Toyohashi University of Technology, Michiteru Kitazaki, Toyohashi University of Technology

A straight gaze target is found faster than an averted gaze target in a visual-search paradigm (von Grulʾ?nau & Anston, 1995). However, the gaze research has been limited to static gaze stimuli though the eye contacting is usually interactive. Thus, we aimed to investigate dynamic gaze using a head-mounted display with eye tracking. We presented 4, 8 or 12 three-dimensional faces at random positions. Their eyes moved when the participant's gaze contacted them. A target was either the eye-contacting or eye-averting face, and distractors were either the eye-averting or eye-contacting face, respectively in Experiment 1. In the half trials, there was no target. Twenty participants were asked to judge whether the target existed or not as quickly as possible. We found that the eye-contacting target among the eye-averting

distractors was detected significantly faster than the opposite combination. Participants' eye-fixation time was significantly longer on the eye-contacting (430ms/face) than the eye-diverting distractors (375ms/face). The target was replaced with the eye-blinking face in Experiment 2. We did not find a difference between the eye-contacting and the eye-averting distractors in either the reaction time or the eye-fixation time. The distractors were replaced with the eye-blinking faces in Experiment 3. We did not find a difference between the eye-contacting and the eye-averting target. Thus, the gaze is fixed on eye-contacting faces longer than eye-averting faces only when the eye-contacting and eye-averting faces are mixed, suggesting that the asymmetry of visual search in the eye-contacting and eye-averting faces is related to human intentional communication.

Topic Line: PERCEPTION & ACTION: Vision

G74 Prefrontal TDCS Preferentially Improves Episodic Memory, but not Working Memory in Older Adults

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Transcranial direct current stimulation (tDCS) is a noninvasive form of electrical brain stimulation that has been widely studied in conjunction with cognitive training regimens, with the purpose of improving learning. Previous work from our lab (Au et al., 2016) has shown benefits of tDCS in improving performance on the n-back working memory task over the course of a multi-day training paradigm. In particular, benefits were observed from spaced learning (sessions spaced apart by a weekend versus consecutive weekdays) and long-term retention even up to a year later. These behavioral benefits, in combination with evidence from animal literature showing increased hippocampal LTP and upregulation of BDNF expression (Podda et al. 2016), suggest a potential role of tDCS in enhancing memory consolidation. Thus, we posited that our previous n-back results might have been driven more by consolidation of memory strategies rather than improvements in working memory, per se. The goal of the current study, therefore, sought to build on our previous paradigm by adding an episodic memory component in order to elucidate the underlying mechanisms of tDCS in enhancing cognitive training performance. We trained 54 older adult participants (ages 65-83) on both word list-learning as well as an n-back working memory task over the course of 5 days. Results showed no differences in n-back performance or immediate word recall, but a significant advantage of the active tDCS group versus sham in delayed recall. This selective advantage provides new support for the role of tDCS in enhancing memory consolidation during cognitive training.

Topic Line: LONG-TERM MEMORY: Episodic

G75 Function vs Structure: Factors Related to Speech In Noise Comprehension In A Thousand Young, Normally-Hearing Listeners

Robert Becker, University of Zurich, Alexis Hervais-Adelman, University of Zurich

The ability to comprehend speech under acoustically challenging conditions varies widely across individuals. This is typically attributed to cognitive factors supporting the listening effort required to comprehend speech in adverse listening conditions. This notion has been formalised in a number of models that focus on the cognitive factors supporting speech comprehension in hearing impairment, e.g. the role of working memory and cognitive flexibility. Here we probe the relationship between word in noise recognition (WIN) and a battery of cognitive factors as well as cortical thickness (N=1113, age: 22 - 37 years, Mean = 28.80, SD = 3.69). After correcting for age and sex, we identify a number of significant (p 0.12). Although the proportion of variance explained by these cognitive factors is low (< 4%), this establishes that they are relevant even in younger listeners, although other factors are evidently also in play. Multiple regression indicated that cortical thickness explained up to 16% of the variance in WIN ($p<0.05$). Among the regions most correlated with WIN were left central sulcus and right superior frontal gyrus, as well as right Heschl's gyrus. Stepwise regression showed that these and five further regions contribute significantly to explaining WIN (adjusted r-squared=.06, $p<.001$). Given the static nature of brain structural information, it is intriguing that it predicts WIN performance to this extent, more so than the cognitive factors that are often associated with speech-in-noise comprehension.

Topic Line: LANGUAGE: Other

G76 Training-dependent changes of cortical network dynamics in musicians

Alexander Belden, Northeastern University, Tima Zeng, University of Pennsylvania, Emily Przysinda, University of Rochester, Psyche Loui, Northeastern.edu

Musical Improvisation is a commonly studied model for creative cognition. Musical improvisation has been associated with altered network dynamics, with a distinct role of the executive control network (ECN), default mode network (DMN), and salience network. Previously, we have compared improvisational musicians, classical musicians, and minimally musically trained controls to determine how differential musical experience informs these network dynamics. Here, we present results from a longitudinal follow up to this work, with a particular focus on how resting state network dynamics change over the course of musical training. Our sample includes 11 improvisationally trained musicians and 9 classically trained musicians, and analyses utilized a combination of ROI to ROI and seed based methodologies to observe developing connections between these networks of interest. Both musician groups showed an increase in connectivity between dorsal DMN and auditory processing areas surrounding Heschl's gyrus. Furthermore, improvisational musicians showed overall higher connections between ECN and DMN associated regions when compared to classical musicians. In particular, a significant interaction between group and session was observed between right hemispheric ECN and dorsal DMN. In contrast, a significant interaction between group and session favoring classical musicians was observed between Left ECN and posterior Salience network. This supports previous work indicating a critical role of ECN to DMN connections in supporting creative behaviors, while also presenting connections between ECN and salience network as potentially more relevant to classical musicianship.

Topic Line: PERCEPTION & ACTION: Development & aging

G77 Long-term memory guides resource allocation in working memory

Allison Bruning, University of Texas at Austin, Jarrod Lewis-Peacock, University of Texas at Austin

Working memory resources are incredibly limited, however, it is not in complete isolation. Prior knowledge in long-term memory can aide in maximizing the information we encode. Here we used a full-report procedure in a visual working memory paradigm to examine the influence of prior information on resource allocation in working memory. For each trial, six colored circles appeared at a random angle about a fixed radius. The location of five of the six colors was drawn from a uniform distribution ('non-prior' items), while the remaining color was drawn from a von Mises distribution (SD=20o) ('prior' item). The color and mean of the prior distribution were randomly determined for each participant at the beginning of the experiment

and remained constant. Participants first completed a training phase where they were explicitly shown and tested on both the color and location of the prior distribution. For the remainder of the experiment, participants reported the locations of all six colors in any order on each trial. We found that participants allocated fewer resources to the prior items, as evidenced by 1) a bias to report the prior item later in the response sequence and 2) a decrease in precision for reports of non-prior items that appeared near the prior location. Together these findings show that participants are using strategies to prioritize encoding items with no prior information. These results give us a better understanding of how working memory may rely on long-term memory to strategically encode information from our environment.

Topic Line: EXECUTIVE PROCESSES: Working memory

G78 Distracted 'from' their surroundings: excessive functional coupling between salience and default-mode networks in ASD

Ya-Yun Chen, Virginia Tech, Joshua Neal, Virginia Tech, Tae-Ho Lee, Virginia Tech

Atypical activities in the salience network and default-mode network have been reported in individuals with autism spectrum disorder (ASD). However, no study has investigated how these two networks dynamically interact in the affected brains. Here we examined functional connectivity between the salience network and the default-mode network in ASD individuals (N = 406) and Typical Development (TD) individuals (N = 432) with the resting-state fMRI data at both static and dynamic levels. As a result, the static functional connectivity analysis shows a stronger coupling between the medial prefrontal cortex (MPFC), as a core region of the default-mode network, and the anterior insular cortex (AIC), as a core region of the salience network, in the ASD group compared to the TD group. Moreover, this MPFC-AIC coupling was significantly more rigid over time in the ASD group (i.e., low MSSD; less variability in connectivity changes), revealed by the dynamic functional connectivity analysis. Given the theoretical model (Uddin, 2015) proposing that the salience network coordinates attentional orientation from the internal to external environment by decoupling the neural activity of the salience network itself from the default-mode network, the current study suggests that the over internally-oriented characteristics of ASD may due to the excessive coupling between MPFC and AIC. In summary, the current study provides the fundamental neural mechanism underlying the deficit of switching attention to the outer social world from a self-oriented mind in ASD.

Topic Line: ATTENTION: Development & aging

G79 Cortical Excitability in Alzheimer's Disease: Meta-Analysis of Transcranial Magnetic Stimulation Studies

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Transcranial magnetic stimulation (TMS) is a non-invasive brain stimulation technique that has been employed to measure in vivo cortical excitability in diverse disease states including Alzheimer's disease (AD) and mild cognitive impairment (MCI). The utility of TMS measures in characterizing excitatory and inhibitory properties of neurotransmitter systems and the integrity of corticospinal pathway has been substantially supported by numerous pharmaco-TMS studies. Recently, neuropathological studies have suggested early-stage motor cortex involvement in AD, despite a lack of motor dysfunction. Thus, motor cortical excitability measures may be sensitive enough to detect dementia in the incipient stage of disease. The purpose of this meta-analysis is to quantify alterations in cortical excitability associated with AD and MCI. Twenty-two studies were included in the meta-analysis. Patients with AD and MCI exhibited significantly (1) lower motor threshold, effect size $d = 1.08$, $p < .0001$, (2) reduced short-latency afferent inhibition (SAI), $d = 1.09$, $p < .0001$, and (3) reduced short-interval intracortical inhibition (SICI), $d = 0.62$, $p < .0001$, compared to healthy controls. The pooled evidence suggests the existence of cortical hyper-excitability as documented by decreased motor threshold as well as reduced inhibition as measured by the SAI and SICI in AD and MCI. Furthermore, cortical hyper-excitability showed a significant correlation with severity of dementia. Future studies will be needed to examine whether these cortical excitability measures are reliable and accurate biomarkers that can be used to differentiate prodromal dementia from normal healthy aging prior to the disease progressing to a more clinically evident phase.

Topic Line: OTHER

G80 Mapping the time course of brain activation in affective picture processing

Lihan Cui, University of Florida, Ke Bo, University of Florida, Andreas Keil, University of Florida, Mingzhou Ding, University of Florida

Viewing emotionally engaging scenes activates a large-scale brain network consisting of both cortical and subcortical regions. Mapping the time course of activation of these regions is a key step toward developing a theoretical account of affective scene processing. For aversive scene content, past work has suggested rapid processing along the subcortical pathway, superior colliculus->pulvinar->amygdala, the function of which is to provide the context for the more deliberate processing along the cortical visual pathway. Less is known about the neural processing of pictures displaying neutral and pleasant content. We recorded simultaneous EEG and fMRI data from 20 participants viewing pleasant (20), unpleasant (20) and neutral (20) pictures from the International Affective Picture System (IAPS). Following data preprocessing, representational dissimilarity matrices (RDMs) were obtained from fMRI in pulvinar, amygdala, early visual cortex, ventral visual cortex, and dorsal visual cortex for each of the three picture categories, as well as from EEG at each time point. RDMs from EEG at each time point were correlated with that from fMRI in each ROI. From the correlation functions peak latencies were estimated. The peak latency data suggested the following sequence of activation: (1) for unpleasant pictures: pulvinar->amygdala->early visual cortex->ventral/dorsal visual cortex, (2) for neutral pictures: pulvinar->amygdala/early visual cortex->ventral/dorsal visual cortex, and (3) for pleasant pictures: amygdala->pulvinar->early/ventral visual cortex->dorsal visual cortex. These results shed new light on affective scene processing and demonstrate that combining simultaneous EEG-fMRI with multivariate methods can yield spatial-temporal dynamics not possible with each method alone.

Topic Line: EMOTION & SOCIAL: Emotion-cognition interactions

G81 Optimal Parameters for Alternating Event-Related fMRI Designs

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Functional Magnetic Resonance Imaging (fMRI) measuring the BOLD signal is a remarkable tool for visualizing human brain activity. But the BOLD signal is slow and sluggish, being delayed seconds after the corresponding neural event(s). This presents challenges for the design and analysis of event-related fMRI studies, which must optimize statistical efficiency âî?¬' the accuracy with which a hemodynamic response evoked by one event type can be detected and estimated âî?¬' in a limited amount of imaging time. For some cognitive designs, the challenges are particularly acute, for example in designs where the events occur in a fixed sequence, like a trial-by-trial cue-target paradigm (e.g., attention cueing paradigms), where there is only limited room for employing event randomization. Using the package fmrisim (Ellis et al., 2020,

PeerJ), we investigated the dependence of efficiency on several design parameters: Stimulus Onset Asynchrony (SOA), frequency of events, and inclusion of semi null trials (e.g., cues not following by targets). The use of shorter SOAs decrease the efficiency of detecting a signal. However, the most efficient design for detecting a response is not the best one to estimate the shape of the response, which is better with longer SOAs (minimizing overlap). Finally, the inclusion of semi-null trials in the event sequence can facilitate the estimation efficiency as opposed to detection power. The goal here was to utilize the simulation power of fmrisim to understand how the varying design parameters could be optimized to minimize the estimation of overlapping events in a fixed sequence.

Topic Line: METHODS: Neuroimaging

G82 Sex Disparities on Effect of Ageing on Brain Network Integrity Across the Lifespan

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Midlife presents a critical period for the beginning of age-related neuropathology and a unique disease-altering window, prior to the manifestation of substantial brain damage. However, how healthy and pathological brain ageing diverge in midlife is poorly understood. It is estimated that 60% of people with Alzheimer's Disease are women, but the impact of sex differences on age-related brain changes remains largely uncharted territory. We examine changes in functional brain network architecture in a lifespan cohort (N=652) from the Cambridge Centre for Ageing and Neuroscience, including young (18-39 years, N=170), midlife (40-59 years, N=204) and older adults (60-88 years, N=278), with a focus on midlife, as well as sex differences. Modular segregation of 10 predefined networks was calculated in resting-state functional Magnetic Resonance Imaging data. Sex differences in segregation of the auditory, ventral attention and frontal-parietal networks were present in young adulthood, suggesting inherent differences. Two key brain networks that support high-order cognition, the default mode and frontal-parietal, showed significant age-related loss of segregation from midlife, well before older age. Females showed significantly lower segregation in the frontal-parietal network than males in midlife. The salience network showed sex differences in older adults; again, females had significantly heavier loss of segregation relative to males. The heavier loss of segregation in females from midlife and continuing into older age, in brain networks key for high-order cognition, may provide an avenue for understanding the higher risk load and incidence of age-related neurodegenerative disorders in females relative to males.

Topic Line: EXECUTIVE PROCESSES: Development &aging

G83 Global Brain Volume is Associated with General Psychopathology in Youth

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Youth is a critical period for both the onset of psychopathology and brain development. Psychopathology is characterized by a considerable degree of comorbidity and heterogeneity. Research suggests that these patterns are mirrored in the underlying neural correlates of psychopathology. Both common and dissociable abnormalities in brain volume have been found across multiple psychiatric disorders in adult and youth samples alike. However, the majority of research surrounding neural mechanisms of psychopathology has employed a categorical perspective with a case-control design. The current analyses examine the association between gray matter volume (GMV) and dimensional psychopathology in a large (N = 9,672) youth sample (9-10 years of age), which is a part of the sample collected for the Adolescent Brain and Cognitive Development (ABCD) Study. A bifactor model was used to identify four dimensions of psychopathology: a general factor, which reflects common variance across disorders, as well as three subfactors measuring specific internalizing, conduct, and ADHD symptoms. Brain volume was acquired using 3T MRI. Results from SEM analysis demonstrate nearly global reductions in cortical and subcortical GMV for the general psychopathology and conduct factors, with significant effects for the ADHD factor as well (p-values < .05, FDR-corrected). Sensitivity analyses including whole brain volume as a covariate further support this global effect, as region-specific results became non-significant when controlling for whole brain volume. These results suggest that smaller brain volume is a common risk factor for psychopathology across disorders, and possibly for conduct and ADHD symptoms in particular.

Topic Line: NEUROANATOMY

G84 Perirhinal and Anterolateral Entorhinal Cortex Patterns Reflect Subjectively Perceived Visual Similarity of Objects

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Perirhinal Cortex (PRC) has been proposed to be part of the ventral visual stream (VVS). Evidence from numerous sources suggests that PRC supports perceptual discrimination of objects with high visual feature overlap. Here, we asked whether PRC activity patterns reflect the subjectively perceived visual similarity of objects, and whether these patterns are distinguishable at higher levels of similarity than in earlier VVS regions. In addition, we investigated whether anterolateral entorhinal cortex (alERC), a region to which PRC projects, shows a similar response profile. We combined ultra-high resolution fMRI in humans (N=23) with representational similarity analyses (RSA). We presented images of objects from multiple categories with differing degrees of visual similarity among exemplars in a 1-back task that required identification of repetitions at the exemplar- and category-level. Participants also rated the perceived visual similarity in an inverse multi-dimensional scaling task (iMDS). Behavioural results revealed sensitivity of performance to variations in this similarity. RSA results showed that patterns in early visual cortex, the lateral occipital region, PRC, and alERC correlated with participants' perceived visual similarity of objects within categories, as expressed in the iMDS. Only PRC and alERC patterns exhibited such a relationship at the highest level of similarities. Furthermore, their activity patterns showed a relationship to visual similarity that was uniquely related to participants' own ratings. These findings suggest that the representational geometry of object representations in PRC and a downstream alERC region is tied to perceived similarity space, and that their fidelity is higher than in earlier VVS regions.

Topic Line: PERCEPTION & ACTION: Vision

G85 An Indexing Theory for Working Memory based on Fast Hebbian Plasticity

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Working memory (WM) is a key component of human memory and cognition. Computational models have been used to study the underlying neural mechanisms, but neglected the important role of short- and long-term memory

interactions (STM, LTM) for WM. Here, we investigate these using a novel multi-area spiking neural network model of prefrontal cortex (PFC) and two parieto-temporal cortical areas based on macaque data. We propose a WM indexing theory that explains how PFC could associate, maintain and update multi-modal LTM representations. Our simulations demonstrate how simultaneous, brief multi-modal memory cues could build a temporary joint memory representation as an 'index' in PFC by means of fast Hebbian synaptic plasticity. This index can then reactivate spontaneously and thereby also the associated LTM representations. Cueing one LTM item rapidly pattern-completes the associated un-cued item via PFC. The PFC-STM network updates flexibly as new stimuli arrive thereby gradually over-writing older representations.

Topic Line: EXECUTIVE PROCESSES: Working memory

G86 Saliency-dependent distractor suppression at one specific location and the underlying neural mechanisms

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To avoid salient distractors is critical in our daily lives. Due to the limited attentional resources, we must suppress distraction from salient-but-irrelevant objects. While previous studies have addressed that we can extract spatial and feature regularities from the visual environment so as to apply location-based and feature-specific suppression to the distractor, in this study we demonstrate a saliency-dependent mechanism of distractor suppression that is distinct from previous findings. Specifically, we show that there can be selective suppression of different saliency values at one specific location, that is, when different types of distractors share the same spatial location where they are more likely to appear, the amount of suppression applied to that location is contingent on the actual saliency of the distractor presented every time, irrespective of the feature dimension of the distractor but sensitive to the overall saliency context of the current environment. We analyzed behavioral data and gave neurobiological interpretations based on the V1 saliency theory. Specifically, we explained this saliency-dependent suppression mechanism as the neural adaptation of V1 cells that cover the high-probability location with their classical receptive fields. The degree of neural adaptation for the group of V1 cells representing the high saliency size distractors is high, while the degree of adaptation for the other group of V1 cells representing the low saliency is low, which finally leads to specific suppression contingent to the saliency of the distractor. The advantages and implications of this explanation are also discussed.

