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Abstracts

Poster Session A

Saturday, March 7, 2026, 3:00 – 5:00 pm, Fairview/Kitsilano Ballrooms

A1 - Auditory Narrative Linger Under Competing Speech

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Speech we hear can linger in our thoughts after listening, a phenomenon known as psychological momentum. Conversational speech shares this immersive quality but often occurs amidst competing talkers, requiring attentional resources to resolve target speech from background speech. The extent to which speech lingers in people's minds under such conditions and whether residuals of competing speech also linger, is unknown. The current study examined whether varying levels of competing speech influence narrative lingering. Twenty-four younger adults (18–35 years) completed three blocks in which they listened to two stories simultaneously, attending to one and ignoring the other. Stories were presented at +2 dB and –6 dB Target-to-Masker Ratios (TMRs), with a speech-in-quiet condition as baseline. Participants completed a free association task before and after listening, verbalizing any words that came to mind. Electroencephalography (EEG) and eye-tracking were recorded to index attention and listening effort. Analyses compared the degree of semantic similarity between participants' pre- and post-listening words with the direct and thematic words extracted from both stories. Compared to pre-listening words, post-listening words were more similar to attended-story direct and theme words, indicative of narrative lingering; however, this effect was not moderated by TMR, suggesting that lingering persists even under challenging listening conditions. No lingering was observed for ignored stories. EEG and eye-tracking analyses will reveal the attentional mechanisms underlying narrative lingering. The current findings suggest that selective attention during speech-in-speech listening promotes narrative lingering, but varying the strength of competing speech does not differentially affect this process.

Topic Area: ATTENTION: Auditory

A2 - A Novel Approach to Improving Sleep in New Parents: Safety Reactivation with a Baby-Responsive Soundtrack

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Disrupted sleep is prevalent among new parents. A prime contributor is sleep-hypervigilance, when alertness persists during sleep (e.g., when monitoring for any noise or vocalization from the infant). This hypervigilance produces sleep-fragmentation. Potential consequences include postpartum depression, relationship dissatisfaction, and physical-health problems. Targeted-Memory-Reactivation (TMR) research demonstrates that people can be influenced in various ways by auditory stimuli during sleep. Perhaps

TMR can influence sleep quality. Here we investigated whether, in new parents, reactivating the concept of infant safety could reduce hypervigilance and improve sleep. We employed a multiple-baseline design. During a daytime-conditioning phase, new parents associated a neutral soundtrack with infant safety. At night, this safety soundtrack was delivered to the sleeping parent via a baby monitor. A real-time algorithm on a custom smartphone app placed near the infant monitored for distress; when a cry was detected, the safety sound paused and an alert sound signaled that parental intervention may be needed. When the safety sound remained uninterrupted, it served as a cue that the infant was safe, which we hypothesized could reduce unnecessary hypervigilance. Sleep was assessed via objective and subjective measures over a 2- or 3-week period. We found that auditory safety reactivation increased subjective sleep quality, positive affect, and total sleep duration (estimated from movement/heart-rate-monitoring). The intervention also reduced awakenings to minor sounds, overnight alertness, daytime sleepiness, and negative affect. We hope to confirm these initial findings with further data collection, but nevertheless conclude that we've developed a safe, inexpensive, and scalable intervention with potential sleep-enhancing benefits.

Topic Area: ATTENTION: Auditory

A3 - What's on Your Mind during the 12 Minutes Before Lights-Out Influences Sleep Quality

Alysiana M. Martinez¹, Alani G. Cox-Cáceres¹, Hannah R. Maybrier¹, James E. Glazer¹, Ken A. Paller¹; ¹Northwestern University