Topic Line: ATTENTION: Spatial

G87 Identification of three highly influential measures within a large neurocognitive and physiological battery in psychosis

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Disorders on the schizo-bipolar spectrum are associated with varying levels of cognitive and visuomotor processing. Large-scale studies have examined performance across comprehensive test batteries to identify subgroups of impairment. Further work is needed to characterize the underlying structure of these large batteries and identify key measures suitable for an abbreviated battery. This study was designed to identify the structure and influential measures of an expanded battery from 1,820 participants from the Bipolar-Schizophrenia Network on Intermediate Phenotypes (B-SNIP) using a regularized partial correlation network. The battery included neuropsychological tests, cognitive neuroscience-based paradigms, smooth pursuit eye movement, and prosaccade and antisaccade tasks. The network showed strong connections within smooth pursuit and saccade tasks as well as within and between computerized paradigms of inhibitory control and attention. Centrality indices indicated that smooth pursuit gain, antisaccade error rate, and the Brief Assessment of Cognition in Schizophrenia (BACS) composite score were the most influential nodes of the network, while regressive errors from the Penn Conditional Exclusion Test and spatial working memory capacity had the fewest and weakest connections. The identification of three highly connected and central nodes within the network was consistent with the factor structure of key domains of general cognition, inhibitory control, and basic visuomotor processing. Smooth pursuit gain, antisaccade error rate, and the BACS may be useful to include as targets for treatment or indices of change in clinical trials for psychosis, as changes in these highly connected measures may influence broader cognitive and physiological functions.

Topic Line: METHODS: Other

G88 Mindfulness-based cognitive therapy: It's got (event-related) potential for attentional bias in anxiety

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Anxiety disorders are associated with threat-related attentional bias, defined as the preferential tendency to allocate attention toward or away from threatening stimuli. Attentional bias may prolong states of anxiety by placing inordinate priority on potential threats in the environment, thus interfering with ongoing task demands and intensifying anxious mood states. Using a dot-probe (DP) paradigm, Mueller and colleagues (2009) observed that individuals with social anxiety disorder display enhanced P1 event-related potential (ERP) amplitudes to angry-neutral versus happy-neutral face pair cues, suggesting early hypervigilance to angry faces, and decreased P1 amplitudes to probes replacing emotional (angry and happy) versus neutral face cues, suggesting reduced visual processing of emotionally salient locations at later stages of information processing-potentially a manifestation of attentional avoidance. In their mindfulness model, Vago and Silbersweig (2012) propose that mindfulness styles of meditation improve the control of attention by improving efficiency of engagement and disengagement processes, thereby reducing attentional bias. This study investigates the effects of Mindfulness-Based Cognitive Therapy (MBCT) on the P1 ERP, an early neurophysiological marker of attentional bias, in a population with moderate to high levels of trait anxiety (n = 42). More specifically, P1 ERPs time-locked to angry-neutral and happy-neutral face pair cues and probes in a DP task are assessed pre- and post-MBCT. P1 results from our current sample (n = 13) suggest that MBCT (1) decreases hypervigilance to angry face pair cues, (2) increases engagement with emotional face cues, and (3) increases attentional allocation to probes replacing happy, compared to neutral, faces.

Topic Line: ATTENTION: Spatial

G89 Neural networks for attention to speech: Mapping distributed and selective attention onto the brain

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Focusing on one speaker in a noisy environment is a challenging task, but so is distributing attention among multiple speakers. Both are critical for successful daily communication, presumably harnessing different cognitive mechanisms. However, the neural pathways involved in selective and distributed attention to speech are not well understood. In this study we use fMRI to distinguish shared neural substrates from regions that are differentially involved in selective versus distributed attention to speech (block design, TR=2 s, voxel size=2x2x2 cubic mm). 35 participants listened to continuous speech from several concurrent speakers, and had to respond to a target word spoken by any of the speakers ('distributed attention' condition), or by a designated speaker ('selective attention' condition). We manipulated the acoustic and cognitive load of both tasks by increasing the number of concurrent speakers from 2 to 4. Results indicate that auditory cortices, bilaterally, are sensitive to the number of speakers, regardless of the attention type required. In contrast, the inferior frontal gyrus and insula, bilaterally, in addition to left parietal areas and right middle frontal sulcus, showed an interaction between type of attention and number of speakers. Specifically, the prefrontal areas show a greater load effect in the distributed attention condition than in the selective attention condition. These results nicely demonstrate the hierarchical relationship between sensory processing of speech and attentional processes. They also highlight the role of prefrontal language regions in applying different listening strategies to incoming speech.

Topic Line: ATTENTION: Auditory

G90 The Effect of Attentional Bias Modification on Body Size Perception and Body Dissatisfaction

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The direction of attention towards people of a smaller body size is associated with higher rates of body dissatisfaction and the tendency to perceive smaller bodies as 'normal' sized. Attentional bias towards thinner bodies may therefore contribute to the pathological levels of body dissatisfaction and body size misperception that are diagnostic symptoms of eating disorders. This research investigated whether two attentional bias modification tasks influence body size perception and body dissatisfaction in a sample of 430 Caucasian women aged 18-35. Participants were trained to attend towards either high or low fat body stimuli using a Dot Probe task (Experiment 1) and a Visual Search task (Experiment 2). Pre- and post-training measures were used to determine the effect of the attention training on 1) attention to high vs low fat body stimuli, 2) the body size perceived as 'normal', and 3) body dissatisfaction. Bootstrapped one sample t-tests showed that participants who were trained to attend towards high fat body stimuli in the Dot Probe task significantly increased their attention towards high fat body stimuli ($p = .001$); however, their perceptions of a 'normal' body size and their body dissatisfaction did not change significantly as a result of the attention training. Participants who were trained using the Visual Search task did not demonstrate a significant change in their attention, perception of a 'normal' body size, or body dissatisfaction. The results indicate that the attentional bias modification tasks used in this experiment may be insufficient in the treatment of body image disturbances.

Topic Line: ATTENTION: Other

G91 Overlapping Intrinsic Connectivity Networks Relate to Emotion, Memory, and Motor Suppression

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Goal-directed behavior benefits from self-regulation. Dysfunction in self-regulation is commonly found in psychiatric disorders, such as post-traumatic stress disorder and ADHD. This study sought to determine whether common neural regions are involved in emotion and memory, and if a data-driven approach using independent components analysis (ICA) would successfully identify intrinsic connectivity networks (ICNs) that contribute to inhibitory regulation. Eighteen participants underwent neuroimaging while completing an emotion regulation (ER) task and a memory suppression (think/no-think; TNT) task. In the ER task, participants were presented with negatively valenced pictures and instructed to either feel or inhibit their emotions. Participants then rated the intensity of their emotional reaction to the pictures. In the TNT task, participants received training to remember face-picture (cue-target) pairs. Participants were then presented with only the cue (face) and told to either recall the picture (think), or try to block its retrieval (no-think). Lastly, a cued recall test was used to assess retrieval performance. ICA (CONN; MATLAB) was conducted on the neuroimaging data. Corresponding components were selected across task based on interrelated patterns of activation. Subsequently, ICNs were correlated with behavioral variables. Two resultant ICNs revealing common regions of activation across task were identified: a striatal-amygdalar network, and a lateral and medial prefrontal cortical network. These results illustrate that: (1) a data-driven approach using ICA was able to successfully identify inhibitory regulation networks across-task, and (2) the regulation of emotional reactivity and memory retrieval exhibit overlapping ICNs as measured through ICA.

Topic Line: METHODS: Neuroimaging

G92 The Effect of Emotion on Driving Performance and Affective Facial Expression

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Emotions play a pivotal role in driving everyday experiences, and driving is not exempt from emotional modulations. Emotions create maladaptive driving behaviors (Roidl, 2014) which are linked to increased incidence of accidents (Deffenbacher, 2001). This study investigated driving behaviors in emotional states, assessing task performance and facial affect. Participants (n=45) were randomly assigned to an anger or happy state, induced through 2 mediums: 1) subliminal word search and 2) musical playlist. After completion of the word search, participants listened to congruent music while in the driving simulation. Facial video recordings, acquired while driving, were coded using the Emotional Expressive Behavior System (Gross, 1993; provides an induction manipulation check). First, results showed a trend between mood induction and infractions, with anger incurring more accidents (2.73) compared to happy (1.40); $F(1,15)=3.867$, $p=0.059$. Second, the manipulation check revealed an incongruent relationship between facial affect and induced valence: happy showed increased angry facial affect (1.37) compared to anger (0.69): $t(28)=-2.37$, $p=0.025$. In conclusion, the results support previous findings of increased driving infractions when angry (Roidl, 2014). Additionally, it suggests the need to further investigate the influences of differently-valenced music during cognitive tasks. Unexpectedly, the anger group may have experienced a cathartic effect via exposure to mood-congruent music, thereby decreasing negative facial affect (Dingle, 2015). Meanwhile, the happy group may have experienced frustration while listening to mood-incongruent music, leading to increased negative affect expressions. Future studies should investigate emotional induction beyond such approach emotions by investigating the potential effects of withdrawal emotions (sadness).

Topic Line: EMOTION & SOCIAL: Emotional responding

G93 A Network Neuroscience Investigation of the Psychological State of Flow

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Flow is a positively valenced psychological state characterized by high levels of intrinsic reward during goal-directed behavior. Flow occurs when there is a high level of task difficulty as well as when an individual has a high level of ability at the task. Empirical evidence shows that, when task difficulty and individual ability are both high, participants self-report the highest levels of flow and behavioral studies show that flow requires high levels of attention. Neurally, flow is associated with increased functional connectivity between fronto-parietal control and subcortical reward networks. Network neuroscience results show that flow is characterized by a brain-network topology that is energetically efficient and studies using tDCS demonstrate that default mode network down-regulation is causally implicated in the flow experience. However, little is known about the network dynamics that underpin flow, or how the network topology that characterizes flow experiences emerges over time. In this fMRI study (n=35), we use multi-layer network analyses to address this gap (GitHub: https://github.com/cogcommscience-lab/flow-dynamic). We apply a multi-layer community detection algorithm to investigate node flexibility ? how many times a node changes community ? in the network. We show that nodes in the fronto-parietal control network are characterized by a high level of flexibility early on, but that this flexibility stabilizes over time. By comparison, subcortical reward network nodes exhibit relatively low flexibility during task. These results provide support for the Synchronization Theory of Flow by demonstrating that the discrete brain network topology characterizing flow emerges and becomes stable over time.

Topic Line: EXECUTIVE PROCESSES: Goal maintenance & switching

G94 ERP Correlates of Semantic Processing During Inattentional Blindness

Brendan Hutchinson, The Australian National University, Michael Pitts, Reed College, Enriqueta Canseco-Gonzalez, Reed College

Findings on the neural activity during inattentional blindness suggest several perceptual processes that can occur despite an observer's inability to report on their percept, ranging from basic feature processing to advanced inference-like processes. One may wonder what perceptual processes remain that require attention. A current point of debate is whether semantic information can be processed during states of inattention or otherwise outside of awareness. The current study sought to establish whether the N400, a well-established ERP marker of semantic processing, could be elicited under conditions of inattentional blindness. The experiment utilized a three-phase design in which pairs of semantically related or unrelated word stimuli were presented hundreds of times at the fovea while participants performed an attentionally demanding distractor task. Word stimuli were either task-irrelevant and not consciously perceived (inattention phase), task-irrelevant but consciously perceived (divided attention phase), or task-relevant and consciously perceived (full attention phase). Results show a widespread N400 during the full attention phase, and an N400 like deflection during the divided attention phase. This same ERP component did not reach significance during the inattention phase, when participants were unaware of the word stimuli. Findings are taken as evidence that semantic processing, as indexed by the N400, does not occur during states of inattentional blindness.

Topic Line: ATTENTION: Other

G95 Age Differences in Functional Network Reconfiguration with Working Memory Training

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Demanding cognitive functions, such as working memory (WM), depend on the brain's ability to balance neural network segregation and integration. This ability, however, declines with age. Evidence suggests that cognitive training improves performance and changes brain activity even in older adults, but less is known about training effects on functional connectivity. We assessed functional network reorganization in younger and older adults after 10-days of verbal WM training leading to performance gains in both age-groups. We examined functional connectivity between pairs of regions, within and between task-related networks, and in the whole brain. Modularity decreased with higher task demand regardless of age, but older adults exhibited lower modularity overall and greater decrement when switching from rest to task, compared to younger adults. Interestingly, younger but not older adults showed increased task-related modularity with training. Furthermore, whereas training increased efficiency within, and decreased participation of, the default-mode network for younger adults, it enhanced efficiency within a task-specific salience/sensorimotor network for older adults. Finally, training increased segregation of the default-mode network from both task-related fronto-parietal/salience and visual networks in young adults, while it diffusely increased between-networks connectivity in older adults. Thus, despite behavioral gains in both groups, younger and older brains responded differently to WM training: Young adults increase network segregation, suggesting more automated processing with training, while older adults persist in, and potentially amplify, a more integrated and costly global workspace. These results suggest different age-related trajectories in functional network reorganization with WM training in younger and older adults.

Topic Line: EXECUTIVE PROCESSES: Working memory

G96 Withdrawn

G97 Dimensions of Psychopathology Associated with Distinctive Patterns of Cortical Thickness in Youth

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Psychiatric symptoms emerge early in life and are associated with abnormalities in brain structure. In conceptualizing psychopathology, a growing body of literature suggests that psychopathology exists on a continuum, not as separate categories as implied by the current diagnostic system. The present study aimed to investigate the association between cortical thickness and dimensions of psychopathology in youth. Analyses were conducted using structural brain and clinical assessment data from the Adolescent Brain Cognitive Development (ABCD) Study which has collected data on over 11,000 children ages 9-10 years. A bifactor model was used to quantify dimensional factors of psychopathology by allowing each item representing behavioral or emotional problems to load onto a general factor representing symptoms shared across disorders and onto one specific factor representing conduct, internalizing, or ADHD symptoms. SEM analysis with the psychopathology factors and ROIs based on the Destrieux atlas indicated that the general factor was associated with increased cortical thickness in

bilateral pericallosal sulcus which demarcates the inner boundary of the anterior cingulate cortex (raw p-values < .01). Sensitivity analyses using the Desikan atlas with and without including whole brain cortical thickness as a covariate indicated that the general factor was associated with increased cortical thickness in the left rostral anterior cingulate, posterior cingulate, and isthmus cingulate (raw p-values < .05). These results suggest that greater cortical thickness in the cingulate region is implicated in the general symptoms of psychopathology observed in youth. The findings are discussed in terms of the developmental trajectory of the brain and psychopathology.

Topic Line: NEUROANATOMY

G98 Concurrent activation of hierarchical neural representations compensates for neural delays in visual motion perception

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Due to the time required for neural transmission and processing, the brain only has access to outdated sensory information. This means that unless the brain can compensate for neural delays, moving objects would be represented in the brain behind their veridical location. Additionally, processing delays accumulate as information progresses through the visual hierarchy, such that later visual representations would lag the true position of moving objects more than earlier representations. Here we investigated whether neural representations of moving objects are predictively activated in order to compensate for these cumulative delays. We presented a circular stimulus in a 37-position hexagonal grid, either briefly flashed in individual positions or moving through the array along one of 42 motion vectors. Electroencephalographic (EEG) data was collected and analysed using multivariate pattern analysis. We trained classifiers to discriminate between different positions based on EEG activity evoked by the flashed stimuli, and then tested those classifiers on the motion trajectories. This allowed us to quantify the points in time at which the moving object activated different hierarchical position representations. We observed that hierarchical neural position representations that were activated sequentially for flashed stimuli were instead activated concurrently for moving stimuli. This suggests that the brain can compensate for the delays that accumulate during its own processing by predictively aligning the neural representations of moving objects in both space and time.

Topic Line: PERCEPTION & ACTION: Vision

G99 Individual Differences in Anxious Temperament relate to Differences in Brain Morphometrics

Jessi Kane, University of Louisville

Anxiety disorders constitute the most prevalent subgroup of mental disorders in most western societies, with an estimated lifetime incidence of 33.7% in the US. Anxiety can be defined as a prolonged state of apprehension elicited by unpredictable threats, or threats that are spatially or temporally distant. The current study utilized structural images from three studies (N=75) to examine individual differences in different mood and anxiety socioemotional questionnaires (Beck Depression Inventory, Penn State Worry Questionnaire, State Trait Anxiety Inventory, Mood and Anxiety Symptom Questionnaire90, Ruminative Response Scale) and both cortical and subcortical brain metrics using surface-based morphometry. Cortical results indicated that increases in both the STAI and MASQ90 (general anxiety) related to increased grey matter area in the bilateral occipital pole (i.e., pericalcarine cortex, lingual gyrus). While subcortical results indicated that increased bilateral amygdala volume was related to increases in the STAI, MASQ90 (general anxiety) and RRS (rumination). Additionally, increases in bilateral nucleus accumbens volume was related to the positive affect dimension of the MASQ90. Results suggest that individual differences in anxious temperament, as measured by the STAI and MASQ90, may be related to increased visual cortex area, perhaps related to hypervigilance of the environment. Additionally, increased anxious temperament as measured by the STAI, MASQ90 and RRS, appear related to increased volume of the amygdala, again perhaps suggesting, increased threat processing due to hypervigilance. Finally, increased positive affect, as measured by the MASQ90, was related to increased nucleus accumbens volume, possibly indicating the role of dopaminergic ventral-striatal regions in positive mood.

Topic Line: METHODS: Neuroimaging

G100 Withdrawn

G101 Dexamphetamine Effect on Tactile Funneling Illusion Experience in Healthy Participants

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The process of integrating of stimuli depends on the stimulus binding windows (SBW) over which the stimuli are presented. This SBW is the temporal or spatial interval over which the presented stimuli are to be associated with one another and bound into a single perceptual entity. These SBWs are wider in people with schizophrenia. Dopamine (DA) is critical in schizophrenia, but its role in SBWs is unknown, although a study on dexamphetamine (DEX) effects on small number of participants using the Tactile Funneling Illusion (TFI) (Kassim et al., 2019) or the rubber hand illusion (Albrecht et al., 2011) indicates that it may increase binding windows. The present study examined the effect of DEX (0.45mg/kg, PO), as a DA-releasing stimulant, on spatial and temporal SBWs using the TFI. A total of 66 healthy participants were used. The experiment was a randomized, double-blind, counter-balanced placebo-controlled cross-over study. The effect of DEX on schizotypy and TFI were tested. Five Spatial and three delay conditions were used to measure the TFI. Compared to Placebo, DEX had a significant effect ($p=0.022$) on the error of localization (EL) but not on funneling illusion (F). DEX had a significant effect ($p<0.05$) at each distance and delay condition. However, the difference was greatest at a 500ms delay condition. Increasing either delay or distance between touches also significantly reduced both F and EL. We conclude that increasing DA increases the error of spatial localization in healthy subjects, increases schizotypy, and widens temporospatial binding windows in both schizotypy and overall

Topic Line: PERCEPTION & ACTION: Other

G102 Patterns of pre-cue alpha power predict the decision about where to attend in willed attention

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In voluntary cued spatial attention paradigms, each trial starts with a cue instructing the subject to focus attention on a spatial location in order to process an impending stimulus. In contrast to cued attention, attention can also be allocated by purely internal decisions (willed attention), such as when subjects are asked to spontaneously decide where to attend on each trial. Bengson et al. (2014) reported that lateralized alpha power over occipital-parietal cortex immediately before a decision predicted where subjects would attend. Here, we used multivariate pattern analysis (MVPA) of EEG in Bengson's data set and a replication recorded at UF. In addition to instructional cues, 33% of trials had a choice cue that prompted the subject to choose the side of the visual field to attend on that trial; inter-trial intervals varied widely

(2-8 s) and unpredictably. To assess the time course of alpha power patterns that predicted where subjects would attend, we performed time window-by-window decoding over the 3000 ms pre-choice cue interval. Above chance (56.42% for UF and 56.57% for UCD datasets) decoding of alpha power prior to the choice cues was observed only immediately prior to the cue, and not earlier in time, replicating Bengson using decoding. These results demonstrate that decisions about where to attend are influenced by the pattern of alpha power only in the few hundred milliseconds immediately before a decision, supporting the idea that independent of goal-directed or bottom-up sensory factors, spontaneous brain states influence how humans focus attention.

Topic Line: ATTENTION: Spatial

G103 The Timing of Attentional Alpha Power Modulations Predicts Sound Localization Performance in Complex Auditory Scenes

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It is widely acknowledged that the hemispheric lateralization of posterior alpha-band oscillations is associated with shifts of auditory spatial attention. We previously demonstrated that such lateralization is limited to situations in which spatial information is task-relevant. Hence, we hypothesized that auditory alpha lateralization may reflect the attentional access to a 'spatial response template'. To follow up on this, we modulated perceptual load and spatial demand in an auditory sound localization task: A centrally presented target sound was followed by a sound array containing two or four lateralized stimuli (low vs. high perceptual load). In separate task blocks, participants indicated whether the target sound was presented on the left or right side (low-spatial-demand: two response alternatives) or specified the exact target position (high-spatial-demand: four response alternatives). Participants performed faster and more accurate in low (vs. high) spatial-demand-trials as well as in low (vs. high) perceptual-load-trials. The difference in accuracy between low and high perceptual load was highest in low-spatial-demand blocks. The analysis of alpha oscillations revealed no modulation of lateralization magnitude by perceptual load or spatial demand. However, the analysis of onset latencies showed that alpha lateralization emerged the earliest in low-spatial-demand / low-load trials and the latest in high-spatial-demand / high-load trials. Crucially, participants with earlier alpha lateralization onsets showed faster response times. The results demonstrate that the timing of alpha lateralization, but not amplitude, promotes efficient attentional selection in auditory scenes.

Topic Line: ATTENTION: Auditory

G104 Irrelevant Predictions: Distractor Rhythmicity Modulates Neural Encoding in Auditory Cortex

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Dynamic Attending Theory suggests that predicting the timing of upcoming sounds can assist in focusing attention towards them. However, whether similar predictive processes are also applied to background noises and assist in guiding attention away from potential distractors, remains an open question. Here we address this question by manipulating the temporal predictability of distractor sounds in a dichotic listening selective attention task. We tested the influence of distractors' temporal predictability on performance and on the neural encoding of sounds, by comparing the effects of Rhythmic vs. Non-rhythmic distractors. Using Magnetoencephalography (MEG) we found that, indeed, the neural responses to both attended and distractor sounds were affected by distractors' rhythmicity. Baseline activity preceding the onset of Rhythmic distractor sounds was enhanced relative to Non-rhythmic distractor sounds, and sensory response to them was suppressed. Moreover, detection of non-masked targets improved when distractors were Rhythmic, an effect accompanied by stronger lateralization of the neural responses to attended sounds to contra-lateral auditory cortex. These combined behavioral and neural results suggest that not only are temporal predictions formed for task-irrelevant sounds, but that these predictions bear functional significance for promoting selective attention and reducing distractibility.

Topic Line: ATTENTION: Auditory

G105 The effects of mood and social relationship on rudimentary sympathy of adults

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Preverbal infants prefer others in distress, suggesting that the rudimentary sympathy may be inherent (Kanakogi, et al., PLoS One 2013). However, it has not been clear whether the rudimentary sympathy is universal or can be affected by the state of persons. We aimed to test if the participants' mood and the social relationship affect the preference of others in distress. In Experiment 1, participants were asked to imagine either cooperative (n=28) or competitive situations (n=29) of several people in pictures to modulate their mood. Then, after they watched animations in that an object (Aggressor) pursued and hit the other object (Victim) for 20s, they answered relative preference for the objects using visual analogue scale. We found that the victim was preferred over the aggressor, suggesting the rudimentary sympatry. There was no difference between the two mood conditions. In Experiment 2, we manipulated the relationship between participants' pair before the preference measurement. Participants performed either 12 cooperative (n=16) or competitive (n=16) games, then they watched the same animations as in Experiment 1. The victim was significantly preferred in the cooperative condition, but not in the competitive condition. However, we did not obtain a significant difference in the direct comparison of the two groups. These results suggest that the mood may not affect the rudimentary sympathy (Experiment 1), but the preference for the victim might be weakened in the socially competitive relationship (Experiment 2). Thus, the rudimentary sympathy is relatively universal, but the social relationship with others might affect the rudimentary sympathy.

Topic Line: EMOTION & SOCIAL: Emotional responding

G106 Tracking the impact of retrieval suppression on neural memory representations

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When we experience aversive events, these often turn into unwanted memories. Simple reminders can then trigger their involuntary retrieval and elicit a negative affective response. However, prior evidence indicates that we can intentionally suppress the retrieval of such unwanted memories. This weakens the avoided memories and can eventually cause forgetting. Here, we test the hypothesis that suppression weakens memories by deteriorating their neural representations. This deterioration, in turn, would lead to a deficient reinstatement of the representations during subsequent recall attempts. In an fMRI study, participants learned associations between reminders and aversive scenes. For some reminders, they then repeatedly suppressed the retrieval of the associated scene. We afterwards assessed the impact of suppression on a recall test. As expected, suppression rendered memories less vivid, and a stronger reduction in vividness was associated with a greater decline in affect (as quantified by heart-rate deceleration). To test our hypothesis, we first assessed the degree to which recall was associated with reactivation of

general scene information throughout the brain. Using a linear classifier, we indeed observed weaker general reactivation during the retrieval of suppressed memories. We then focused on the parahippocampal cortex to scrutinize the reinstatement of individual memory representations. Using representational similarity analysis, we found that a greater reduction in the specificity of memory reinstatement in right parahippocampal cortex was associated with a stronger decline in vividness. These results support the hypothesis that suppression deteriorates declarative and affective components of unwanted memories by compromising their neural representations.

Topic Line: LONG-TERM MEMORY: Episodic

G107 Effects of facing direction of humanoid avatar on the cognitive process of the imagined shift of perspective

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We can imagine a scene in a viewpoint different from the actual viewpoint (the imagined shift of perspective). Similarly, humans have an ability called visual perspective-taking to judge how a certain object looks from another person's viewpoint. Thus, we predicted that the presence of the humanoid avatar as the base point of view could facilitate the imagined shift of perspective. We also investigated whether the facilitation is simply due to the presence of the avatar or the perspective of the avatar. In the experiment, a table was placed in the center of the room in a virtual environment, and either a chair alone or an avatar sitting on the chair was presented at one of the three positions on the left, back, and right of the table. Then, a ring with a gap like Landolt C was presented on the table. Twenty participants were asked to judge the direction of the ring's gap from the chair's or avatar's position, as quickly and accurately as possible. There were three avatar conditions: The avatar facing the ring (facing condition), the back of the avatar facing the ring (backing condition) and without an avatar (without condition). We found that the reaction time was the shortest in 'facing condition', second shortest in 'without condition' and longest in 'backing condition'. These results suggest that taking perspective of virtual avatar facilitates the cognitive process of the imagined shift of perspective, and the avatar's facing direction is critical for the perspective taking.

Topic Line: PERCEPTION & ACTION: Vision

G108 Lateralization of Word Reading fMRI Activation and DTI Structural Connectivity: Implications for Temporal Lobe Epilepsy

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In cases of temporal lobe epilepsy (TLE), damage over time may result in functional reorganization, leading to a shift in the dominant hemisphere of language processing. We compared left hemisphere TLE (lTLE) and right hemisphere TLE (rTLE) patients on a novel measure of laterality based on t-tests of left hemisphere (LH) and right hemisphere (RH) activation in language related brain regions (Broca's area and the fusiform gyrus) from functional magnetic resonance imaging (fMRI) during overt lexical (whole-word) reading. Diffusion tensor imaging (DTI) connectivity data was used to provide converging evidence for functional lateralization findings. Patients with rTLE had more strongly lateralized LH activation than lTLE patients and healthy controls. DTI also found differences in connectivity indicative of lTLE patients having greater tract integrity than rTLE patients in the RH uncinate fasciculus (UF), inferior longitudinal fasciculus (ILF), and inferior fronto-occipital fasciculus (IFOF) using the network based statistic method, but no differences were found in the LH. Both UF and IFOF tract integrity have previously been associated with lexical reading. Multivariate distance matrix regression provided converging evidence for the RH UF and IFOF having group dependent differences between individuals' connectivity profiles. This novel and efficient method for measuring language lateralization provided evidence for language lateralization differences between lTLE and rTLE groups, and corresponding differences in the integrity of the ILF, IFOF, and UF. This approach will inform future studies of language lateralization as a continuous measure, and language reorganization in patients such as those with TLE.

Topic Line: LANGUAGE: Other

G109 The temporal organization of free recall in childhood

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The organizational structure of memory is often studied using free recall paradigms (e.g., adults study lists of words and are asked to retrieve as many words as possible from the studied list). This work reveals consistent patterns in the order in which items are recalled (e.g., temporal clustering, spatial clustering). For example, temporal clustering is the finding that adults recall in succession items/events that were experienced closer in time. Relatively little is known about the organization of recall in children. The present research aimed to fill the gap with a naturalistic study. 4-5-year-olds, 6-7-year-olds and 8-10-year-olds (N=149) took part in a 5-day camp at a local zoo; children visited various unique animal exhibits each day (schedule predetermined). On day 5, children were asked to recall all the animals they visited. Using schedules, we calculated a 'same context' score for each child: the number of times successively recalled animals were experienced in the same temporal/spatial context. We then created a 'permutation distribution' for each age group (based on randomizing the order of responses; 1000 permutations, paralleling past adult studies). We found that older children recalled more than younger groups ($F(2,144)=39.41, p<.05$). All age groups showed evidence of clustering (observed same context scores > permutation distributions; $ps<.001$). This study advances our understanding of how memory is organized across development (findings of age-related differences and similarities) and the engagement of executive processes during memory search, while highlighting the utility of naturalistic memory studies (dynamic events, experienced over multiple days).

Topic Line: LONG-TERM MEMORY: Development & aging

G110 Neural responses to drug induced cues in cocaine and heroin users: an activation likelihood meta-analysis.

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Chronic substance abuse represents a significant public health threat. FMRI studies examining cue-reactivity generally implicate increased corticostriatal reward responses to drug cues in addicted samples. Yet, while behavioral differences exist as a function of substance of choice- e.g., cocaine addicted individuals demonstrate greater inhibition impairment than heroin addicted individuals- it is unclear whether differences in patterns of neural activation exist in relation to substance of choice. Such findings may elucidate neurocognitive risk factors and interventions. We performed an activation likelihood estimation meta-analysis (GingerALE) to probe neural differences during cue reactivity in cocaine and heroin users. Preliminary analyses included 23 studies (11 cocaine, 12 heroin; selection criteria: participant age over 18, no comorbid diagnoses or history of mood disturbances, currently abstaining from drug use). ALE maps were generated using 5000

permutations and corrected to p<.05 (FWE, cluster-level). Preliminary analyses across substances revealed engagement of the left dorsal (caudate) and ventral striatum, bilateral amygdala, bilateral thalamus and left posterior cingulate (PCC) to drug cues. PCC recruitment is consistent with evidence of increased PCC activation in response to multisensory drug cues and may be related to the PCC's role in multisensory self-relevant information. Exploratory contrast analyses revealed enhanced engagement of the occipital lobe and right posterior cerebellum declive in heroin relative to cocaine users. This pattern may reflect increased attentional bias to heroin cues in heroin users. These preliminary findings lay the groundwork for future investigations of visual cortex and attentional bias as predictors or consequences of opioid use disorders.

Topic Line: EMOTION & SOCIAL: Other

G111 Learning faces as concepts rather than percepts improves face recognition by engaging the social brain network

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Face recognition benefits from associating conceptual information to faces during learning. For example, making trait-inferences, relative to perceptual-evaluations, during face learning improves face recognition. Two hypotheses were proposed to account for this conceptual benefit in face recognition. According to the feature elaboration hypothesis, conceptual evaluations encourage elaborated processing of perceptual information from faces (Winograd, 1981). According to a conceptual-hypothesis, conceptual evaluations convert faces from a perceptual image-based representation to a socially meaningful representation of a person. To decide between these two hypotheses, we ran a functional MRI study in which we functionally localized the occipital-temporal face areas (i.e., perceptual face network) as well as the social brain-network (e.g., dmPFC, vmPFC, PCC, TPJ). Prior to scanning, participants watched video-clips depicting a social interaction between young adults and were asked to study them for a memory test, while making either perceptual evaluations (e.g., how round/symmetric is their face?) or conceptual evaluations (e.g., how trustworthy/intelligent does the face look?) about them. During the fMRI scan, participants performed an old/new recognition test on the faces that were presented during the learning phase and novel faces. Behavioural findings replicated the conceptual benefit in face recognition. Functional MRI results showed higher fMRI response during recognition for the faces that were learned conceptually than perceptually, in the social network brain areas but not in perceptual face areas. These results support the conceptual-hypothesis and highlight the important role that social processing mechanisms, rather than purely perceptual processes, may play in face recognition.

Topic Line: EMOTION & SOCIAL: Person perception

G112 Functional connectivity in the Healthy Oldest Old: Findings from the McKnight Brain Aging Registry

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Measuring relationships among brain regions using functional connectivity metrics has been a successful biomarker of disease and relates to cognition. The majority of work has been performed in young adult and younger-older adult populations with mean age under 85. Little work has described functional connections in the oldest-old.

Characterizing functional connectivity in the healthy oldest-old allows us to characterize what the successful aging brain should look like by identifying typical distributions of functional connectivity metrics and how they relate to cognition.

Data were acquired as part of the McKnight Brain Aging Registry, across the four McKnight Brain Research Foundation sites. For this analysis, 125 cognitively unimpaired older adults, ages 85-99 were included who had undergone structural and BOLD resting state MRI scans. Functional connectivity was measured within three networks: Default-Mode Network, Cingulo-Opercular Network, and Fronto-Parietal Network. Brain network functioning is an important avenue for aging and cognitive research since network infrastructure, including network integration and segregation, is likely to have a large impact on cognition.

We found that this cohort of healthy oldest old participants showed strong, reproducible connectivity networks for the three networks we tested. Further, level of connectivity within the frontoparietal network was positively associated with score on the MOCA, consistent with a contribution of cortical network integrity to performance on this task of generalized cognition. This work shows feasibility for examining connectivity in the healthy oldest old and helps set the stage for understanding how individual variability in connectivity relate to cognitive performance.

Topic Line: EXECUTIVE PROCESSES: Development &aging

G113 Interoceptive Awareness and Affective Empathy Share Intrinsic Spatial and Temporal Connectivity

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Awareness of internal bodily sensations (interoception, IA) and its connection to complex socio-emotional phenomena like empathy have been postulated, yet its neural basis remains poorly understood. The goal of the present fMRI study employs a data-driven approach to investigate whether cognitive or affective empathy and IA share spatial and/or temporal resting state functional connectivity (rsFC). Healthy participants viewed an abstract movie demonstrated to evoke strong connectivity in intrinsic brain networks (InScapes), and resultant resting-state fMRI spatial and temporal connectivity data was correlated with their self-reported empathy and interoception scores. We demonstrate a complex bidirectional behavioral and neurological relationship between empathy and IA, depending on the type of empathy interrogated: affective empathy and IA are distributed across similar spatial and temporal neural systems, while cognitive empathy and IA are only related temporally. Specifically, increased rsFC within the R IFG was associated with a decreased awareness of inner body sensations and increased vicarious emotional experience which may lead to impaired emotion regulation capability. Furthermore, enhanced information integration between an interoceptive experience network was related to both increased sensitivity of internal sensation, but in addition, to a dampening of discomfort arising from witnessing another's pain. Finally, improved processing between brain regions subserving mentalizing related to not only a sense of mind-body interconnectedness but also a better ability to take someone's perspective. Our findings could have implications for understanding differences in empathic and interoceptive functioning without needing to probe participants with specialized tasks or questionnaires.

Topic Line: EMOTION & SOCIAL: Emotion-cognition interactions

G114 The effect of epistemic curiosity and financial reward on younger and older adults' memory

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Epistemic curiosity-a desire for new knowledge-is a source of intrinsic motivation that can boost memory in younger and older adults. Likewise, monetary reward is a source of extrinsic motivation that has been shown to facilitate memory in both age groups. However, less is known about the interactive effect of these sources of intrinsic and extrinsic motivation on memory. According the undermining effect, extrinsic reward may weaken the benefits of intrinsic motivators such as curiosity. Alternatively, findings from fMRI literature suggest that extrinsic and intrinsic motivation share a common neural mechanism in the dopaminergic reward circuit. To assess the nature of this interaction, healthy younger (N = 60) and older (N = 52) adults completed a trivia task where they encoded high- and low-curiosity trivia questions. Half of each age group was in the extrinsic motivation condition, where they earned money for correctly guessing answers to trivia. The next day, participants completed a surprise memory test in which they recalled answers to high- and low-curiosity questions from the trivia task. Results revealed main effects of both curiosity and reward such that participants had better memory for questions that they were curious about and participants in the extrinsic motivation condition performed better than those in the purely intrinsic motivation condition. Interestingly, there was also a main effect of age indicating better memory in older than younger adults. These findings suggest that intrinsic curiosity and extrinsic reward do not interact competitively, and also show an age-related advantage in memory for trivia.

Topic Line: LONG-TERM MEMORY: Development & aging

G115 Consolidation

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In animals, memories are thought to become hippocampus-independent across the weeks and months following learning via systems consolidation. In humans, there is evidence that hippocampal fMRI activity decreases, while neocortical activity increases over this timeframe (Takashima et.al., 2006). Yet, behavioral measures of memory strength also change over this timeframe. These measures can complicate interpretation of brain activity that changes with memory age that is thought to reflect consolidation. Young adults (N=21) studied photos of indoor and outdoor scenes 1 hour, 1 day, 1 week, and 1 month prior to scanning. Memory for scenes was tested during an fMRI session. Participants viewed old and new scenes, made old/new recognition judgments, and gave confidence ratings. Accuracy, confidence ratings, and response times changed with memory age. We examined brain activity associated with targets to identify regions where activity changed with memory age (ANOVA) or where activity followed a power function. Unexpectedly, hippocampal activity was not related to memory age in either analysis. Three regions in the prefrontal cortex (PFC), one sensorimotor region, and four posterior parietal cortex (PPC) regions were identified by both analyses. A separate analysis that minimized the effect of behavioral differences across conditions revealed that activity in the sensorimotor region and two PPC regions was no longer significantly related to memory age. Accounting for the influence of behavioral changes over short timescales revealed regions that reflected behavior rather than memory age. It is important to consider the influence of behavioral changes when examining brain activity thought to reflect memory consolidation.

Topic Line: LONG-TERM MEMORY: Other

G116 Longer Lengths of Time Smoking Predict Poorer Cognitive Performance Later in Life among Former Smokers without Dementia

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With the exception of the immediate and short-lived cognitive benefit of nicotine, chronic smoking has been associated with considerable cognitive deficits and marked by neurological abnormalities (e.g. reduced gray matter in various areas of the brain) and global brain atrophy. Likewise, smoking has been associated with an increased risk of the development of dementia. The purpose of this study is to investigate the association between the length of time smoking and longitudinal decline in cognitive function of older adults who were former smokers without dementia. This study utilized longitudinal data from the National Alzheimer's Coordinating Center (NACC) Uniform Data Set (UDS). A total of 1,964 former tobacco smokers completed a battery of neuropsychological tests measuring general cognitive function, processing speed, executive functioning, memory, and language. Overall, results showed that participants who smoked for more years showed statistically poorer performance over time in processing speed (Digit Symbol), executive functioning (Trail-Making Test B), verbal fluency (Categorical), and memory (Delayed Recall), while adjusting for incidence of stroke and hypertension. The amount individuals smoked did predict decline in cognitive performance. Although difficult to study among cognitive healthy adults, longer durations of smoking appear to accelerate the cognitive aging process in later life. This study contributes to the previous literature by providing additional insight into the contribution that smoking has on age-associated cognitive decline in former smokers of those who have no demonstrated clinical cognitive impairment (mild cognitive impairment (MCI) or dementia).

Topic Line: EXECUTIVE PROCESSES: Development &aging

G117 Dopamine selectively increases information-seeking about potential losses

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Curiosity, commonly defined as the desire for knowledge, is a fundamental part of human nature. Such behaviour is integral to learning, social engagement and decision-making. However, how the brain motivates information-seeking is unknown. It has been shown that the opportunity to receive information (both instrumental or non-instrumental) is encoded by the same neural system as for primary rewards. As this system includes regions rich in dopamine (e.g., Ventral Tegmental Area, Substantia Nigra), it has been hypothesised that dopamine plays a critical role in information-seeking. By manipulating dopamine levels in humans, we were able to directly test this hypothesis. We show that administration of a drug that enhances dopamine function (dihydroxy-L-phenylalanine; L-DOPA) results in selective increase of information-seeking in humans. L-DOPA reduced the impact of valence on information seeking: while under placebo, participants were more likely to seek and pay for information about potential gains, under LDOPA this difference was significantly reduced. In particular, administration of LDOPA increased information-seeking about potential losses without impacting information-seeking about potential gains. The findings generate predictions of how atypical dopaminergic function (which characterize Parkinson's disease or Schizophrenia) may manifest as abnormal patterns of information-seeking, and how prescription drugs which targets dopamine function may impact

patients' information-seeking behaviour with potential consequences to patients' well-being.