High-quality sleep is valuable for cognitive function, emotional well-being, and physical health, but many people miss out on these benefits due to poor sleep. Effective methods for improving sleep at home could help those suffering from poor or insufficient sleep. Calming, pre-sleep routines are commonly recommended to reduce pre-sleep arousal and improve sleep quality; how that can be most easily accomplished and how much it helps is unclear. Prior studies typically used polysomnography in a sleep lab or were conducted at home without objective sleep measures. Here we used EEG in the home to evaluate a guided program of pre-sleep relaxation with elements of mindfulness, mental imagery, and body scan. Participants (N=38) slept as usual on night one (baseline) and listened to a 12-minute audio recording immediately before bed on nights two and three, counterbalancing two conditions across participants. We thus compared pre-sleep relaxation versus a control recording of ambient music with layered pink noise and tonal rhythms presented as brain entrainment. We assessed sleep measures using a wireless sleep-monitoring device with four-channel EEG (Muse-S). The relaxation program significantly reduced sleep-onset latency compared to entrainment, with a trend for shortened N2 latency. Participants reported greater subjective-relaxation improvement after the relaxation versus entrainment program. This study thus demonstrates the feasibility of wearable-EEG methods to assess pre-sleep routines while sleeping at home and suggests that listening to a relaxing guided

audio before bedtime can help people fall asleep quicker and maybe obtain better sleep.

Topic Area: ATTENTION: Auditory

A4 - Autonomic Activity of Distraction Suppression and Early Adversity in Children

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Serena Zaenali¹, Ryan Giuliano¹; ¹Hearts & Minds Lab, University of Manitoba

Research has documented relationships between socioeconomic adversity and neurophysiological mechanisms underlying selective attention in childhood. Adversity has been associated with reduced filtering of distractor stimuli as indexed by event-related potentials (ERPs), and some evidence suggests this effect is explained by adversity-related alterations in autonomic nervous system activity. Here, we aimed to replicate and extend that result with a sample of preschool-aged children recruited from a diverse array of socioeconomic backgrounds. Children (N=87) completed an ERP dichotic listening task, while electrocardiogram (ECG), and impedance cardiogram (ICG) data were recorded for measurement of parasympathetic (i.e., high-frequency heart rate variability, HRV) and sympathetic activity (i.e., pre-ejection period, PEP), respectively. Mean amplitudes of the primary auditory ERP (P1) were extracted from attended and unattended auditory probes as respective indices of target selection and distractor suppression. We failed to replicate a broad relationship between socioeconomic risk or poverty status with distractor suppression as indexed by P1 amplitudes, and no evidence emerged for mediation by PEP. Instead, children from lower socioeconomic backgrounds showed larger ERP amplitudes to attended stimuli, suggesting enhanced engagement with goal-relevant input rather than impaired suppression of distractors. Exploratory analyses revealed that HRV mediated associations between socioeconomic risk and P1 amplitudes, consistent with a neurovisceral-integration framework. These findings align with models of experiential canalization, proposing that children's cognitive and physiological systems adaptively reorganize in response to environmental contingencies, and challenge deficit-based assumptions about adversity by demonstrating that attentional mechanisms in children from diverse socioeconomic backgrounds may be optimized for distinct environmental demands.

Topic Area: ATTENTION: Development & aging

A5 - The effects of prestimulus alpha power on neural and behavioral responses to task stimuli

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Bilateral alpha-band oscillations (8-12 Hz) over occipitoparietal cortex are thought to reflect large-scale thalamocortical and corticocortical interactions that support neural inhibition and are inversely associated with general attentiveness and arousal. Theories debate whether modulations in bilateral posterior prestimulus alpha gate sensory processing through inhibition or disinhibition of visual cortex— analogous to the selectively modulatory effects of spatial attention—or instead reflect general cortical readiness to process input. This study evaluated these accounts by examining how prestimulus alpha-power fluctuations relate to stimulus-evoked event-related potentials (ERPs) and whether this relationship influences cognitive task performance. EEG data were analyzed from three paradigms differing in visual and cognitive demands: (1) a target-perception task with masked targets, (2) a visual-search task, and (3) a color-word Stroop task. Across paradigms, lower prestimulus alpha power predicted a more negative ERP wave starting at 150 ms. However, the ramifying behavioral effects were varied and task-specific. With target-perception, the 'prestimulus-alpha-negative-ERP' effect predicted poorer accuracy of reporting target presence, but a greater likelihood to report seeing a target regardless of actual target presence. With visual search, the 'prestimulus-alpha-negative-ERP' effect predicted overall faster behavioral responses. With the Stroop task, the 'prestimulus-alpha-negative-ERP' effect did not result in significant cascading effects on performance. These findings suggest that lower bilateral posterior prestimulus alpha power reflects a domain-general state of cortical excitability that enhances early sensory and behavioral responsiveness but does not necessarily confer—and could even reduce—sensory specificity. Overall, the results favor a general cortical state account over one of gated inhibition.