Topic Line: EMOTION & SOCIAL: Emotion-cognition interactions

G118 Prediction in vision - elements of predictive coding in awake and anaesthetized primates

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Effects of suppression and expectation are hypothesized to be independent elements of predictive coding with expectation being dependant on long-range cortical connections. We tested this by comparing neuronal activities recorded in awake and anaesthetized monkeys presented with visual stimuli manipulating both elements. Awake monkey was performing a fixation task and was presented with pairs of gratings of either the same (match trials) or orthogonal orientations (non-match), while anaesthetized monkey's gaze was artificially fixated. Expectation was controlled by setting probabilities of match and non-match trials to 80% (expected) or 20% (unexpected). Local field potentials (LFP) and neuronal spikes were recorded from the primary visual cortex (V1) of awake (N sites = 28) and anaesthetized (N sites = 16) monkeys. In awake monkeys we also conducted simultaneous recordings from receptive field matching sites of V1, lateral intraparietal (LIP) and dorsolateral prefrontal (dlPFC) cortices to assess oscillatory activity in the dorsal stream. Expectation changes V1 LFP amplitude only in the awake monkey (24/28 recordings in awake, 0/16 in anesthetised), while repetition effects were present in both. Repetition leads to LFP peak-to-peak amplitude increase (12/28) or decrease (4/28) in V1, but LIP and dlPFC demonstrate only suppression, strongest in LIP, and dlPFC shows amplification of the difference in response to common/novel stimuli. LFP coherence is expectation-sensitive in gamma range for both V1-LIP and V1-dlPFC pairs and in theta-low alpha in LIP-PFC pairs. Thus, V1 is affected by both expectation and repetition, but effects of expectations are eliminated by anaesthesia.

Topic Line: PERCEPTION & ACTION: Vision

G119 Strategy Awareness and Use Questionnaire: A Validation Study

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Students cope with the attentional demands of a university setting by accessing a range of cognitive
and behavioural strategies. Yet, they may not be aware of the full scope of strategies available to them.
The aim of the study was to design and evaluate the Strategy Use and Awareness Questionnaire to
estimate students' awareness and use of strategies that optimize control of attention and/or compensate
for stress on an executive system due to environmental and/or neurobiological influences. An item
analysis was conducted that included an assessment of dimensionality and item trimming. Findings
from an exploratory factor analysis suggest a seven factor solution is optimal; Comprehension
Monitoring, Planning/Organization, Self-Reward, Self-Regulation, Organization with Mobile Phone
Technology, Regulating Technology, and Organization of Materials. This measure is likely to benefit
students, as well as counsellors and coaches interested in improving strategy use of students.

Topic Line: EXECUTIVE PROCESSES: Other

G120 Rapid motor responses based on perceived brightness, not on local contrast

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The perception of brightness is fundamental for human vision. Previous work suggests that rapid motor responses, as opposed to visual perception, are driven by local contrast and not by perceived brightness. We explored this suggestion with White's illusion, in which local contrast and perceived brightness move in opposite directions. Participants made speeded responses to a pair of rectangular target stimuli on a neutral background, which differed in luminance. To determine whether motor responses to targets were influenced by local contrast or perceived brightness, we briefly presented a pair of primes, which preceded and flanked the targets. Primes were gray bars located within an array of alternating black and white bars (White's illusion). When presented on black bars and surrounded by white bars, the gray bars appeared brighter than identical bars presented on white bars, although local contrast pointed in the opposite direction. Our results showed that motor responses to targets were systematically influenced by the perceived brightness of primes and not by the local contrast. We then manipulated the luminance of primes to increase the local contrast. Despite having a stronger contrast in the opposite direction, primes affected responses to targets based on perceived brightness. Our results demonstrate that even during the fast motor responses, which some have suggested depend on unconscious processing, our visual systems rapidly extract perceptual qualities.

Topic Line: PERCEPTION & ACTION: Vision

G121 Distracted by affective pictures: Neural mechanisms revealed by multivariate pattern analysis

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Affective pictures are highly potent distractors. In this study we examined the impact of picture valence on task-relevant visual processing and the underlying neural mechanisms. Simultaneous EEG-fMRI were recorded while participants detected instances of coherent motion in a random dot kinematogram (RDK) overlayed on IAPS pictures (pleasant=erotic couples, neutral=workplace people, and unpleasant=bodily mutilations). Applying support vector machines to BOLD responses in ventral visual cortex (VVC) and MT cortex we found the following results. First, decoding accuracy of both pleasant-vs-neutral and unpleasant-vs-neutral distractors was above chance level in both VVC and MT cortex, at 62.6% and 59.4% for VVC , 71.2% and 64.5% for MT, respectively. Second, in early period of VVC (3-5 TR after stimulus onset) across subjects, decoding accuracy of unpleasant-vs-neutral distractors was negatively correlated with the correctly identified instances of coherent motion ($p=0.01$), namely, the higher the decoding accuracy the lower behavior performance; decoding accuracy of pleasant-vs-neutral distractors, however, was not associated with behavioral performance. Third, in MT we found similar effect ($p =0.019$) on unpleasant-vs-neutral distractors with VVC in late period (6-8 TR after stimulus onset) yet pleasant-vs-neutral distractors did not show such effect. In summary, these results demonstrated that (1) although pleasant distractors were better represented than unpleasant distractors in these two ROIs, it was the unpleasant distractors that had a stronger adverse influence on behavior and (2) Unpleasant distractor

represents on VVC and MT to adversely impacted behavior of ongoing task in sequence.

Topic Line: EMOTION & SOCIAL: Emotion-cognition interactions

G122 Frontoparietal Control of Willed Attention

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Cueing paradigms are commonly used to study the neural mechanisms of visual spatial attention control. In these paradigms, each trial starts with an external cue, which instructs the subject to pay covert attention to a spatial location in order to process an impending stimulus. Neuroimaging studies have consistently shown that the dorsal attention network (DAN) is activated following the cue. Recent work has introduced a new form of cueing which asks the subject to spontaneously decide which spatial location to attend (willed attention). We examined the neural substrate of willed attention control by analyzing fMRI data recorded at two institutions (UF and UC Davis) using the same willed attention paradigm. In addition to instructional cues, a choice cue was included, which prompted the subject to choose the side of the visual field to attend. Applying the general linear model we found that both instructional cues and choice cues activated the DAN. Choice cues additionally activated frontoparietal regions including the dorsal anterior cingulate cortex (dACC), anterior insula (AI), dorsal lateral prefrontal cortex (DLPFC) and inferior parietal lobule (IPL). An MVPA analysis showed that for neural activity evoked by choice cues, decoding accuracy in these frontoparietal regions was significantly above chance level, whereas for instructional cues, decoding accuracy was at chance level. These results, consistent across the two datasets, suggest that willed visual spatial attention is controlled by three major brain networks: the salience network (dACC and AI), the central executive network (DLPFC and IPL), and the DAN.

Topic Line: ATTENTION: Spatial

G123 Self-reported Mind Wandering Differentiates Pre-stimulus EEG Microstate Dynamics during a Sustained Attention Task

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Brain activity continuously fluctuates in the time period between trials in tasks of sustained attention. This spontaneous activity reflects the intrinsic dynamics of neurocognitive networks which ought to be of relevance for understanding one's ongoing attentional state. But few studies have examined the millisecond temporal dynamics of global brain states in these moments and their links to the experience of mind wandering. In the present study, we investigated the association between EEG microstate temporal dynamics and self-reported mind wandering. Thirty-six participants completed a sustained attention to response task in which they were asked to respond to upright faces (nontargets) and withhold responses to inverted faces (targets). Intermittently, experience sampling probes assessed whether they were focused on the task or whether they were mind wandering (i.e., off-task). Broad-band EEG was recorded and segmented into a time series of brain electric microstates based on data-driven clustering of topographic voltage patterns. The strength and rate of occurrence of specific microstates differentiated on- versus off-task moments in the pre-stimulus epochs of trials preceding probes. Similar associations were also evident between microstates and variability in response times. Together, these findings demonstrate the sensitivity of ongoing electrocortical microstate dynamics to self-reported mind wandering, and provide suggestive evidence that dynamic sequences of microstates encode behaviorally relevant information about one's ongoing attentional state.

Topic Line: ATTENTION: Other

G124 Causal manipulation of activity in the ventral visual stream changes visual long-term memory storage

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Modern theories of memory propose that the temporal cortex is critical for storing detailed visual long-term memory representations. Here we tested this idea by causally manipulating activity in the temporal lobe of human subjects performing a visual recognition memory task. Subjects were required to remember 500 pictures of common visual objects following 20 minutes of transcranial direct current stimulation (tDCS) applied to the temporal lobe (10/20 electrode T3 or T4) or following a sham procedure to which subjects were blind. First, we applied anodal tDCS and found that subjects' recognition memory performance was better than their sham baseline. Second, we applied cathodal stimulation and found that subjects' recognition memory performance was worse than their sham baseline. Third, to determine whether the memory enhancement effect was due to enhanced encoding or retrieval, we applied stimulation immediately prior to the visual memory test phase. This experiment showed no benefit of stimulation when applied prior to retrieval. Fourth, to understand the neural dynamics underlying the enhanced recognition memory performance, we recorded the subjects' electroencephalogram (EEG) and their averaged event-related potentials (ERPs) after anodal tDCS. We found that the stimulation-induced memory enhancement was accompanied by significant inhibition of alpha-band power as the pictures were encoded into visual long-term memory. Our findings provide causal support for the view that activity in the temporal lobe (i.e., the ventral visual stream) is essential for accurate storage of representations in visual long-term memory.

Topic Line: LONG-TERM MEMORY: Episodic

G125 Sensory Modality-Independent Activation of the Brain Network for Language

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The meaning of a sentence can be understood, whether presented in written or spoken form. Therefore, it is highly probable that brain processes supporting language comprehension are at least partly independent of sensory modality. To identify where and when in the brain language processing is independent of sensory modality, we directly compared neuromagnetic brain signals of 200 human subjects (102 males) either reading or listening to sentences. We used multiset canonical correlation analysis to align individual subject data in a way that boosts those aspects of the signal that are common to all, allowing us to capture word-by-word signal variations, consistent across subjects and at a fine temporal scale. Quantifying this consistency in activation across both reading and listening tasks revealed a mostly left-hemispheric cortical network. Areas showing consistent activity patterns included not only areas previously implicated in higher-level language processing, such as left prefrontal, superior and middle temporal areas, and anterior temporal lobe, but also parts of the control network as well as subcentral and more posterior temporal-parietal areas. Activity in this supramodal sentence-processing network starts in temporal areas and rapidly spreads to the other regions involved. The findings indicate not only the

involvement of a large network of brain areas in supramodal language processing but also that the linguistic information contained in the unfolding sentences modulates brain activity in a word-specific manner across subjects.

Topic Line: LANGUAGE: Other

G126 Isolating Pathways Critical for Speech Repetition with Connectome-Based Lesion-Symptom Mapping in Stroke-Induced Aphasia

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The neuroanatomical basis for speech repetition has long been a point of contention ever since classical neurobiological models of language were proposed in the late 19th century. So-called 'disconnection' accounts, which posit that disruptions to the arcuate fasciculus prevent communication between anterior and posterior language sites, are still widely taught in modern textbooks even though there is little empirical evidence to support them. Here, we mapped the structural connectome in a large sample of individuals with stroke-induced aphasia with varying degrees of repetition impairment. Brain-behavior relationships were evaluated using a predictive algorithm popularized in genetics research: sparse Partial Least Squares-Regression (sPLS-R). sPLS-R is able to accommodate high-dimensional, collinear datasets through supervised latent projections and embedded feature selection to generate parsimonious predictive models while also informing users of relative feature importance via the variable importance in projection (VIP) coefficient. By bootstrap resampling the sPLS-R training procedure, the distributions of VIP coefficients with strongest magnitude revealed that a localized cluster of seven short-range white matter connections within the parieto-temporal junction were consistently selected by the algorithm. The identified pathways connected intraparietal and posterior temporal areas without frontal involvement. Moreover, by purely using the seven highest ranking features, a reduced PLS model was able to successfully generate out-of-sample predictions for speech repetition performance. These novel data indicate that speech repetition might be explained by a disruption to an essential set of short-range pathways interconnecting posterior language areas known to possess auditory-motor properties rather than a long-range disruption to the arcuate fasciculus.

Topic Line: LONG-TERM MEMORY: Development & aging

G127 Cumulating negative experiences induces structural changes in the dentate gyrus-CA3 and self related cortical areas

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Neuroimaging research typically does not take into account the effects of cumulating negative life
experiences when assessing healthy or neuropsychiatric population's brain functioning. The brain at
the time of scanning is also a result of the negative experiences participants went through during
their life. The direct impact on cumulating negative life experiences in the brain stays largely
unknown. We here collected high-resolution T1 of 43 healthy participants and used freesurfer to
individually segment the dentate gyrus (DG) and CA1-3 hippocampal volume subfields (Iglesias et
al 2015), known to, be related to life experiences memory circuitry, as well as cortical medial areas
implicated in life experience integration (i.e., left orbitofrontal cortex, left precuneus). The same
day they underwent MRI scanning, participants also fulfilled questionnaires on accumulation of life
experiences during their lifespan (Sarason et al. 1978).
The more participants went through negative life experiences the smaller the volume of the left DGCA3.
In the self-related cortical areas the accumulation of negative experiences was also associated
with less grey matter volume in the left precuneus, with no significant effects being found for left
orbito-frontal cortex.
These results suggest that our brains are not only the results of pure biology without context,
negative life experiences matter to our brain and more specifically the brain areas that integrate life
experiences. Future research should take into account potential changes induced by negative life
experiences for the interpretation of clinical and neuroscientific findings.

Topic Line: LONG-TERM MEMORY: Development & aging

G128 Enriching the Human Connectome: Newly digitized von Economo & Koskinas atlas integrated in The Virtual Brain

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Fundamental relations between architecture, connectivity and function of the cerebral cortex still remain elusive. This is partly due to a lack of detailed, quantitative cytoarchitectonic data for the human brain. Currently, the only comprehensive source of such information is the classic work of von Economo and Koskinas (vEK) which, however, is only available in a paper-based 2D atlas in non-standard space. This data, comprising systematic quantitative macroscopic as well as microscopic anatomical descriptors, such as layer thickness, cell density and cell sizes, is essential for linking fundamental aspects of macroscopic and microscopic cortical organization and connectivity and complements recent efforts.

Our project is aimed at constructing an open-source, comprehensive and interactive, virtual 3D of the von Economo and Koskinas atlas in stereotactic space (i.e. MNI-152, Colin-27). Recent efforts manually mapped the von Economo and Koskinas parcellation onto the FreeSurfer Desikan-Killiany atlas based on the textual description and 2D drawings. To overcome related problems, we aimed at explicitly defining a virtual 3D von Economo and Koskinas model independent of existing reference geometries- which became possible by 3D scanning 2 individual, well-preserved 3D plaster models of the cortical parcellation manufactured in the era of von Economo. We have reconstructed the 3D model and illustrate the integration of the extracted atlas into the TVB (The Virtual Brain) neuroinformatics platform- and by extension-Human Brain Project Knowledge Graph infrastructure offering the prospect of reliably mapping human cytoarchitectonic information into common cortical parcellation schemes, enabling and advancing the enrichment of the human connectome.

Topic Line: NEUROANATOMY

G129 Gamma burst length in the human DLPFC predicts memory scan time in Sternberg task ? an intracranial study

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Comparing incoming stimuli to the content of memory is a fundamental function of cognition. In 1966, Sternberg proposed that scanning short-term memory for a target is an exhaustive serial search process. He supported this argument with reaction time (RT) data that indicated that search time increased by 38 ms for each additional element held in memory. Theoretical work suggests that gamma oscillations are a neural mechanism for implementing this ?memory scanning' process. In the present study we tested the involvement of gamma oscillations in the memory scanning process during a Sternberg task. Dorsolateral prefrontal cortex (DLPFC) is thought to be critical for working memory as shown by many monkey single unit and human fMRI studies. We recorded local field potential (LFP) signals from depth electrodes implanted in the DLPFC in 13 epileptic patients (14 sessions) during a modified Sternberg task with three levels of memory load. We found that the LFP exhibited a load-related increase in gamma power. This increase was mainly due to the elongation of gamma-band activity in higher memory loads. We also calculated, for each trial, the number of bursts, as well as the duration of the first and the longest gamma burst. This revealed a correlation between the duration of the longest burst and RT as well as a correlation between load-related changes in RT and load-related changes in burst duration. Together our data suggests that gamma-band bursts in DLPFC are a reflection of the memory search process.

Topic Line: EXECUTIVE PROCESSES: Working memory

G130 Spatio-temporal dynamics of word production: neuromagnetic evidence

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Language production is thought to involve a series of computations, from conceptualisation to articulation, engaging cascading neural events [Indefrey and Levelt, 2004]. In contrast, recent neuromagnetic evidence [Miozzo et al., 2016; Strijkers et al., 2017] suggests simultaneous meaning-to-speech mapping in picture naming tasks, as indexed by early (~130ms after stimulus onset) parallel activation of fronto-temporal regions to lexical semantic, phonological and articulatory information.

Here we asked to what extent such earliness is a replicable property of the spatiotemporal dynamics of word production.

We recorded the neural responses elicited by object naming using magnetoencephalography (MEG). Stimuli consisted of 128 object images from 4 categories of animals, foods, tools, clothes. Word length (20 mono- and 20 bi-syllabic words) and diphone frequency (20 high and 20 low frequency) were co-varied within categories to respectively target syllabification and phonetic encoding.

Multivoxel pattern analyses (MVPA) searchlights in sensor space distinguished the stimulus-locked spatio-temporal responses to conceptual categories early on, from ~100ms after stimulus onset, but showed no phonological effect. In the same time interval, source localisation analyses confirmed early differentiation of conceptual categories in left inferior temporal cortex. Furthermore, word length and diphone frequency triggered later effects (from ~250ms) in left inferior frontal cortex. These results point to differential spatio-temporal modulations of neural activity by conceptual preparation in regions relevant to object knowledge and by phonological variables in left inferior frontal regions supporting phonological processes.

Topic Line: METHODS: Neuroimaging

G131 Variability in inhibitory function reflects changes in motor performance after physical exercise

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Cross-sectional studies have shown that cortical recruitment in older adults varies as a function of physical fitness when performing a unimanual motor task. This variability may explain differential motor performance. The present study employed a 12-week exercise intervention with sedentary older adults to test if increased physical fitness changed cortical activity profiles that may underlie improvements in upper extremity performance. Twenty-four participants were randomly enrolled into an aerobic Spin or non-aerobic Balance control group. Before and after the intervention, participants completed upper extremity motor tasks and physical fitness assessments to evaluate changes in fine motor ability (dexterity and psychomotor speed) and estimated VO2 maximum. We used functional magnetic resonance imaging (fMRI) and transcranial magnetic stimulation (TMS) to assess patterns of cortical excitability/inhibition between hemispheres. Regardless of the intervention, participants showed similar improvements in physical fitness and motor performance after the 12-week programs. A multiple regression analysis showed that changes in the motor control measures were predicted by a more left-lateralized cortical recruitment assessed by blood oxygenation level dependent (BOLD) fMRI. This was quantified using a volumetric analysis of activity in sensorimotor cortices between hemispheres. The direction of the BOLD profile (positive to negative) did not differ after the intervention in either hemisphere, however. Importantly, changes in fMRI were also associated with TMS measures of cortical excitability, and paired-pulse measures of interhemispheric inhibition. We conclude that by increasing physical activity and aerobic fitness, previously sedentary older adults may enhance cortical inhibition and consequently improve their motor performance.

Topic Line: PERCEPTION & ACTION: Motor control

G132 Connectome-based predictive modeling of individual anxiety

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Anxiety and anxiety-related illnesses are highly prevalent in human society. Being able to identify neurobiological markers signaling high trait anxiety could aid the assessment of individuals with high risk for mental illness. Previous neuroimaging studies collapsed group data to decode anxiety in the brain, but little is known with respect to predicting individual anxiety levels using neural models. Here, we applied connectome-based predictive modeling (CPM) to whole-brain resting-state functional connectivity (rsFC) data to predict the degree of anxiety in 76 healthy participants. Using a computational 'lesion' method in CPM, we then examined the weights of the identified main brain areas as well as their connectivity. Results showed that the CPM could predict individual anxiety from whole-brain rsFC, especially from limbic areas-whole brain and prefrontal cortex-whole brain. The prediction power of the model significantly decreased from (simulated) lesions of limbic areas, lesions of the connectivity within the limbic system, and lesions of the connectivity between limbic regions and the prefrontal cortex. Although the same model also predicted depression, anxiety-specific networks could be identified independently, centered at the prefrontal cortex. These findings highlight the

important role of the limbic system and the prefrontal cortex in the prediction of anxiety. Our work provides evidence for the usefulness of connectome-based modeling of rsFC in predicting individual personality differences and indicates its potential for identifying personality structures at risk of developing psychopathology.