Topic Area: ATTENTION: Nonspatial

A6 - Holding Back the Past: Controlling When LTM Guides Attention

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Objects stored in visual working memory (VWM) guide attention toward matching features in the environment. Notably, an object's features do not need to be seen to influence attention—features previously associated with that object in long-term memory (LTM) can be reinstated into VWM and bias attention, even when task-irrelevant. But are remembered features always reinstated, or is LTM reinstatement under the observer's control? To examine this question, we first tested whether reinstatement depends on task demands. After memorizing-coloured objects, participants either completed a VWM-based speeded object-search task, or non-speeded object-recognition task, for those object's shapes. Some trials alternatively ended with a diamond search, allowing an independent measure of reinstatement. We found that reinstated object colours only biased attention in the diamond search when objects were remembered for speeded search, not non-speeded recognition, indicating that reinstatement depends on task demands. We next examined temporal control over

reinstatement. First, to establish when reinstatement emerges, we varied object-shape viewing duration and pre-search delay in the speeded-search task, finding reinstatement after 100 ms of viewing and 50 ms of maintenance. Using these timings, we had participants complete the diamond search and object search on every trial, in that order. Although object shapes were maintained in VWM for the whole trial, reinstated colours only biased attention at object search, suggesting reinstatement was delayed until after the diamond search. Together, these studies demonstrate that reinstatement can occur rapidly, and is flexibly modulated by task demands and timing, which determine when task-irrelevant features guide attention.

Topic Area: ATTENTION: Other

A7 - Two stages of processing for visual awareness identified in a novel inattentional blindness video-game paradigm

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What is the difference in neural processing when we are aware versus unaware of a stimulus? Previous attempts to identify neural signals uniquely associated with visual awareness have faced several challenges. A critical one has been to isolate neural events linked with perception from those associated with reporting one's perception. To address this, we developed a dual-task inattention paradigm in which participants played an engaging video-game as the primary task, while face and object stimuli were occasionally presented in the background. In 1/3 of the trials, a secondary task was presented immediately after stimulus offset (500ms post-stimulus-onset): the game was paused and participants were prompted to report whether they just saw a stimulus. We first analyzed MEG-EEG data from the report trials. We then trained a pattern classifier to differentiate reported-seen versus reported-unseen trials, and used it to label the remaining 2/3 of the EEG data (no-report trials). In the report trials, we found a visual awareness negativity (VAN; ~220-270ms) followed by a fronto-central negativity (fcN2) and concurrent late bilateral occipital positivity (LBOP) from ~320-550ms. The P3b was also evident but only at ~800-1000ms post-stimulus (~300-500ms after the report-prompts). In the classifier-labeled no-report trials, we found the VAN and fcN2/LBOP with no evidence for P3b. These results demonstrate the potency of this paradigm and classification approach for isolating neural events linked with conscious perception from perceptual-reports. They also suggest that after the VAN, there may be a second stage of processing necessary for visual awareness, indexed here by the fcN2/LBOP.

Topic Area: ATTENTION: Other

A8 - Left, not right, congruency effects in the flanker task activate frontoparietal and control networks

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Introduction: The congruency effect in the flanker task is generally considered to reflect executive control processes and inhibition. Previous studies have shown that incongruent flankers tend to engage fronto-cingulate networks responsible for conflict monitoring and response selection. We here show that when the flanker is unilateral and congruency is defined by color, the congruency effect for flankers in the left hemifield activates bilateral fronto-parietal networks in addition to the cingulate cortex. Methods: Forty-five healthy adults (26 females; mean age = 61.7 years) performed a color-based flanker task during fMRI acquisition. They were required to react to a central, colored target preceded by a single left or right flanker of the same (congruent, ConL or ConR) or a different (incongruent, IncL or IncR) color. Data were pre-processed and analyzed using SPM. Contrasts were computed with main effects and interactions of congruency and side. Whole-brain results were corrected for age and FWE-thresholded at $p < .05$. Results: Compared to each other, left and right flankers activated contralateral occipito-temporal cortex, irrespective of congruency. When comparing the congruency effects for left flankers (IncL-ConL > IncR-ConR) we found bilateral activation of frontoparietal regions, including the dorsolateral prefrontal cortex (dlPFC), frontal eye field (FEF), dorsal anterior cingulate (dACC), visual and motor areas. The reverse contrast did not yield any significant results. Conclusions: Our findings show that only the congruency effect associated with left flankers triggers a strong bilateral activation of attention and executive networks, suggesting a bias in the left hemifield toward conflicting information.