Topic Line: METHODS: Neuroimaging

G133 The neurocognitive development of pragmatic interpretation in youth

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A cornerstone of effective communication is our ability to understand what is and is not being said by conversational partners (a.k.a. pragmatic interpretation). However, the developmental trajectory of pragmatic interpretation remains largely unclear. Several lines of research in human adults suggest that pragmatic interpretation involves a few subprocesses such as extracting relevant information from communicative context (context processing) and organizing the information in a specific way for modeling the speaker's utterance selection process (mental simulation). Here, by combining model-based fMRI and computational and experimental pragmatics, we tested for the functional development of brain regions separately recruited for the latent operations and their relationships with behavioral changes. A large sample of subjects (fMRI = 141, behavioral = 175; ages 8-24 years) participated in a well-established referential game, where they needed to recover a target object in a given context from a referring expression received from a speaker. Our data suggested that the ability of pragmatic interpretation continuously developed into adulthood. The age-related improvements were supported by (i) an adolescent-nonspecific increase in the engagement of mental simulation of speakers, subserved by functional changes in the ventral medial prefrontal cortex, and (ii) an adolescent-specific development in contextual processing, subserved by functional changes in regions including the visual cortex. Importantly, the integration of the two systems was affected by age-related changes in the frontoparietal network, areas widely implicated in executive function development. These findings suggest separable neurodevelopmental trajectories whose interplay contributes to the maturation of social communication from middle childhood through adolescence to adulthood.

Topic Line: LONG-TERM MEMORY: Episodic

G134 Effects of attachment styles on prefrontal cortex during social interaction: An fNIRS hyperscanning study

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As a recently emerging methodology in social neuroscience, hyperscanning have opened up important opportunities for investigating neural correlates of behaviorally observed individual differences such as attachment orientation in realistic social contexts. This study investigates possible differences of prefrontal cortex (PFC) activity as well as brain-to-brain coordination across PFCs of dyads during naturalistic social interaction from an attachment theory perspective by employing functional near-infrared spectroscopy (fNIRS) hyperscanning. Male participants with right-hand dominance (N=48) were administered Turkish Experiences in Close Relationship Scale (Sumer, 2006) to assess predominant adult attachment style. Regular and reverse cooperative and competitive versions of the well-known rock-paper-scissors (RPS) game were introduced to facilitate standardized social interaction, which dyads were asked to play twice facing each other. By using a novel coherence difference measurement method (mean social?solo coherence), significant inter-brain coherence were observed for both competition and cooperation tasks at fronto-polar cortex (FC) and dorsolateral PFC (DLPFC) bilaterally in a lateralized manner depending on the task type (regular tasks: right-DLPFC, reverse tasks: left-DLPFC). Moreover, two-sample t-tests based on 27 secure and 21 insecure participants revealed that attachment styles do have effects on FC oxygenated hemoglobin (HbO) activation (at right FC: cooperation-normal-l t(28)=3.77, p

Topic Line: EMOTION & SOCIAL: Other

G135 Interrupting Working Memory: Frontal Theta and Posterior Alpha Oscillations Reflect Reactivation Processes

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In our working environment, for example, interruptions frequently disturb ongoing tasks and lead to impaired performance. This study investigates the cognitive mechanisms underlying the detrimental impact of interruptions as reflected in theta (4-7 Hz) and alpha (8-14 Hz) oscillatory power of the electroencephalogram (EEG). A working memory (WM) task was applied in which a primary task was interrupted by a cued secondary task in two-thirds of all trials. Participants had to memorize the orientation of two bars on either the left or right side of a central fixation cross. A retro-cue indicated one bar as target whose orientation had to be reported at the end of the trial. Prior to the retro-cue, participants were interrupted by a high- or low-demanding math task or a prolonged fixation cross was presented as a control condition. Behavioral results revealed that an interruption impaired WM performance, with the strongest impact of a high-demanding interruption. On the EEG level, this was reflected by decreased frontal theta power after retro-cue presentation indicating reduced cognitive resources. Additionally, the suppression of alpha power contralateral to the target position in the memory array was weaker following an interruption compared to trials without one, suggesting that interruptions impaired the reallocation of attention towards the primary task. Furthermore, alpha power at right-hemispheric posterior sites was increased in high-performance trials but only after low-demanding interruptions. This suggests a performance benefit when the time interval before the resumption of the primary task could be used for inhibiting the WM representation of the interruption.

Topic Line: EXECUTIVE PROCESSES: Working memory

G136 Neurophysiological Correlates of the Dunning-Kruger Effect

Richard Addante, California State University, Alana Muller, University of Arizona

The Dunning-Kruger Effect is a metacognitive phenomenon of illusory superiority in which individuals who perform poorly on a task believe they performed well, yet individuals who performed very well believe they under-performed. This phenomenon has yet to be directly explored in episodic memory, nor explored for reaction times and physiological correlates. We designed a novel method to elicit the Dunning-Kruger Effect (DKE) via a test of item and source recognition while electroencephalography was recorded; throughout the task, participants were asked to estimate the percentile in which they performed compared to others. Results revealed participants in the bottom 25th percentile overestimated their percentile the most, while participants in the top 75th percentile underestimated their percentile, exhibiting the classic DKE. Reaction time measures revealed a condition x group interaction whereby over-estimators responded faster than under-estimators when estimating being in the top percentile and responded slower

when estimating being in the bottom percentile. Between-group EEG differences were evident between over-estimators and under-estimators when collapsing across all Dunning-Kruger responses, which revealed FN400-like effects of familiarity supporting differences for over-estimators from 400-600ms, whereas 'old-new' memory ERP effects revealed a late parietal component (LPC) associated with recollection-based processing for under-estimators that was not evident for over-estimators. Findings suggest over- and under-estimators use differing cognitive processes when assessing their performance, such that under-estimators rely on recollection during memory and over-estimators draw upon familiarity when over-estimating their performance. Episodic memory thus appears to play a contributory role in metacognitive judgments of illusory superiority in the DKE.

Topic Line: EXECUTIVE PROCESSES: Monitoring & inhibitory control

G137 REFLECTION ON SELF-TRANSCENDENCE VALUES INVOLVES THE PRESUMED BRAIN SITE FOR THE CORE SELF REPRESENTATION: AN FMRI STUDY

Emilia Leszkowicz, University of Gdansk, Gregory R. Maio, University of Bath, David E.J. Linden, Maastricht University, Nikas Ihssen, Durham University

Human values, such as 'world peace' or 'helpfulness', aim to preserve and enhance the welfare of others and of nature: They drive attitudes and behaviours which transcend selfish interests. Other values, such as 'power' and 'success', focus on promotion of self-interest, and enhancement of the self. The aim of our study was to identify the neural signature of self-transcendence values, with particular attention to the putative role of the medial prefrontal cortex, which has been linked to a self-transcendent mindset, the ability to mentalize in the context of such mindset, and the representation of a 'core self'. We asked volunteers to rate different human values as their personal guiding principles in life, while brain activity was recorded with an fMRI scanner. BOLD signals during self-transcendence and self-enhancement values rating were compared (t-test between conditions, cluster defining threshold of 0.001; cluster-size thresholding: Monte Carlo simulations, BrainVoyager). Processing of self-transcendence values was linked to higher activity in midline cortical regions of the brain, namely in the dorsomedial and ventromedial prefrontal cortices. The observed greater activity in brain regions associated with self-transcendent mindsets and mentalizing might suggest that prosocial tendencies expressed with self-transcendent values are linked to the appreciation of others' mental states. Thus, our data suggests that prosocial tendencies expressed by human values may arise from our capacity to understand the minds of others. What is also interesting, these values are associated with greater activity in a brain site where 'a core self' is presumably represented.

Topic Line: EMOTION & SOCIAL: Self perception

G138 The relationship between news event memory and performance on traditional neuropsychological tests

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Individuals with mild cognitive impairment (MCI) exhibit mild anterograde amnesia and mild or no semantic memory impairment on traditional neuropsychological tests. In contrast, they exhibit severe, but temporally-limited, retrograde amnesia when novel measures of semantic memory (news event memory) are used. Yet, it is unclear how news event memory relates to traditional measures of cognitive domains. In 47 elderly adults we obtained traditional measures of cognitive domains (episodic memory, semantic memory/language, executive function, attention/processing speed, and visuospatial function) and a novel measure of retrograde memory (retrograde memory news events test, RM-NET). The RM-NET is a 231-item, 4-choice recognition memory test (12.6 seconds per question) for knowledge about events that occurred across most of the adult lifespan (2017-1948). We examined the relationships between mean RM-NET accuracy scores and composite Z-scores for each cognitive domain. Overall, RM-NET accuracy scores were significantly correlated with every cognitive domain. The association was strongest for episodic memory, attention/processing speed, and visuospatial function and was weakest for semantic memory. The association between RM-NET accuracy and episodic memory was strongest for recent memories (news events that occurred 1-12 years ago) and was weaker for more remote memories. Because the hippocampus supports episodic memory, this decline in the strength of the episodic memory-RM-NET correlation is consistent with the idea that recent news event memories are hippocampus-dependent while more remote memories are not. Impairment in news event memory in neurological patients may not reflect isolated deficits in semantic memory and may also reflect broader deficits affecting other domains.

Topic Line: LONG-TERM MEMORY: Other

G139 Layer and rhythm specificity for predictive routing

Andre Bastos, MIT, Mikael Lundqvist, MIT, Nancy Kopell, Boston University, Earl Miller, MIT

In predictive coding, experience generates predictions that attenuate the feeding forward of predicted stimuli while passing forward unpredicted 'errors'. Different models have different neural implementations of predictive coding. We recorded spikes and local field potentials from laminar electrodes in five cortical areas (V4, LIP, area 7A, FEF, and PFC) while monkeys performed a task that modulated visual stimulus predictability. Pre-stimulus predictions were associated with increased alpha/beta (8-30 Hz) power/coherence that fed back the cortical hierarchy primarily via deep-layer cortex. Unpredictable stimuli were associated with increases in spiking and in gamma- band (40-90 Hz) power/coherence that fed forward up the cortical hierarchy via superficial-layer cortex. Area 7A uniquely showed increases in high-beta (~22-28 Hz) power/coherence to unpredicted stimuli. These results suggest that predictive coding may be implemented via lower-frequency alpha/beta rhythms that 'prepare' pathways processing predicted inputs by inhibiting feedforward gamma rhythms and associated spiking.

Topic Line: EXECUTIVE PROCESSES: Working memory

G140 Familiarity signals in the human amygdala during recognition memory

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Signals related to the familiarity of stimuli shown in recognition memory tasks are frequently observed in both the hippocampus (HF) and the amygdala (AMY) in humans. It remains little understood what the familiarity signal in the amygdala contributes to declarative memory. To address this issue, we investigated the properties of memory selective neurons recorded in epilepsy patients implanted with depth electrodes in the HF and AMY for seizure monitoring. 48 subjects were shown a set of intermixed novel and familiar images and were asked to determine the novelty of each together with a confidence rating. We identified memory selective (MS) neurons in both AMY (n=75) and HF (n=68) that responded selectively to either new or old images. Using these cells, we investigated the latency at which familiarity signals

emerged first after stimulus onset. Population decoding with leave-one-out cross validation revealed that the novelty/familiarity of an image could be decoded with ~80% accuracy with either HF or AMY cells. However, this signal became decodable ~200 ms earlier in the AMY relative to the HF. The early AMY familiarity signal was specifically carried by cells that increased their firing rate when old stimuli were presented and not by cells that increased their firing rate when new stimuli were presented. Additional analysis of high and low confidence trials revealed no area differences. This data suggests that the early amygdala familiarity signal represents a non-declarative form of familiarity that, in contrast to the hippocampus, does not predict retrieval confidence.

Topic Line: LONG-TERM MEMORY: Episodic

G141 Evidence for an interactive account of hemispheric lateralization in visual perception of words and faces

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A standard and influential account of cortical organization posits that face and word perception are mediated by domain-specific cortical areas in the right (RH) and left (LH) hemispheres, respectively. An alternative, interactive account (Behrmann & Plaut, 2020, Perception) claims that learning to read imposes topographic pressures on word representations to be proximal to left-dominant language representations, resulting in left-lateralization of words; strong LH competition between words and faces then results in right-dominant lateralization of face representations. We tested this account by examining individual variability in hemispheric organization with functional neuroimaging of 28 right-handed native English speakers. Targeting inferotemporal and fusiform cortex, as expected, we found that most subjects evinced right-dominant face selectivity and left-dominant word selectivity, and weaker but significant selectivity in the other hemisphere. Crucially, in line with the interactive account, word selectivity in the left hemisphere was found to strongly correlate with rightward laterality of face selectivity, as well as the individual components of this laterality; LH word selectivity was positively correlated with RH face selectivity and negatively correlated with LH face selectivity. The opposite comparisons were not true; RH word selectivity was uncorrelated with LH and RH face selectivity. Further within-hemisphere control comparisons revealed a lack of competition between object and word selectivity, and weak cooperation between object and face selectivity, highlighting the specificity of the results. Our results thus support a graded and interactive account of the development of asymmetric hemispheric weighting of the neural representations supporting word and face perception.

Topic Line: PERCEPTION & ACTION: Vision

G142 The role of statistical learning in speech processing of dogs as evidenced by awake fMRI

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Human infants quickly learn to decode and compute the patterns present in speech, using a process called statistical learning. Living in a similar environment, dogs obtain incomparably lower language proficiency. Since statistical learning is a mechanism commonly found in other species, we tested whether it contributes to the speech processing of dogs.

Using functional magnetic resonance imaging (fMRI), 18 healthy, awake, unrestrained, specifically trained dogs were exposed to a previously unknown continuous speech stream consisting of syllables that were a) randomly ordered and b) forming artificial three syllable words. The words were defined exclusively by the transitional probabilities between the syllables. The experiment consisted of three parts, all on the same day: a baseline fMRI measurement, a 16-minute learning phase and a second fMRI scan, testing the learning outcomes.

We found that a cluster in the basal nuclei, encompassing portions of the left caudate nucleus and the left thalamus discriminated between the random and the word condition after learning. While in the first measurement, there were no activity differences in response to the two conditions, in the second measurement the artificial word condition elicited lower activity than the random condition ? a pattern similar to that reported in humans. Thus dogs can quickly learn and extract statistical regularities found in a linguistic input. However, while in humans statistical language learning involves predominantly language processing areas, our results suggest that in dogs regions in the basal nuclei supporting general sequence learning are necessary for tracking syllables in a continuous speech stream.

Topic Line: LANGUAGE: Other

G143 Long-term daily touchscreen testing acts as a cognitive enhance in mice.

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With the growing popularity in touchscreen cognitive testing in rodents, it is imperative to understand the fundamental effects the paradigm can have on the animals involved. In this study, we set out to assess hippocampal dependant learning in the APP/PS1 mouse model of Alzheimer's Disease (AD) on two highly translatable tasks ? the Paired Associate Learning (PAL) task and the Trial Unique Non-Matching to Location (TUNL) task ? at ages this model has shown deficits on traditional cognitive tasks. Mice were assessed for deficits in PAL at 9.5-11.5 months of age, then on TUNL at 8-11 and 13-16 months. No cognitive deficits were evident in APP/PS1 mice at any age, contrary to previous reports using maze-based tasks. We hypothesized that daily and long-term touchscreen testing training may have inadvertedly acted as a cognitive enhancer. When touchscreen tested mice were assessed on the Morris water maze, they showed improved performance compared to naïve mice. In support of this theory, we show that touchscreen trained WT and APP/PS1 mice show increased cell proliferation in the hippocampus compared to behaviourally naïve WT and APP/PS1 mice. This result indicates that the touchscreen testing paradigm could improve cognitive performance or mask an impairment in an experimental mouse models through increased neurogenesis. This is the first study to show increased numbers of proliferating and young neurons in the hippocampus following touchscreen testing, and that touchscreen training can improve performance on traditional cognitive tasks.

Topic Line: METHODS: Other

G144 Longitudinal reliability of functional connectivity in depressed adolescents

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Reliability is essential to the interpretability of fMRI studies, which require large sample sizes and high reliability to be properly powered. The present study examined the reliability of a longitudinal sample of depressed adolescents. 42 participants (median age = 16.6, 31 females) were scanned in one of two 3T GE Discovery MR 750 scanners between three and four times over the course of one year. Scans consisted of one 8 minute block of rest (TR = 2.5 s) and 15 minutes of the Monetary Incentive Delay task to assess neural correlates of depression symptoms such as reward prediction error. Here we investigate the reliability of three connectivity measures - task background, task intrinsic, and resting state - quantified with two-way random mixed effects model intra-class correlation (ICC). Intrinsic task connectivity (mean ICC = .23, std = .13) and background connectivity (mean ICC = .23, std = .13) were marginally more reliable than resting connectivity (mean ICC = .15, std = .11; Intrinsic-resting: t-value: 17.95, p-value: 7.14; Background-resting: t-value: 17.45, p-value: 1.94). Intrinsic connectivity and background connectivity also yielded more reliable correlations between regions than resting connectivity (33 and 31 correlations with ICC above .5, respectively, vs. 14). This may be due to greater variability in cognition during rest than during the task. The resting phase was also shorter than the task phase, which may have contributed to decreased signal. The low ICC values highlight the inherent difficulty in longitudinal fMRI studies and the importance of conducting thorough reliability assessments.

Topic Line: METHODS: Neuroimaging

G145 Digital therapeutic engagement: moving beyond usage time to identify efficacious engagement.

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The Selective Stimulus Management EngineTM (SSME) is a proprietary algorithm for a videogame-based at-home digital intervention (AKL-T01) designed to improve attentional control by training interference management at an adaptive and personalized high rate of difficulty. Interference is instantiated through two concurrent tasks (multi-tasking): a perceptual discrimination targeting and a sensory-motor navigation task. A meta-analysis of the impact of AKL-T01 (used ~25 mins per day, 5 days per week for 4 weeks) on the Test of Variables of Attention (TOVA) in >600 children (6-15 years old) across 5 clinical studies (comprising Attention-Deficit/Hyperactivity Disorder, Autism Spectrum Disorder, Sensory Processing Disorder, and neurotypical participants) showed an overall 0.17 effect size (Cohen's D range 0.12-0.23 across attention measures) and thus indicating a small but significant improvement in objective attention. In a sensitivity analysis of our largest clinical trial (STARS-ADHD, n=168; Cohen's D range 0.19-0.29), number of sessions played (usage time) was not highly correlated with efficacy. Due to the substantial variance in user engagement, we developed an algorithm to classify differing engagement instead of sessions completed. We identified key features of engagement (Task-Responsive Interaction; TRI) and manually labeled 600 representative treatment sessions. We then applied a machine learning algorithm (random forest classifier) to categorize the remaining sessions. Unlike number of sessions played, subjects with higher TRI across all sessions showed a greater improvement in objective attention (Cohen's D range 0.20-0.55). This new method affords a better understanding of efficacious engagement than traditional methods.

Topic Line: METHODS: Other

G146 The independence between statistical learning and episodic memory: Evidence from individual differences

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The relationship between statistical learning (SL) and other cognitive abilities has been the focus of recent research. Empirical evidence from some neuropsychological and neuroimaging studies has shown that the neural substrates critical to the formation of episodic memory, namely, the hippocampus and the medial temporal lobe (MTL), may also support regularity extraction in SL tasks. Consequently, one might suspect that the abilities of SL and episodic memory might be closely related to the same neural mechanisms and exhibit high correlation. To investigate this hypothesis, we adopted a within-subject design to measure individual differences in SL tasks (including the classis triplet segmentation task in both visual and auditory modalities), in an implicit learning (serial reaction time, SRT) task, as well as in standardized long-term memory tests of different aspects of episodic memory, and in tests of basic cognitive abilities including IQ and working memory (WM). Analysis of Pearson correlation among the performance in these tests indicated that the association between SL tasks and any of the episodic memory test scores was not significant, nor was there an association between triplet segmentation and implicit learning. Therefore, it is unlikely that the abilities of SL and episodic memory reside in identical brain regions. To account for the evidence from the literature and the present study, it is postulated that SL and long-term memory may rely on different specific neural mechanisms that are supported by the hippocampus and the MTL, which can be discerned by high-resolution neuroimaging tools in future research.

Topic Line: LONG-TERM MEMORY: Episodic

G147 Behavioral and Electrophysiological Evidence of Contingent Attentional Capture by Color Distractors

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Feature-based attention to color (FBAC) is the process that facilitates brain representation of colors, independently of spatial attention. While there is consistent evidence of endogenous FBAC, it is unknown whether FBAC occurs within the exogenous temporal window and whether this effect is contingent on task goals. In Experiment 1, 54 participants performed a Symbol- and a Color Task, while behavioral data were registered. In both tasks, the same stimuli were employed, but in one task participants were asked to detect symbols and in the other one colors. Distractor-target color congruence was manipulated by peripheric color distractors. In Experiment 2, 41 participants performed the same tasks (the distractor appearing 200 ms before target onset), while behavioral and electrophysiological data (ERPs) were recorded. Reaction times and accuracy revealed a facilitation/ interference by congruent and incongruent distractors, respectively, only in the Color Task. For early exogenous ERP components after distractor onset, no significant modulation was found. However, after target onset, independently of the task, an advantage of distractor color appeared at 200ms, reflected in higher P2/N2 amplitudes. In line with behavioral results, only for the Color Task, parietal P3 (400ms) presented significant differences between incongruent and congruent/ neutral conditions. These results reveal 1) no evidence for early exogenous FBAC; 2) evidence for color capture at intermediate latencies, after color target onset; and 3) evidence for top-down goal contingent FBAC at later latencies. Supported by: Comunidad de Madrid/UAM, Spain (2017-T2/SOC-5569; SI1-PJI-2019-00011); MICINN, Spain (PGC2018-093570-B-I00); CSIC, Uruguay (I+D-CSIC 2019-20 ID-369).

Topic Line: ATTENTION: Nonspatial

G148 Characterizing the interaction of temporal and semantic information in categorized memory search

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Human memory search exhibits strong influences from temporal and semantic information. These effects have been characterized individually, however fewer studies have examined how they interact to bind, or segment, individual events into meaningful episodes. To examine this, participants studied lists composed of short trains of 3 same-category items (27 items total, 9 from each category). We manipulated the nature of the inter-item distraction such that in half of the lists we used a light distraction task (button press) and in the other half we used heavy distraction (mental arithmetic).

In contrast to previous studies, we found that manipulating distraction attenuated temporal and semantic organization during recall. In light distraction, the train structure at study was preserved in recall, indicating that participants take advantage of the temporal proximity of same-category items. This category clustering was not seen in heavy distraction, suggesting a disruption of the cognitive processes utilizing the category structure of the trains. Aspects of these results may be challenging for retrieved-context models which describe memory search as guided by a representation of temporal context. We consider the possibility that these models could be modified to capture a control process that is disrupted by distraction and takes advantage of list structure. We present results from an analysis of fMRI data examining the neural representation of category across train position in multiple brain regions. We will discuss these findings and their implications with regards to existing retrieved-context models.

Topic Line: LONG-TERM MEMORY: Semantic

G149 Characteristic Traits of Mild cognitive impairment in Parkinson's disease

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Mild cognitive impairment (MCI) is a well-known risk factor for dementia in Parkinson Disease (PD). This study examines which functional brain networks are affected by PD-MCI using a Connectome ICA (connICA) approach with functional MRI. Eighty seven participants (28 healthy controls (HC), 26 PD cognitively normal (PDCN) and 33 PD-MCI) were scanned under anti-parkinsonian medication in 3T MR scanner, acquiring T1-weighted, T2-weighted images, and two runs of 10-min eyes-open resting state fMRI with multiband (MB=3) and conventional acquisition per subject. A battery of neuropsychological tests was conducted in each individual to diagnose PD-MCI according to MDS task force guidelines (level II). After strict fMRI preprocessing, denoising and motion censoring, 21 HC, 21 PDCN and, 23 PD-MCI subjects remained for further analyses. Functional connectivity (FC) was computed between brain regions defined using Schaefer cortical parcellation and subcortical areas from Destrieux atlas. Subject-specific whole-brain FC matrices were input to connICA to extract 65 independent FC-traits and corresponding weights per subject. A linear mixed effect model on the weights of each FC-trait revealed significant group differences in 4 FC traits after Bonferroni correction. Post-hoc tests concluded that the HC group showed differences with PD-MCI and PD in a FC-trait with hubs in putamen, caudate and thalamus. Two FC-traits were distinctive of the PD-MCI group involving regions of the sensorimotor and attention networks, and medial motor cortices respectively. A FC-trait comprising visual, parietal and frontal areas identified the PDCN. In conclusion, functional connections between attentional and sensorimotor regions are key for PD-MCI development.

Topic Line: ATTENTION: Development & aging

G150 Age-related declines in nap oscillatory activity are mediated and moderated by grey matter volume

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Sleep is comprised of different stages, which are characterized by unique combinations of neural signals that vary in frequency and distribution across the brain. This regional distribution of neural activity results in stereotyped topography at the scalp. Moreover, maturational and aging-related changes in cortical volume lead to changes in the topography of sleep neural activity across the lifespan. In the current study we assess how aging-related differences in cortical volume mediate and moderate aging-related changes in the topography of delta (0.5-4 Hz), theta (4-8 Hz), and sigma (12-16 Hz) activity during a midday nap, after performing a motor sequencing task. Absolute and relative delta, theta, and sigma amplitude declined with age, especially over frontocentral scalp. Grey matter volume declined with age across nearly all brain regions. Age-related declines in delta were mediated by grey matter loss in frontal medial and right premotor cortices and the striatum, and were reduced in older adults with increased cerebellar grey matter. Age-related declines in theta were mediated by grey matter loss in frontal medial cortex. Age-related declines in sigma were moderated by grey matter in the putamen and pallidum, with larger declines for individuals with increased grey matter. These results replicate previous findings from overnight sleep in a midday nap, indicating they were not driven by sleep pressure or circadian confounds, and novelly extend to the theta band, suggesting that theta generators are not exclusively allocortical. Together, these findings clarify the neural loci of aging-related changes in sleep physiology critical to learning and memory.

Topic Line: LONG-TERM MEMORY: Development & aging

G151 What do 'two times four', '2x4', and 'cat' have in common? An ERP study of arithmetic and language in children

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Multiplication problems can be represented in several ways, like Arabic digits or spoken number words. Models of arithmetic have proposed that children rely on verbal rehearsal to encode these facts into memory, suggesting that the format of the encoded problems could influence solution retrieval. The current study measured brain and behavioral responses from 55 children (8-12 years) on two multiplication verification tasks and a word-picture verification task administered in separate sessions. Event related potentials and performance (accuracy/response time) were compared across tasks in a within subject design. Participants judged the correctness of single-digit multiplication problems with operands presented either as Arabic digits (Session 1) or spoken number words (Session 2). Proposed solutions were either correct or incorrect Arabic digits. A robust N400 correctness effect was observed from solution onset in both math tasks, with larger amplitude for incorrect than correct solutions. Operand format did not significantly modulate the N400 or performance. The N400 was similar in timing but smaller in amplitude than the N400 congruency effect observed when children verified word-picture semantic (mis)matches. A later frontal positivity was observed for multiplication trials with auditory operands and for word-picture trials, but not for digit only trials. The results indicate that 1) verifying math facts and word-picture (mis)matches engages similar semantic level processes, 2) retrieving multiplication facts from memory occurred similarly regardless of operand format, and 3) spoken number words engage language-like

processes similar to the language task. These findings challenge models of math cognition based primarily on adult data.

Topic Line: LONG-TERM MEMORY: Semantic

G152 The two stages of facial expression recognition? An ERP study

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Facial expressions are the dominant way of human emotion and social communications. However, it is still unknown that how can perceivers extract emotion from the face. In the present study, we adopted a repetition-priming paradigm in combine with event-related potentials (ERP) to examine neurocognitive processing stages of facial expression perception. Results showed that emotional words were recognized faster than emotional faces, both of which were primed by emotional faces, which means there exists concepts processing for happy, neutral and angry emotions. ERP results showed larger responses of N170 to differences between happy and neutral words than those between angry and neutral words, which were not different for emotional faces. These results suggest that geometrical configuration of faces rather than emotional concepts of faces is processed at the stage of N170. However, both emotional words and faces showed larger P2 when processing angry emotion, which suggests that participants extract emotional concepts at the stage of P2. The information flow analysis showed significant decreases of information flow from the fusiform gyrus to dorsal anterior cingulate cortex/dorsal medial prefrontal cortex and increases of information flow from the fusiform gyrus to posterior insula, which revealed mechanisms underlying processes from physical structure to emotional concepts. These findings suggest that facial expression recognition consists of two stages from structure of faces to emotional concepts of facial expressions, which contributes a clearer understanding of the processing mechanism of facial expression.

Topic Line: EMOTION & SOCIAL: Emotion-cognition interactions

G153 Brain Region Importance for the Auditory N-back Task via Machine Learning

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The domain-general account of language development suggests that attention and memory influence language development. fNIRS data were recorded for children (n = 84, Ages 9-14) while they performed an auditory N-back task. Children were assigned to four groups: Bilingual Chinese (BCH), Bilingual Spanish (BSP), Monolingual Typically Developing (TD), and Developmental Language Delay (DLD). We asked 1) Could a random forest, trained on an individual, identify what brain regions related to language and memory are the most important for children performing auditory 0-back, 1-back, and 2-back tasks. 2) Which brain regions mattered most for predicting task performance for the different groups. Six regions of interest (ROI) were selected: left and right Dorsolateral Prefrontal Cortex (DLPFC), Inferior Parietal Lobule (IPL), Inferior Frontal Cortex (IFC), Superior Temporal Gyrus (STG), and Subcentral Area (SA). Features were selected by taking the average channel measurements of the oxy and deoxy signals for the ROI. Results revealed within-group differences. Generally, STG, SA, and IPL showed higher areas of importance for 0-back and 1-back. 2-back showed a more uniform distribution among regions. Across groups, STG and SA were more active in children in the DLD group. STG, SA, and IPL appear to play an important role in n-back and may contribute to capacity limitations that impact language development.

Topic Line: EXECUTIVE PROCESSES: Working memory

G154 Partitioning Feedforward from Feedback Components of Bayesian Sensorimotor Learning.

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Movement planning and execution are accomplished through optimal integration of sensory information and internal predictive signals. This integration may occur in a Bayes-optimal manner during visuomotor feedback control. However, it remains unclear whether feedforward updating in visuomotor adaptation follows similar Bayesian principles. We replicate Kording and Wolpert's (2004) findings that humans can integrate sensory information in Bayes-optimal fashion during feedback control, and extend these findings by asking whether feedforward adaptation also follows Bayesian principles, and what the time course for Bayesian integration is in both feedforward and feedback control. While the integration of variability in the sensory likelihood is a feedback process, we found that the initial movement error reflects feedforward rather than feedback influences, providing an accurate estimate of the evolving visuomotor prior. Together, these findings indicate that Bayesian integration in sensorimotor learning involves both feedforward and feedback components.

Topic Line: PERCEPTION & ACTION: Motor control

G155 Understanding the Role of Social Cognitive Mechanisms of Behavior in Individuals At-Risk for Psychosis

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Individuals with a longer duration of untreated psychiatric illness (DUI), particularly those with schizophrenia and those at-risk (AR) for the disorder, have demonstrated more severe symptomatology and dysfunctional outcomes, such as isolation and disability. As such, early intervention is critical to mitigate the risk of conversion to psychosis and/or enhance outcomes. It therefore remains essential to examine the factors that may curtail DUI. In AR, deficits in social cognition have been associated with a negative illness course, which may be mediated by prosocial help-seeking attitudes and actions. The current study examined social cognitive predictors of help-seeking in AR (N=57) relative to healthy controls (HC, N=25). Participants were assessed on psychosis-spectrum symptoms, psychosocial function, social cognitive performance (Reading the Mind in Eyes Task [RMET]; Hinting Task [HT]), and help-seeking attitudes and actions. Results revealed the expected deficits in AR relative to HC in social cognition and psychosocial function (all $p<0.05$). In AR, better performance on social cognition tasks was related to higher prosocial help-seeking attitudes (HT $r=.45$, $p<0.01$; RMET $r=.44$, $p<.001$). Yet, higher social cognition performance predicted fewer experiences in actual help-seeking actions (HT $r=-.27$, $p<.05$; RMET $r=-.22$, $p=.09$). These findings suggest that social cognitive aptitude may have a diametric relationship with reported attitudes on help-seeking versus active help-seeking. Taken together, further clarification on the role of social cognitive skill as a factor in

the reduction of DUI is warranted, and could most benefit those at highest risk for psychosis.

Topic Line: EMOTION & SOCIAL: Other

G156 Estimating the relationship between sleep EEG spectral peaks and general intelligence from the whitened Fourier spectrum

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Several studies reported positive correlation between sleep EEG spindle amplitude/density/intensity and IQ. Furthermore, some authors proposed a sexual dimorphism of this effect, meaning that women but not men are characterized by the positive correlation of sleep spindle activity with IQ. However, the methods of defining sleep spindles can vary significantly between different studies which can lead to biases in published results. We suggest that the Fourier spectrum can be reliably described by an approximation of the parameters of the following function: P(f)=C(f^?)PPeak(f), where P is power as a function of frequency, C is the constant expressing the overall, frequency-independent EEG amplitude, ? is the spectral exponent indicating the decay rate of power as a function of frequency and PPeak(f) is the peak power at frequency f. The latter is a whitened peak-power function, independent from overall amplitude and spectral slope. Based on the above considerations, we hypothesized that PPeak(f) values of the broad sleep spindle range (9-18 Hz) correlate positively with IQ in women. We tested this hypothesis on a database of sleep EEG records and IQ tests of 149 healthy adult individuals. Pearson correlations revealed significant associations of PPeak(f) and IQ in women but not in men. No other parameters of the power law function correlated with IQ. This is in line with earlier findings suggesting that we can avoid the largely inconsistent time-domain sleep spindle features, rather we can analyze the peak attributes of the NREM sleep EEG in humans.

Topic Line: METHODS: Electrophysiology

G157 Cross-hemispheric Connectivity Benefits Cognition in Normal Aging & MCI

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The left and right cerebral hemispheres collaborate to complete complex cognitive tasks, which healthy older adults often take advantage of to offset the deleterious effects of aging on cognition. Bilateral patterns of fMRI and EEG activity are associated with increases in memory and attention, suggesting a compensatory mechanism. Nonetheless, little is known about the specific role these kinds of connections play in cognition and their increasingly important role as we age. Here, we use neuroimaging and neurophysiology to assess whether bilateral transcranial magnetic stimulation (TMS) delivered online to prefrontal cortex (PFC) maintain a strong role in measures of fluid intelligence. We related bilateral brain connectivity during a resting state and episodic memory task, as measured by both structural (based on diffusion weighted imaging) with functional connectivity (phase coherence between homotopic, bilateral regions as measured by EEG). We also collected an extensive neuropsych battery on all 22 older adults subjects. We found a strong, selective relationship between structural connections in bilateral prefrontal regions and scores of working memory, a relationship which remained after accounting for individuals' age. We also assessed both the neurophysiological correlates of unilateral and bilateral TMS during the resting state task, and found that bilateral alpha stimulation increased bilateral PFC alpha power. Critically, during the memory task bilateral alpha TMS was related to worse performance in the memory task. Our experiment helps to confirm the hypothesis that bilateral connectivity patterns help mediate cognition in older adults, and suggests specific neurophysiological correlates of this effect.

Topic Line: LONG-TERM MEMORY: Episodic

G158 How between-study variance in thought probes complicates the measurement of mind wandering and on-task thought

Austin Hurst, University of Waterloo, Allison Drody, University of Waterloo, James Danckert, University of Waterloo, Daniel Smilek, University of Waterloo

Current methods of measuring mind wandering typically involve administering thought probes on multiple occasions throughout an experimental task. Participants are asked to describe their attentional state just prior to the appearance of the probe. Occurrences of mind wandering are then linked to behavioural or neurophysiological responses. One issue that is often overlooked regarding this approach to studying mind wandering, is that the phrasing and format of probes varies considerably between studies. This variation in probe design raises the possibility that we are not measuring the same thing across studies. Even if we are measuring the same thing, distinct methodologies of this kind may lead to different estimates of the magnitude of mind wandering across studies. Here, we selected probes from three of the most frequently cited papers on mind wandering to investigate whether reports of mind wandering and on-task thought are comparable, regardless of differences in probe design. Participants completed a sustained attention task containing mind wandering probes in one of three conditions which differed only in terms of the probes administered. Reports of mind wandering and on-task thought differed substantially as a function of probe type, suggesting that rates of mind wandering and on-task thought are not comparable across studies. Moreover, these data should urge researchers to be mindful when creating thought probes or replicating past research on mind wandering.

Topic Line: METHODS: Other

G159 Neurocomputational mechanisms of learning on social networks

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Many social species are embedded in social networks, including our own. The structure of network plays an important modulatory role in decision-making, ranging from foraging to finding a partner. However, it remains largely unknown how network structures are represented in the brain and integrated with other social information to guide decision-making. Here, we combine model-based fMRI with a lab experiment involving various 7-node, static social networks, and investigate the neurocognitive mechanisms by which individuals learn from observing actions of others embedded on the same network. Results of computational modeling reveal that, rather than optimally integrating information obtained from network neighbors, individuals deploy a heuristic learning rule similar to the error-driven reinforcement learning (RL), while additionally accounting for the differences in observees' social connections. In particular, information related to a neighbor's degree, a fundamental measure of a node's connectedness, modulates the speed of learning from this neighbor. The degree-related signal is encoded in the observer's brain regions classically associated with cognitive control, including the dorsal anterior cingulate cortex and anterior insula. Importantly, these high-level brain regions track the degree signal according to our model

predictions, such that the neural encoding is only observed when an observee's connectedness reflects the reliability of information contained in her action. These results suggest that observational learning within complex, interconnected social contexts can be realized by the well-established RL mechanisms. Such learning is biased toward decisions of well-connected individuals, likely through top-down control signals associated with key properties of interpersonal structures.

Topic Line: THINKING: Decision making

G160 Alpha, but not Gamma, Visual Oscillations are Impacted by Movement

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Visual processing is widely understood to be served by a decrease in alpha activity in occipital cortices, largely concurrent with an increase in gamma activity. While the characteristics of these oscillations are well documented in response to a range of complex visual stimuli, little is known about how these dynamics are impacted by concurrent motor responses, which is problematic as many common visual tasks involve such responses. Thus, in the current study, we used magnetoencephalography (MEG) and a novel visuo-motor task to identify the impact of motor responses on visual oscillatory activity. Thirty-four healthy adults viewed a moving grating stimulus that was known to elicit robust alpha and gamma oscillations in occipital cortices. The resulting data was preprocessed, transformed into the time-frequency domain, and alpha and gamma visual responses were imaged using a beamformer. The resulting maps were then averaged across participants and conditions for each response individually, and virtual sensors were extracted from the peak voxel for each response and hemisphere. Frequency and power characteristics were assessed statistically for differences as a function of the movement condition. Our results indicated that occipital alpha significantly decreased in peak frequency and increased in power during movement relative to no movement trials. No differences in peak frequency or power were found for gamma responses between the two movement conditions. These results underscore the importance of careful task design and interpretation, especially in the context of complex visual processing, and suggest that even basic motor responses alter occipital visual oscillations in healthy adults.

Topic Line: PERCEPTION & ACTION: Vision

G161 Distinct electrophysiological signatures of task-unrelated and dynamic thoughts

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Humans spend much of their awake time engaged in their internal train of thought. Traditionally, research has focused on whether these thoughts are task-unrelated, and has revealed reliable behavioural and neural correlates of task-unrelated thoughts. A recent theoretical framework focused on the dynamics of thoughts: whether one's thoughts move freely between topics, are deliberately constrained by one's goals, or automatically constrained by emotionally salient stimuli. Notably, the neural correlates of these dynamic thought dimensions are unknown. We aimed to determine their electrophysiological signatures by recording EEG while participants performed an attention task. They were periodically interrupted to answer a novel set of multidimensional thought sampling questions about whether their thoughts were 1) task-related, 2) freely moving, 3) deliberately constrained, or 4) automatically constrained. In particular, we examined the P3 event-related potentials (ERP; indexing stimulus-evoked activity), as well as alpha power and variability (indexing stimulus independent activity), as a function of each dimension of thought. Parietal P3 was larger for task-related thoughts relative to task-unrelated thoughts, whereas frontal P3 was increased for deliberately constrained thoughts relative to unconstrained thoughts. A cluster of frontal electrodes showed enhanced alpha power for freely moving thoughts compared to non-freely moving thoughts. Finally, alpha power variability was increased for task-unrelated thoughts, freely moving thoughts, and unconstrained thoughts. These findings indicate distinct neural patterns associated with each dimension of thought, providing evidence that these dimensions are dissociable using objectives measures.