Topic Area: ATTENTION: Spatial

A9 - Neural correlates of mental rotation in aphantasia

Rain Paul¹, Kelsey Roberts, Theo Rhodes, Sien Hu; ¹SUNY Oswego

Mental rotation refers to the cognitive ability to manipulate a visual image in three-dimensional space internally and imagine it from various orientations. Some people are unable to use visual imagery in cognitive processing, a condition known as aphantasia (Zeman et al., 2015). Previous research on mental rotation reported longer response time (RT) but comparable accuracy in aphantasics (people with a lack sensory mental imagery) than controls. The current study aimed to investigate the behavioral and neural differences between people with and without aphantasia. Subjects performed a mental rotation task (Shepard & Metzler, 1971) in fMRI. They were presented pairs of three-dimensional objects side by side. For each object, four different orientations were generated by a rotation in depth, 0°, 50°, 100°, and 150°. In each pair, the object on the right can be rotated from the object on the left (the "identical" condition) or from the mirrored version of the object on the left (the "mirrored" condition). Subjects pressed a button

with their right thumb for “identical” and right index finger for “mirrored”. Aphantasics showed no difference in RT in all orientations and no difference in accuracy in 0°, 50°, and 100° orientations than controls, though they were lower in accuracy in 150°. In identical and mirrored conditions, aphantasics showed greater activations in the frontal and parietal regions as well as areas in the default mode network than controls. These results suggested that aphantasics recruit additional brain regions in cognitive control to compensate for lacking mental visualization during mental rotation.

Topic Area: ATTENTION: Spatial

A10 - Brain activity during guided imagination differentially relates to loneliness in younger and older adults

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Background: Decreasing emotional well-being (EWB) is an area of concern during aging. Loneliness, in particular, increases risk for negative health outcomes, cognitive decline, and mortality. Task-based functional magnetic resonance imaging (fMRI) can examine age-related differences in cognitive processes that may confer vulnerability for decreasing EWB. Research suggests we spend 30-50% of our mental lives mind wandering and differences in mind wandering content have been associated with EWB. Age-related differences in mind wandering processes may reflect mechanisms for decreasing EWB. Methods: In a case-control design, 30 cognitively unimpaired older adults and 30 younger adult controls performed guided imagination during fMRI scanning. Individual differences in brain activity while imagining specific scenarios was extracted and associated with EWB components (perceived quality of life and loneliness) using Generalized Estimating Equations. Results: Brain activity was not associated with perceived quality of life. Ventral attention network activity during social scenarios was linked to increased loneliness in older adults and younger controls, while default mode network (DMN) activity during social scenarios was associated with decreased loneliness only in younger adults. For older adults, frontoparietal network activity during active alone scenarios was linked to less loneliness. Behavioral analyses suggested that the protective effects of DMN activity for loneliness may be linked to imagining more pleasant social scenarios; this mechanism was not present in older adults. Conclusions: We found differences in how neural and behavioral aspects of mind wandering processes relate to loneliness between younger and older adults that warrants exploration with more ecologically valid and temporally precise methods.

Topic Area: EMOTION & SOCIAL: Development & aging

A11 - Effects of informal musical engagement on white matter integrity across development.