Topic Line: THINKING: Other

G162 Exogenous attention improves perception through facilitation, not suppression

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It is unknown whether exogenous attention facilitates processing of attended information, suppresses processing of unattended information, or some combination of the two. In order to test this, we recorded EEG while participants (N = 19) performed an attentional cueing task that included lateral 'shift' cues as well as central 'no-shift' cues that allowed us to separate facilitatory from suppressive effects. Participants reported the orientation of a tilted visual target, which was preceded by an auditory cue that was randomly presented from either the left side, right side, or center of a monitor. We focused on neural activity elicited by these different cue types: in particular, the Auditory-evoked Contralateral Occipital Positivity (i.e., ACOP), an ERP component associated with the exogenous orienting of cross-modal attention. Participants demonstrated higher target discrimination accuracy following valid 'shift' cues than following invalid 'shift' cues as well as central 'no-shift' cues (ps < 0.003). Mirroring this behavioral pattern, peripheral cues elicited a greater positivity over visual cortex contralateral vs. ipsilateral to the cued side on target-absent trials (i.e., ACOP; $p < 0.001$), consistent with previous research. Critically, the contralateral waveform differed reliably from the waveform elicited by the central 'no-shift' cues ($p < 0.001$), but there was no difference between the central and the ipsilateral waveforms ($p = 0.45$). This indicates that the ACOP is representative of increased neural activity over visual cortex contralateral to a cued location, suggesting that exogenous attention operates solely via facilitation of information at an attended location.

Topic Line: ATTENTION: Spatial

G163 Alpha Oscillations are Related to Children's Developing Word-Reading Ability

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For skilled reading to occur, the neurocognitive processes associated with retrieving a word's meaning from its written form and integrating it into context must be highly automatic, so cognitive resources are left available for comprehension. Understanding how these processes develop would enhance our understanding of why many children struggle to become skilled readers. In this study, EEG was recorded while children (n=16; ages 7-14) read word pairs in two conditions: related (e.g., open/close) or unrelated in meaning (e.g., net/close) in a semantic priming paradigm. EEG was analyzed in the time-domain (Event-related potentials, ERPs), and time-frequency domain (oscillatory power). Any effects found were correlated with psychometric tests

of reading/language ability (controlling for non-verbal ability). The goal of this study was to examine whether ERPs and oscillatory power can provide unique insights into the neurocognitive basis of reading development. ERPs revealed significant N400 and P600 effects (ps<.002), that related to children's expressive expressive vocabulary (r=-.562, p=.029; r=-.646, p=.009); the P600 additionally related to receptive vocabulary (r=-.597, p=.019). Oscillatory power revealed greater alpha-band activity at central electrodes (8-13 Hz; 0.216-1.408 s; p=.035) for unrelated (vs. related) words, which correlated with children's word-reading skill (r=.557, p=.031). Marginally significant theta-band effects (4-7Hz, 0.098-1.269s, p=.068; 0.154-1.463s, p=.063) showed no correlations with reading/language ability. Alpha-activity may play an important role in the development of children's word-reading ability, while ERPs and oscillatory power may provide unique insights into the neurocognitive basis of reading development.

Topic Line: LANGUAGE: Semantic

G164 Functional and effective connectivity of default mode network is disrupted in chemotherapy-treated patients with breast

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Cognitive impairment is common after chemotherapy treatment. We examined default mode network (DMN) connectivity in 43 patients with breast cancer age 34-65 from pre- (T1) to 1-year post-chemotherapy (T2), and at yoked intervals for 50 frequency-matched healthy controls. We acquired resting functional magnetic resonance imaging (fMRI) and cognitive testing at both timepoints. Modularity analysis resulted in 11 DMN nodes consistently identified across groups and timepoints. Functional connectivity was defined as edge centralities of these nodes. Effective connectivity was defined by directed acyclic graphs (DAGs) with false discovery rate (FDR) correction determined by Bayesian network analysis. We compared edge centrality slopes between groups using nonparametric permutation testing (5000 permutations, FDR). False positive/negative DAG edges for patients compared to controls were tested for significance using permutation testing. Cognitive function was compared using t-tests and linear mixed modeling. Patients showed significantly decreased centrality in 55% of edges over time compared to controls (p0.10). Cognitive function was significantly lower in patients compared to controls at both T1 and T2 (p0.25). In patients, edge centralities were negatively correlated with cognitive function (p<0.03) and positively correlated with number of chemotherapy cycles (p<0.04). Disruption of DMN functional and effective connectivity after chemotherapy may help explain persistent cognitive deficits in patients with breast cancer.

Topic Line: METHODS: Neuroimaging

G165 Eye tracking of attention allocation during prospective remembering

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Prospective memory (PM) is the ability to remember to perform goal-relevant actions at an appropriate time in the future. Previous research has identified a critical role for strategic, effortful monitoring of the environment for PM-related cues in the successful execution of delayed intentions. The canonical method for inferring the use of strategic monitoring in PM tasks is to compare response times on an ongoing task performed with versus without a concurrent PM task. However, the use of this indirect measure has led to a debate as to how strategic monitoring underlies costs and subsequent PM performance. Here, we used eye tracking to directly compare search strategies to PM-costs on a moment-to-moment basis, and to relate strategies to PM ability. Participants performed an ongoing visual search task with tilted arrows that varied in difficulty level while concurrently performing a PM task that involved identifying the occurrences of face or scene targets presented elsewhere on the screen. We found that PM-costs and PM performance were more strongly related to overt monitoring on easy than hard difficulty trials. We also found that trials with high PM-costs were characterized by early and prolonged monitoring for PM targets, while trials with low PM-costs were characterized by relative inattention to PM targets. However, performance on the PM task was equivalent across search strategies. These results describe PM costs in terms of direct measures of search strategies, and demonstrate how individuals adjust attention allocation in response to environmental demands to solve PM tasks.

Topic Line: EXECUTIVE PROCESSES: Working memory

G166 Neurophysiological evidence for sensitivity to English semantic but not syntactic anomalies in native Chinese speakers

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Previous research has demonstrated that semantic and syntactic anomalies in sentences elicit specific neurophysiological components in native speakers across different languages. However, whether similar neural correlates of semantic and syntactic processing would be identified in learners of a foreign language and whether the sensitivity underlying such correlates is associated with other cognitive abilities are still open questions. To address these issues, college students who are native speakers of Mandarin read Chinese sentences, half of which were with semantic or syntactic anomalies, while their brain activities (i.e., event-related potentials, ERPs) were simultaneously recorded by electroencephalography. It was found that semantic anomalies evoked a stronger N400 component than the same word in a normal sentence context. Moreover, in participants whose abilities of statistical learning (SL) are measured, the magnitude of the N400 effect tended to correlate with SL in both the auditory and visual modalities. On the other hand, no ERP responses were found to be associated with syntactic anomalies, nor was there a correlation between SL and ERPs to syntactic anomalies. The neurophysiological responses were consistent with participants' behavioral accuracy of acceptability judgment following each sentence, which showed better (though not significantly) performance in the semantic than the syntactic condition. These results indicated that learners of a foreign language with sub-optimal proficiency are sensitive to the regularity in semantics in a way similar to native speakers. In contrast, the sensitivity to the regularity in syntax might be weak or non-existent at this stage, and requires further learning/experience to develop.

Topic Line: LANGUAGE: Semantic

G167 Easily learned, easily remembered: Encoding-fluency predicts hippocampal activation

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When memories are acquired more easily, i.e., with higher encoding fluency, learning is judged as more effective and frequently results in better subsequent memory. Although this 'easily learned, easily remembered' heuristic may have profound influence on our learning behavior, there is little research on how encoding-fluency is related to neural activation of the hippocampus, and related structures, that play key roles in memory processing. To address this issue, in this fMRI study we asked participants to

associate face and house pictures and indicate encoding fluency for each trial (while the stimuli were still displayed on the screen), by answering whether it was easy or difficult for them to build the associative memory. We then compared participants' associative memory and their brain activation for trials with higher vs. lower subjective encoding fluency (i.e., easy vs. difficult trials). Behaviorally, we found that trials with higher encoding-fluency, i.e., judged as easy, were later remembered better, compared to those with lower encoding-fluency, confirming the validity of 'easily learned, easily remembered' heuristic. Importantly, we found that at the brain level, regions supporting face-house associative processing, such as the hippocampus, fusiform-face-area, and parahippocampal-place-area, showed stronger activation during encoding of easy, compared to difficult, trials. This encoding-fluency effect remained strong even after controlling for subsequent actual memory. These results suggest that greater neural activation of structures implicated in the learning task supports the perceived ease with which stimuli are encoded.

Topic Line: LONG-TERM MEMORY: Episodic

G168 Attractive faces in one's own race are more eye-catching: Evidence from the continuous flashing suppression paradigm

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Previous research shows that upright faces are detected earlier than inverted faces. This face inversion effect (FIE) is stronger in own-race than other-race faces, suggesting that the attribute of race is perceived unconsciously. To investigate whether the perception of facial beauty is also processed unconsciously and whether this attribute interacts with race, photographs of upright and inverted Chinese and Australian male and female attractive and unattractive faces were employed in the continuous flashing suppression paradigm. Specifically, Taiwan college students were asked to judge the spatial position of a face which was presented to their non-dominant eye, while continuous flashing masks were presented to their dominant eye simultaneously. Although response accuracy only revealed the FIE, participants' reaction time demonstrated a robust FIE, and processing advantages of own-race (i.e., Chinese) and female faces. To control for low-level differences originated from the physical properties of photograph stimuli, we further analyzed the effects of attractiveness, as well as race and gender, of faces on the FIE. Although none of the facial attributes exerted a main effect on the FIE, there was a significant interaction between race and attractiveness. Critical to our research question, the FIE was stronger for attractive than unattractive faces in own-race (Chinese) faces, but the reserved pattern was observed in other-race (Australian) faces. These findings replicated previous results in showing that race and attractiveness of faces were processed unconsciously. Furthermore, perception of facial attractiveness is modulated by race, which is likely due to life-long experience, hence sensitivity, to own-race faces.

Topic Line: PERCEPTION & ACTION: Vision

G169 Speech Error Monitoring Relies on the Integrity of Anatomical Connections to Bilateral Frontal Brain Regions

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Speech error detection is essential for effective communication and is often impaired by strokes that cause language deficits (i.e. aphasia). Activity in medial-frontal brain regions is associated with speech error detection, but it is unclear whether these regions are critical since they are usually intact in aphasia. We investigated whether integrity of anatomical connections to medial-frontal brain regions correlates with speech error detection performance in adults with aphasia from chronic left-hemisphere stroke in a whole-connectome analysis. Constrained spherical deconvolution and anatomically-constrained probabilistic tractography of diffusion weighted images was used to derive anatomical connectomes in 36 left-hemisphere stroke survivors with aphasia. Support-vector regression connectome-symptom mapping identified connections in which the loss of apparent fiber density was associated with poor error-detection rates in a picture-naming test, after correcting for lesion volume (continuous family wise error rate=.05 at v=10, 10,000 permutations). Analyses examined detection rate of all errors (n=36), phonological errors (n=29), and semantic errors (n=17). Omnibus tests revealed that maps for detection of all errors and phonological errors were significantly non-random, with 15 connections surviving thresholding in each analysis, whereas the map for semantic errors was nonsignificant. Seven significant connections for detection of all errors involved medial-frontal regions in the left and right hemispheres, with six connected to left lateral-frontal regions. All connections for phonological error detection involved left lateral-frontal or right lateral/medial-frontal regions. The importance of connectivity to bilateral frontal brain regions for speech-error detection in aphasia supports a critical role of executive networks in speech error monitoring.

Topic Line: LANGUAGE: Other

G170 The role of the DG in the perceptual discrimination of complex, novel objects

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The dentate gyrus (DG) subregion of the hippocampus (HPC) is purported to be a pattern separator, orthogonally representing similar information such that distinct memories are formed. Separate research points to the HPC as playing a domain-specific role in spatial scene/configural processing, while other medial temporal lobe structures are specialized for item-specific representations of faces and objects. However, previous work in our lab has demonstrated that a unique brain-damaged individual, B.L., who experienced an anoxic event leading to 50% cell loss in his DG, had poor discrimination of similar, everyday objects in memory (Mnemonic Similarities Task). Here, we present preliminary data extending these findings. Specifically, B.L. was presented with matched possible and impossible objects, which are novel, non-contextual stimuli that do not require training in order to differentiate. B.L. performed significantly worse than controls when asked to select an odd object (e.g., possible) amongst three identical counterpart objects (e.g., impossible) presented in varying rotations (Oddity Task). In contrast, B.L.'s performance was indistinguishable from controls on a series of other judgement and comparison tasks involving these objects, indicating intact general perception and attention. Similarly, neuropsychological tests revealed intact general perception (Benton Judgement of Line Orientation) and spatial attention span (Finger Windows), but impaired visual perceptual discrimination of abstract objects (Benton Visual Retention Test ? Recognition; Beery Visual Perception). Collectively, these results further suggest that the DG is necessary for fine-grained discrimination of objects, and that it plays a role in perception, not just memory.

Topic Line: LONG-TERM MEMORY: Other

G171 Sustained Attention and Inhibitory Control in Patients Exposed to Mindfulness-Based Stress Reduction

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Mindfulness-Based Interventions (MBIs) are a family of standardized cognitive and behavioral therapies that focus on cultivating mindfulness-related skills for improving maladaptive cognitive, emotional, and behavioral processes. MBIs have been developed for a wide range of clinical issues and populations in a variety of health settings. Empirically supported MBIs include acceptance and commitment therapy (ACT), dialectical behavior therapy (DBT), and mindfulness-based stress reduction (MBSR). As the empirical evidence for the efficacy of these interventions continues to grow, the importance of investigating the mechanisms or processes by which they lead to beneficial outcomes is increasingly recognized. The purpose of the present study was to investigate the behavioral and cognitive mechanisms by which MBIs may improve health outcomes. Specifically, we sought to examine engagement between MBSR, perceived levels of stress, and performance on an emotional variant of a Go-NoGo task. Pilot data (n = 9) was collected from a multi-site collaboration in individuals with moderate to high levels of stress. Perceived levels of stress, measured by the Perceived Stress Scale (PSS), and performance on an emotional Go-NoGo task were assessed before and after MBSR. Performance was measured using errors of omission and commission, Aâ?¬2, and response time variability. Post-MBSR testing showed a significant decrease in stress levels and performance changes in the Go-NoGo task. Preliminary data indicate a decrease in errors of omission and commission, an increase in Aâ?¬2, and a decrease in response time variability. These preliminary results suggest MBSR targets self-regulatory mechanisms, leading to changes in perceived stress.

Topic Line: EXECUTIVE PROCESSES: Monitoring & inhibitory control

G172 vmPFC lesions impact the multi-attribute integration of decisions in opposite ways for delay and probability discounting

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If the tendency to discount rewards reflect an individuals' general level of 'impulsiveness', then the discounting of delayed and probabilistic rewards should be negatively correlated: The less willing one is to wait for delayed rewards, the more willing one should be to gamble on chance outcomes. Empirical findings, however, report delay and probability discounting as being uncorrelated or even positively correlated, albeit weakly. It has been suggested that ventromedial prefrontal cortex (vmPFC) damage makes patients impulsive, but intertemporal choice and risky choice have rarely been studied in the same patient group. Here, we assess delay and probability discounting by comparing individuals with vmPFC damage (n=8) to those with medial temporal lobe (MTL) damage (n=10), as well as age- and education-matched controls (n=30). On average, vmPFC patients discounted delayed rewards more steeply but discounted probabilistic rewards more shallowly than controls. Moreover, whereas MTL patients and controls showed the usual nonsignificant, weakly positive correlations between delay and probability discounting, vmPFC patients showed the significant negative correlation expected if vmPFC damage increases impulsiveness. That is, the more a patient chose smaller, immediate rewards over larger delayed ones, the more likely they were to forego smaller, certain rewards and gamble on obtaining larger, probabilistic ones. These results suggest vmPFC lesions impact multi-attribute integration in opposite ways, decreasing the decision weight of reward amount relative to immediacy while increasing the weight of amount relative to reward certainty. These findings challenge the hypothesis that a single valuation mechanism underlies both intertemporal and risky choice.

Topic Line: THINKING: Decision making

G173 Rapid category selectivity for animals versus man-made objects: An N2pc study

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Prior behavioral research has demonstrated that faster visual search for animals compared with man-made objects can be observed with images of comparable gist statistic among the categories, suggesting that search advantage for animals is unlikely driven by low/mid-level visual features. We examined whether previously observed behavioral advantages can be observed early in visual search process via the N2pc event-related potential, the fastest marker for target selection. Participants searched for images of animals and man-made objects (among fruit/vegetable distractors) of comparable gist statistics at different categorization levels: an exact image (e.g., a specific dolphin, Image condition), any images of an item (e.g., any dolphins, Item condition), or any items in the category (e.g., any animals, Category condition). In addition to target present trials, we investigated the involuntary activation of category representations in foil trials, which displayed a non-target of the same image/item type for the Image condition (e.g., a different dolphin) and Item condition (e.g., non-dolphin animals). Results revealed at 200-250ms after stimulus onset a significant main effect of category (larger amplitudes when searching for animals than objects, p=.047). This suggests that search for animals is more efficient than for objects. At 250-300ms for foil trials, we observed a larger amplitude for animals than objects when participants searched for a specific image (p=.014), suggesting strong task-irrelevant, involuntarily activations of animal representations. Together, these results suggest that category selectivity for animals emerges early, even after controlling for low/mid-level visual features.

Topic Line: PERCEPTION & ACTION: Vision

G174 Dynamic feedback valuation impacts learning in a probabilistic two-armed bandit task

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How much do learners value feedback? Conventional wisdom suggests that both context and personality influence its perceived value, which should also optimally change over the course of learning. To examine these questions we developed a novel probabilistic two-armed bandit task where participants worked to reveal a trial's outcome, allowing us to derive a dynamic estimate of feedback valuation (measured by choice to work for feedback and subsequent work rate).

One hundred two participants were presented with 160 choices between two bandits, each with a distinct probability of yielding a positive outcome

(pwin=0.8 or 0.6). After selecting a bandit, participants received veridical feedback about the outcome on 60% of trials and non-informative, neutral feedback on 40% of trials. On half of the noninformative trials (20% overall), participants could choose to work for feedback, pressing the spacebar as many times as possible in three seconds to reveal it. To examine changes in performance over time, we computed 20-trial moving performance averages for each bandit. We then computed the distance between the two curves, dOptimal, reflecting the relative selection of the better compared to the worse bandit. We found that a significant time-dependent correlation between dOptimal and work rate (spacebar presses per second) predicted overall task performance ($F=3.97$, $p<0.05$).

Using this novel approach, we identify feedback valuation as a critical, yet rarely addressed component in motivated learning. We demonstrate that the valuation of feedback changes to reflect its information content, and that information valuation is predictive of overall performance.

Topic Line: PERCEPTION & ACTION: Vision

G175 The Lateralized Hippocampus: functional differences across multiple scales of neural activity during recognition memory

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It has long been appreciated that the Right and Left Hippocampi (RH and LH) have distinct roles in cognition. Though hotly debated, the specific contributions of the two sides at the neuronal level remain unclear. Here we utilize intracranial recording of local field potentials (LFP) and single-neuron activity in human subjects (n=41), undergoing monitoring for localization of intractable epilepsy, to examine electrophysiological correlates of hemispheric Hippocampal differences, and how they manifest in a recognition memory task using pictures as stimuli.

We found that RH cells were more likely to have narrow waveform action potentials indicative of putative interneurons, and were more visually responsive than LH cells. In addition, RH cells were more likely to phase-lock to ongoing theta oscillations. The proportion of cells that phase-locked to theta in RH but not LH was inversely correlated with individual memory ability. RH had significantly higher baseline delta power than LH, and significantly higher theta power following stimulus presentation. Bridging these two sets of findings we found that the extent to which LH cells phase-locked their spiking to ongoing theta predicted correct recognition across all of our participants, and that this effect was driven by individuals with strong memory. We conclude that RH and LH show significant electrophysiological differences on micro, meso, and macroscopic levels of neural activity. Our data indicates that the well-documented lateralization of semantic and visual memory in the Hippocampus may be based on inter-related and multimodal neuronal differences.

Topic Line: LONG-TERM MEMORY: Other

G176 Reliability and variability of the P3 network configuration revealed by multi-resolution source-space analysis

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The temporal characteristics of the P3 component in the EEG event-related potential have been widely used as biomarkers for individual differences in normal and abnormal brain functions. By introducing a novel approach to the spatial characterization of this component, we hope to provide researchers a new and improved quantitative method for characterizing the underlying network of the P3 biomarker. Specifically, using a blind source separation algorithm (second order blind identification (SOBI) we were able to reliably extract, in all participants, a P3 component. The network configuration of the P3 component (P3N) was modeled as a set of widely distributed equivalent current dipoles (ECDs) and characterized by their corresponding anatomical structures at three levels of spatial resolution (Talairach Client). We show that by analyzing the number of hits associated with each structure at each level, the involvement of different structures within the P3N, and the consistency of their involvement across different individuals can be quantified. We found highly reliable involvement of frontal lobe structures coupled with a highly variable involvement of parietal, temporal, and occipital structures at all levels of analysis. At the highest spatial resolution, the P3N spanned all lobes of the neocortex, with BA10 most reliably found (11 out of 13 participants) accounting for 22% of total hits. These results demonstrate that EEG can be effectively used to provide quantitative characterization of the P3N's spatial configuration. We suggest that patterns of variability across different brain structures may in part reflect individual differences associated with mental order and disorder.

Topic Line: METHODS: Electrophysiology

G177 Does sleep-dependent memory consolidation rescue memories from decay in early childhood?

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Naps in preschoolers have been found to benefit declarative learning. Intriguingly, these data also suggest that naps may recover memories that may have decayed over wake. That is, following an interval with >1hr awake followed by 2hrs of sleep, performance was unchanged while accuracy declined if the 3hrs were spent awake. This study tested the prediction that memories decay over wake following learning and are then recovered by a delayed nap. Forty-seven preschool-aged children (M age = 51.9 mo, 54.5% female) learned a visuo-spatial memory task in the morning on two separate occasions separated one week apart, where on one occasion they napped and the other they did not. Recall was tested immediately after encoding, and after the afternoon nap/wake interval. Additionally, performance was probed either 1hr (pre-test A) or 2hrs (pre-test B) after immediate recall. Accuracy decayed between immediate recall and pre-test A ($p=0.010$; $n=27$) and between immediate recall and pre-test B ($p=0.005$; $n=20$). An additional 6 participants replicated previous findings that learning was protected following the nap and decayed following wake ($p=0.038$). These results thus far are consistent with predictions that naps can recover memories. Whether or not the memories were recovered by an active or a passive role is ongoing. Future analysis will include more participants to further explore the role of mid-day naps in preschool aged children.

Topic Line: LONG-TERM MEMORY: Development & aging

G178 Cognitive Health in Ageing - A ranked view on the impact of lifestyle factors on cognitive functioning

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With the number of healthy older adults increasing in developed countries, it is important to understand the cognitive changes beyond the pathological state. Cognitive health varies throughout the individual's lifespan and is related to general health, independence and social engagement. For that reason, it is essential to understand how daily life activities can help preserve cognition during aging. In our work, we have been studying the role of lifestyle factors

on cognitive health in a 15,823 participant cohort. To investigate this question, we used delayed and composite word recall as proxies of cognitive function. Then, we computed an ordered stratification of the measure of cognitive function. Finally, we created an ordinal logistic regression (OLR) model of our data allowing us to better understand how daily life activities affect cognition, and to model how these activities benefit different individuals. Our analysis identified that several life activities, including knitting and computer games, are contributing to cognitive health. Moreover, our results suggested that daily life activities have differing benefits based on existing levels of cognitive health. This finding highlights the importance of tailoring community-based activity programs for different users and push forward the importance of social prescribing.

Topic Line: ATTENTION: Development & aging

G179 The Effect of Acute Stress on Time Based Prospective Memory

Peter Sawka

Time-based prospective memory (TBPM) is the ability to remember to perform an action at a specific point in time. During a stressful day, one usually encounters many instances where TBPM is required. The objective of this project was to see if acute stress (situational) has an effect upon TBPM. Trinity College Undergraduates from ages 18-22 were used in this study. The Socially Evaluated Cold Pressor Test (SECPT) was performed to induce acute stress and raise cortisol levels in participants. Each participant had an EEG recording collected during a computer-generated TBPM Paradigm. The resulting data was analyzed within group as well as compared to nonstressed students. Comparing the groups, there was a significant increase in response time on TBPM tasks. Additionally, comparisons of simple ERPs recorded from 0-900 ms post ongoing task response between control and stress groups indicated significant differences in frontal electrodes (FP1, F1). To our knowledge, this is the first study to investigate the electrophysiological correlates of TBPM in response to acute stress.

Topic Line: LONG-TERM MEMORY: Other

G180 Modulated Error-Related Negativity (ERN/ERP) in Depressed Patients Exposed to Mindfulness-Based Cognitive Therapy

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Mindfulness-Based Interventions (MBIs) are steadily infiltrating mainstream healthcare as nonpharmacological alternatives with evidence-based efficacy for depression and anxiety, commonly co-morbid among chronic conditions. Depression is a significant leading cause of disability worldwide according to the World Health Organization (WHO). Mindfulness-Based Cognitive Therapy (MBCT) shows high clinical efficacy for mood disorders, whilst neurobiological mechanism and specificity has not been fully disentangled. Our previous work has examined the Error Processing System in Major Depressive Disorder (Schoenberg, 2014), finding amplitude differences in depressed patients compared to healthy controls, regardless of stage of illness (characteristic of a phenotype). Aberrated error processing is significant since it reflects deficits in cognitive and emotional flexibility to disengage and adapt to future responses, detrimentally affecting goal-directed cognition and behaviors. This study presents first phase data from an investigation into the effects of MBCT upon error processing in depressed patients, specifically examining the early component Error-Related Negativity (ERN) Event-Related Potential (ERP). Patients undertook an emotional Go-NoGo task concomitant to electroencephalographic (EEG) recording, pre and post MBCT exposure. Findings elucidated two main patterns: (1) ERN amplitude was enhanced with False Alarms (FAs) to neutral NoGo trials, compared to emotionally valenced conditions (positive, negative), and (2) examining by valence dichotomy, attenuated amplitude for FAs to negative stimuli was observed, compared to marginal modulation for positive stimuli, pre-to-post MBCT. This preliminary data supports that MBCT may target the Error Processing System with emotional specificity for attenuation from negative saliency, suggesting an adaptive mechanistic pathway involving attention and executive allocation during threat-related processes.

Topic Line: EXECUTIVE PROCESSES: Monitoring & inhibitory control

G181 Fast sensorimotor learning in middle-aged adults

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Using behavioural and imaging techniques, we examined the acquisition of perceptual-cognitive-motor skills during a dynamic and complex task in a group of middle-aged adults (40-50 years old, N=22). To investigate the neurophysiological adaptations that result from short-term cognitive training, we used a within-subjects design with phase of testing (Early Learning, Late Learning) as the within-subjects factor. We used a novel computer-based task that requires participants to move a cursor to a target whilst avoiding random moving objects, and requires the selection of appropriate actions to execute from more than one available option. We used fMRI to investigate activations in brain regions during and following short-term practice at this task. In addition, we used diffusion imaging (qMT, NODDI) to examine microstructural differences in white matter in relation to performance. We report a main effect of testing phase in the cerebellum, the pons, the thalamus and the lingual gyrus. The activation of the lingual gyrus (middle occipitotemporal area) is congruent with findings that show its activation enhanced when visual and tactile information are combined to strengthen the representation of the visual stimulus (1), suggesting back projections from multimodal convergence areas can feedback and modulate representations in a primary modality (2). We discuss the activations of the cerebellum, pons and thalamus in the context of Schmahmann's theory of the role of the cerebellum in cognition (3).

(1) Macaluso, E., C. D. Frith and J. Driver (2000) (2) Driver, J. and C. Spence (2000) (3) Schmahmann J.D. (2019)

Topic Line: PERCEPTION & ACTION: Other

G182 Withdrawn

G183 Oscillatory patterns in behavioral and hippocampal responses during an associative memory task

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When we form new memories or retrieve stored events, information is sent within and between the hippocampus and the cortex. It has been proposed that memory encoding and retrieval occur at opposite phases of the hippocampal theta rhythm, so that new information entering the hippocampus is separated, in time, from reinstated information (Hasselmo et al., 2002). Indeed, memory processes have been found to be phase locked to the theta rhythm (Kerren et al., 2018; Kunz et al., 2019), and therefore might themselves

appear to be rhythmic.

Here, we ask whether theta-rhythmicity of encoding and retrieval is detectable at the level of behavior. We analyzed the behavioral response times from an associative memory task (227 participants) and compared them to responses from a visual task (95 participants). We report that memory-dependent task phases produced detectable oscillations in response onsets across trials, while memory-independent responses were not oscillatory. Oscillation frequencies centered in the theta frequency range (2-5Hz), in line with previous reports of hippocampal theta in humans. During memory retrieval, phase locking was limited to correct trials, with incorrect trials occurring at random phases.

In addition, we recorded intracranial EEG using Behnke-Fried electrodes in 10 epilepsy patients while they performed the memory task. In line with the behavioral findings, we show that the memory task induced temporally extended phase locking of hippocampal local field potentials for correct trials, but not for incorrect trials. These findings provide a mechanistic underpinning for the oscillations in behavioral responses.

Topic Line: LONG-TERM MEMORY: Episodic

G184 The Effect of Age on Longitudinal Measures of Resting State Functional Connectivity

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Several cross-sectional studies have shown that participant age has a significant effect on whole-brain functional connectivity at rest, however little is known about how the healthy aging process affects change in functional connectivity over time. The present study examines multiple aspects of resting state functional connectivity in healthy adults age 20-80 at two time-points in order to determine which aspects of functional connectivity change over a five-year period, whether participant age affects the magnitude of these changes, and whether these measures of functional connectivity are able to predict change in cognitive performance over five years. Results suggest that some aspects of resting state connectivity do change over the course of five years, and that these changes are mostly consistent with previously observed cross-sectional effects of age on whole-brain functional connectivity. Specifically, connections across the whole brain tended to weaken over this five year period, however the degree of system segregation did not change. Further, change in Default Mode Network (DMN) within-network strength is related to change in memory performance over the course of this five year period, such that strengthening of within-DMN correlations was associated with reductions in memory performance. The moderating effects of age and IQ on this relationship were marginally significant. These longitudinal results generally support results from cross-sectional studies assessing the effect of age on functional connectivity metrics, and also suggest that some change in memory function over time may be accounted for by change in functional network properties.

Topic Line: METHODS: Neuroimaging

G185 Neural representation of Abstract Concepts in English and Mandarin:Similar Neural Structure but with Cultural Influences

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This project examined the similarities and differences between the neural representations of the same abstract concepts in English and Mandarin, to explore the possible effects of language differences and cultural differences. Recent research suggests there is a common neural substrate for representing abstract concepts across English speakers (Wang et al., 2010; Wang et al., 2017; Vargas & Just, 2019). Multivariate pattern analysis (MVPA) techniques applied to fMRI data were used to characterize the neural representations of 28 individual abstract concepts in native English speakers and native Mandarin speakers. A classifier trained on the concepts' neural signatures in one language reliably decoded their neural representations in the other language (mean rank accuracy = 0.66). A factor analysis of the activation patterns of the 28 abstract concepts from both languages indicates a common set of four underlying dimensions, namely, whether a concept is Internal, Verbally Represented, contains Social Content, and is Rule-Based. There was also systematic variation in how accurately various abstract concepts were decoded across languages. Specifically, force, ethics, and gravity were very accurately decoded across languages while equality, causality, and intimidation were less accurately decoded across languages. The group differences in abstract concept representations were associated with activation differences in certain brain regions. Specifically, native English speakers showed more activation in regions related to visuospatial processing such as left intraparietal sulcus and left lateral occipital complex whereas native Mandarin speakers showed more activation in regions associated with executive functioning, such as medial prefrontal cortices.

Topic Line: LANGUAGE: Semantic

G186 Dual-Language Exposure Following Preterm Birth: Language, Executive Function, and Frontal Lobe Development

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Premature birth, which affects approximately 10% of U.S. infants, has long-term developmental consequences, including difficulties with language and executive function. Some researchers have speculated that bilingual exposure may overwhelm preterm children; others argue that it may benefit executive function. In this study, we analyzed language samples obtained from videos of preterm toddlers and their mothers during a dyadic toy play session. Working memory was measured with a widely used searching task. Mothers were considered single-language mothers (English or Spanish, n=5) or dual-language mothers (English and Spanish, n=7) based on the language samples. Children of single-language and dual-language mothers did not differ in language production (i.e., number and mean length of utterances, number of unique words produced) nor in age (adjusted for prematurity), gestational age at birth, or Bayley-III cognitive scores. Single-language mothers produced longer utterances ($t = 3.06$, $p = 0.01$) and reported higher levels of education ($t = 2.71$, $p = 0.02$) than dual-language mothers. Children of dual-language mothers had higher working memory than children of single-language mothers ($t = -3.33$, $p = 0.01$). Controlling for intracranial volume, children of dual-language mothers had less frontal lobe gray matter volume than children of single-language mothers ($F = 4.93$, $p = 0.05$), and frontal lobe gray matter volume trended towards a negative correlation with working memory ($r = -0.52$, $p = 0.08$). These preliminary findings suggest that dual-language exposure following preterm birth is unrelated to toddler language production, but may be related to working memory and frontal lobe development.

Topic Line: LANGUAGE: Development & aging

G187 Bayesian attribution of incentives predicts action-induced preference changes

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Classical decision theories usually assume that choices reflect, but do not modify, preferences. By contrast, extant data from behavioral and

neuroimaging studies have suggested that humans sometimes change their preferences for or against certain things, places, or people in a seemingly irrational manner, after they have made decisions about the stimuli. It remains largely unknown, however, when, how, and why such action-induced preference changes occur. Here, we present a computational model in which preference shifts result from probabilistic perception of preferences: Internal evaluation of a stimulus emerges from a Bayesian inferential process that incorporates and justifies past decisions related to the stimulus. Preliminary behavioral results suggest that the proposed model is capable of capturing the well-documented phenomenon that accepting (rejecting) an unfamiliar stimulus leads to an increase (decrease) in preference ratings. Importantly, the model offers novel, quantitative predictions about the potential factors that could modulate the amount of change in the preference rating following a particular decision, which we validate with empirical data. These results, although preliminary, point to a mechanism by which internal incentives are appraised flexibly and dynamically, reflecting subtle differences in a decision maker's experience and cognitive states. They also raise intriguing questions regarding how past decisions are retrieved and evaluated in the brain and how such processing interacts with value signals in service of internal reward assessment.

Topic Line: THINKING: Decision making

G188 Silence in the brain: An EEG study of expressive silence in individual and joint musical action

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Silence is an inherent feature of speech and music. Speakers often pause between sentences; musicians often pause at musical phrase boundaries. When people converse or play music together, they must coordinate the duration of silences to interact smoothly. We used electroencephalography (EEG) to investigate how musicians determine the duration of silences in individual and joint music performance. 40 trained pianists (20 pairs) performed a simple piano melody featuring expressive silences of unspecified duration (fermatas) while EEG was recorded. Pianists performed the melody first alone (Solo) and then simultaneously with a partner (Duet). Findings revealed that expressive silences were a challenge for interpersonal coordination: Duet partners' tone onset synchronization was significantly reduced following fermatas relative to other score locations. Partners coped with this challenge by reducing the duration of silences: Fermatas were shorter in Duets relative to Solo performance, and Duet synchronization was better following shorter relative to longer fermatas. Event-related desynchronization (ERD) of cortical beta oscillations (13-30 Hz), a stereotypical signature of action planning, was observed over the time-course of expressive silence in both Solo and Duet performance. Beta ERD did not differ between conditions, but was enhanced for shorter relative to longer silences, suggesting that the observed reduction of silence durations in Duet performance may have facilitated partners' action readiness. Taken together, the current findings suggest that silence is a challenge for social interaction, and shed light on behavioural and neural processes by which partners resolve silences in joint action.

Topic Line: PERCEPTION & ACTION: Other

G189 Behavioral evidence that the rapid formation of distributed representations benefits inference

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Neural representations can be characterized as falling along a continuum, from distributed populations of neural units that overlap to reflect shared structure amongst related entities, to localist codes that orthogonalize representations despite any input similarity. Distributed representations support powerful learning in neural network models and have been posited to exist throughout the brain, but it is unclear under what conditions brains acquire distributed representations and what computational advantages such representations may confer. To examine these questions, we exploit a signature behavioral difference between these two kinds of representations: distributed representations support fast and automatic recognition of item relatedness, whereas localist representations require additional processing time for activation to spread amongst individual items. In a series of experiments, we present evidence that, as in neural network models, interleaved exposure to information facilitates the formation of distributed representations in humans. Once formed, such representations support rapid, automatic inference across novel associations and are especially critical for inference when learning requires statistical integration of information over time. We show that a neural network model of the hippocampus, which hosts both kinds of representations, accounts for these findings. Together, these results demonstrate the power of interleaved learning and implicate the use of distributed representations in rapid learning of structured information in humans.

Topic Line: LONG-TERM MEMORY: Episodic

G190 Age Differences in Predicting Executive Functioning from Structural and Functional Neuroimaging Data

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Aging is associated with altered behavioral performance and brain activation patterns in executive functions (EFs). The neural correlates of these changes, however, remain unclear. This study aimed to gain a better understanding of the neural implementation of EFs and its change throughout the lifespan. We therefore defined an extended EF-network (eEFN) and examined to what degree individual abilities in inhibitory control (IC), cognitive flexibility (CF), and working memory (WM) can be predicted within this network in young and old adults. Whole-brain RS-fMRI and behavioral data of 138 younger (20?40 years, 82 females) and 116 older (60?80 years, 76 females) healthy adults were obtained from the enhanced Nathan Kline Institute?Rockland Sample (eNKI). Individual z-transformed scores were then predicted from within-network RSFC and regional GMV using partial least squares regression with 100 repetitions of a 10-fold cross-validation scheme. eEFN network RSFC predicted IC performance (r =.24; MAE =.45) in the full sample. In the younger subgroup, eEFN network RSFC predicted WM performance (r =.21, MAE =.55). eEFN regional GMV predicted IC and CF performance for the full sample (r ?.34; MAE ?.41), IC and WM for the younger subgroup (r ?-.21; MAE ?.65) and CF for the older subgroup (r =.21; MAE =.47). Our results suggest that GMV may be a better predictor for EF-performance than RSFC. Furthermore, they question if executive functioning can or should be defined in a network and if individual differences in EF performance even manifest in canonical networks.

Topic Line: EXECUTIVE PROCESSES: Development &aging

G191 Neural Signatures of Dual-Task Response Conflicts and Their Modulation by Age

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Dual-task performance has been found to decline in advanced age, but the neural mechanisms are still unclear. To elucidate the neural correlates of response-related interference and their age-related differences, we implemented a spatial auditory-manual dual-response paradigm. Using fMRI, we measured task-related brain activity in 42 young (mean age: 25.7 years) and 35 older (61.7 years) healthy adults while they responded to high- or low-pitched tones by pressing upper or lower response buttons with one or both hands simultaneously. We manipulated (i) the compatibility between stimulus-pitch-implied and response directions (S-R compatibility) and (ii) the directional congruence between simultaneous manual response codes (R-R congruence). R-R incongruence significantly increased dual-task costs (DTC) on performance, which were further enhanced with age. S-R compatibility and R-R congruence significantly interacted, revealing a reversed S-R compatibility effect in R-R incongruent trials: In both age groups and in R-R congruent trials, DTC were higher for S-R incompatible than compatible responses, whereas the opposite was true for R-R incongruent trials. Dual-tasking recruited motor and parietal areas and deactivated irrelevant occipital regions, in line with the nature of this auditory spatial paradigm. S-R compatibility did not modulate this effect, but R-R incongruence (vs. congruence) enhanced activation in regions linked to cognitive action control and multitasking. Taken together, our results suggest that opposing response codes enhance dual-task interference via inducing (additional) conflict at a post-central stage and that this output-related conflict resolution in advanced age suffers from a less efficient brain network subserving top-down control.

Topic Line: EXECUTIVE PROCESSES: Other