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Early engagement with enriching activities can have a profound impact on subsequent brain structure. For example, formal musical training in middle childhood (e.g., playing an instrument) is associated with greater integrity of white matter pathways within the arcuate fasciculus when compared to children without formal musical training. However, barriers exist that may restrict access to formal music training (e.g., cost) in childhood. Meanwhile, survey and in-home recording studies illustrate that a vast majority of individuals informally engage in musical experiences (e.g., being sung to or playing with musical toys) in development. Whether similar differences in white matter integrity can be attributed to such musical engagement remains to be investigated. The present study will use diffusion tensor imaging (DTI) in a sample of children, adolescents, and young adults (n = 129, age range = 5-24, mean age = 18.5) to investigate whether similar structural differences emerge among populations with informal music experiences across development. Informal exposure to music during childhood and formal musical training were measured via self-report on the Music@Home and Goldsmiths Musical Sophistication Index surveys, respectively. Planned analyses will leverage whole brain Tract-Based Spatial Statistics (TBSS) as well as evaluate diffusion values for fractional anisotropy, mean diffusivity, axial diffusivity, radial diffusivity, and mode of the arcuate fasciculus to test the unique contributions of formal musical training and informal musical exposure on white matter microstructure. This effort highlights the potential effects of an under-investigated but extremely common dimension of the early environment on brain development.

Topic Area: EMOTION & SOCIAL: Development & aging

A12 - Non-REM oscillations and emotion regulation are related to anxiety and depression symptoms in adolescents

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Non-REM (NREM) sleep oscillations such as spindles and slow oscillations are critical for cognitive and affective processes, and their disruption may contribute to symptoms in psychiatric disorders. This study examined whether NREM oscillations are altered in adolescents with anxiety disorders (ANX) compared to a matched comparison group (COMP), and whether these oscillations relate to symptom severity, emotion regulation, and resting-state functional connectivity of anxiety-relevant networks. Forty-three adolescents aged 9-13 years (M= 11.3; 17 ANX, 26 COMP) completed an overnight sleep EEG, a behavioral emotion regulation task, and a 7T resting-state fMRI scan. Validated algorithms detected NREM oscillations and characterized their morphology. Seed-to-voxel connectivity maps were generated using bilateral amygdala and thalamus seeds. Spindle duration was significantly reduced in the ANX group (tcluster=-26.62, pcorrected=.03), with no group differences in other oscillation measures. Across participants, reduced spindle duration correlated

with higher parent-rated anxiety ($t_{cluster}=-63.28$, $p_{corrected}<.001$), depression ($t_{cluster}=-91.8$, $p_{corrected}<.001$), and internalizing symptoms ($t_{cluster}=-76.00$, $p_{corrected}=.002$). Emotion regulation problems were also positively related to parent-reported anxiety ($r=.46$, $p=.01$), depression ($r=.39$, $p=.01$), and internalizing symptoms ($r=.45$, $p=.004$). Spindle duration was not related to emotion regulation. No group differences were observed in seed-to-voxel connectivity. Thalamic connectivity was not related to spindle activity, and amygdala connectivity was not related to symptoms. These findings reveal, for the first time, that adolescents with anxiety disorders have reduced spindle duration, correlating with severity of internalizing psychopathology. Ongoing work includes adding a medial prefrontal cortex seed analysis and collecting longitudinal EEG data to assess developmental trajectories of NREM oscillations and anxiety symptoms.

Topic Area: EMOTION & SOCIAL: Development & aging

A13 - Adolescent Anxiety Adversely Impacts the Thalamic-Basal-Ganglia-Cerebellar Network

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Anxiety adversely impacts cognitive function across domains and affects over 30% of adolescents, yet its mechanisms of action on the developing brain are incompletely understood. In a sample of 2905 youth from the Adolescent Brain and Cognitive Development (ABCD) cohort (median (IQR) age = 12 (1.1) years; 51.29% females) with resting-state fMRI and measures of anxiety (t-scores) from the Child Behavior Checklist (CBCL) and the DSM-5, this study investigated associations between anxiety and the brain's circuit organization and topological properties. Multiple topological properties were estimated from resting-state connectivity matrices, to characterize local and network-wide connection strength, efficiency of information processing, community structure, resilience, topological fragility and regional role in controlling brain dynamics. Median (IQR) anxiety scores were 51 (2). About 5% of participants had scores ≥ 65 . Statistical analyses consistently identified associations between anxiety and properties of the thalamic-basal ganglia-cerebellar network. Higher anxiety was associated with higher difficulty to dynamically individual regions of this network except the thalamus (reflected in higher control costs: ($\beta = 0.04$ to 0.07 , $CI = [0.01, 0.12]$, $P \leq 0.03$), but also higher difficulty to control the overall network including the thalamus; $\beta = 0.04$ to 0.09 , $CI = [0.01, 0.15]$, $P < 0.04$). Higher anxiety was also associated with aberrantly connected cerebellum ($\beta = 0.07$ to 0.08 , $CI = [0.03, 0.13]$, $P \leq 0.01$). These results suggest that anxiety impacts specific brain circuits that support a wide range of cognitive processes beyond motor function, including decision-making, reward and emotion processing.

Topic Area: EMOTION & SOCIAL: Development & aging

A14 - DNA Repair and epigenetic regulation in mice overexpressing SIRT6 variants from long- and short-lived species

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Sirtuin 6 (SIRT6), an NAD-dependent enzyme, regulates several of the hallmarks of aging, including genomic stability and epigenetic modifications. DNA damage repair plays a major role in genomic stability, and SIRT6 from longer-lived species has been shown to enhance DNA double-strand break (DSB) repair activity. SIRT6 overexpression in mice has been shown to significantly increase longevity. We isolated mouse, beaver, human, and bowhead whale SIRT6 variants and tested how overexpression of these variants in mice affects DNA DSB repair in response to oxidative stress. Following induction of oxidative stress with H₂O₂ treatment, there was a trend toward an increase in live cells in cells overexpressing beaver, human, and bowhead whale SIRT6 compared to controls, suggesting that the SIRT6 from beaver, humans, and bowhead whales may reduce apoptosis due to oxidative stress. Additionally, to understand why there are differences in DNA DSB repair activity, we investigated post-translational modifications via immunoblotting. SIRT6 from bowhead whale showed increased phosphorylation, which may be responsible for its enhanced DNA DSB repair activity. Lastly, we assessed the cognitive and locomotive differences in the mice to determine the effect of human and bowhead whale SIRT6 overexpression on the mice's physical and mental ages via an open field test. Old human SIRT6-overexpressing male mice showed a trend of increased in-center frequency (a measure of decreased anxiety) compared to the older control mice, which demonstrates that human SIRT6 may be ameliorating the age-related anxiety in the mice.

Topic Area: EMOTION & SOCIAL: Development & aging

A15 - Age-Dependent Relationships Between Resting-State Network Connectivity and Hot and Cold Cognition in Adults with Major Depressive Disorder: A MEG Study

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Major Depressive Disorder (MDD) affects mood and hot cognitive functions, including emotion recognition, reward processing, impulsivity, and social decision-making. Little is known about how these processes and their neural networks vary across the adult lifespan. We investigated this using resting-state connectivity in adults with MDD. Twenty-eight adults with MDD (age 22–76 years; mean $\pm$ SD = 45 ± 15.4) completed a battery of hot cognitive tasks, including emotion recognition, moral decision-making, and delay discounting. Resting-state MEG was source-reconstructed across Salience, Default Mode (DMN), and Frontoparietal Control (FPCN) networks,

with FPCN subdivided into frontal and parietal subnetworks. Amplitude envelope correlation and graph centrality metrics (degree, betweenness, clustering) were computed per network and frequency band (delta, alpha, low gamma), and correlations and age-partial correlations with cognitive performance were computed (all p-values FDR corrected). In the Salience network, delta and low gamma band centrality (degree, betweenness, clustering) predicted emotion recognition and moral decision-making ($p < .05$), but these associations did not survive age adjustment. In the DMN, alpha-band betweenness predicted delay discounting ($p = .011$), remaining significant and slightly stronger after controlling for age ($p = .002$). In the FPCN frontal subnetwork, delta-band connectivity predicted delay discounting only after age adjustment ($p = .030$). Resting-state network connectivity predicted hot cognitive performance in adults with MDD, with age influencing network-specific effects. Salience effects weakened, whereas DMN and FPCN frontal associations persisted or strengthened across age. This suggests that age-sensitive declines in Salience connectivity affect emotion recognition and moral decision-making, while DMN and FPCN frontal networks maintain stable or compensatory function.

Topic Area: EMOTION & SOCIAL: Development & aging

A16 - Investigating meaningful experiences using fMRI and a personalized movie paradigm

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¹University of British Columbia

We are all motivated to seek meaning, prioritizing events and experiences that provide purpose, significance, and coherence within the broader context of our lives. Meaning is pervasive, though its precise phenomenological and neuroscientific elements remain unclear; partly due to the field's lack of a meaning-eliciting paradigm. In this study, we investigated the neuroscience of meaningful experiences elicited by standardized ('The Present' and 'Forrest Gump') and self-selected movies in a novel fMRI paradigm. First, movie clips were personalized by having each participant annotate moments that felt meaningful (in terms of an experience of connection or resonance) and events that they thought were meaningful (in terms of their purpose, importance or relationship to the overall story). We also measured the degree to which participants found events engaging and self-relevant. Second, participants engaged in uninterrupted viewing of the annotated movie clips during fMRI scanning. Behavioral analyses evaluated the relationship between meaning ratings and movie content (e.g., presence of faces or music), as well as between-subject differences in meaning ratings in response to standardized films. fMRI analyses with general linear modelling evaluated the unique neural activation associated with moments that felt meaningful and events that were thought to be meaningful to the overall story. Results from this study advance our understanding of the neural correlates of meaning and highlight the unique experiential and neural responses that participants report when engaging with film.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

A17 - Frontal midline theta in trait anxiety and associative memory

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Frontal midline theta (FMT) activity is implicated in both memory and anxiety research. We tested the hypothesis that trait anxiety modulates FMT processes that, in turn, support associative memory performance and related FMT in healthy adults. Anxiety was assessed with the Behavioural Inhibition Scale (BIS), and memory was measured with an associative recognition task. Behaviour was not significantly affected by anxiety: BIS and d' showed no reliable association ($r(55) = 0.191$, $p = 0.144$, $BF_{10} = 0.58$). However, higher anxiety was reliably linked to a reduced difference in FMT power during successful vs. unsuccessful encoding (subsequent memory effect, $r(55) = -0.341$, $p = 0.009$, $BF_{10} = 4.40$) and retrieval (retrieval success effect, $r(55) = -0.295$, $p = 0.026$, $BF_{10} = 1.87$), although less robustly. Critically, the effect was found for theta power but not when strict criteria for rhythmicity were applied, whereas the memory effects are typically rhythmic (e.g., Chen, 2017; Shalamberidze et al., in preparation). These findings suggest that trait anxiety modulates neural mechanisms that, despite sharing spectral characteristics with memory-related theta oscillations, are distinct processes.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

A18 - The Effect of Acute Exercise on Emotion Regulation

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¹University of Manitoba

Background: Physical exercise supports mental health through autonomic and emotion regulation, influencing our ability to up- or down-regulate emotional reactions and consolidate them into memory. This two-experiment study examined the acute effects of moderate-intensity continuous exercise on emotion regulation. Methods: In two experiments, participants completed 30-minutes of exercise or sitting (control) on an ergometer, then completed an emotion regulation task involving passive viewing or reappraisal of emotional pictures while physiological responses were recorded. Participants rated how negative and positive the photos made them feel either immediately (experiment 1) or 24-hours after (experiment 2) reappraising or viewing them. During affective rating of previously seen photos, new photos were intermixed to measure aspects of memory, specifically photo familiarity and source monitoring. A 2x2 mixed design was used with condition (view vs reappraise) and group (exercise vs control) as independent variables. Results: In experiment 1, negative affect was significantly lower during reappraisal compared to passive viewing, and skin conductance responses (SCR) did not significantly differ. In experiment 2, SCRs were lower during reappraisal compared to

passive viewing across groups. Negative affect ratings showed a significant Group × Condition interaction, with reappraisal reducing negative affect more in the exercise group. Discussion & Conclusion: Exercise did not immediately improve emotion regulation or autonomic response but strengthened potentially delayed memory-related reappraisal effects. Exercising led to greater reductions in negative affect 24-hours later when rating previously seen images, suggesting that while acute exercise does not enhance immediate regulation, it may bolster the lasting emotional benefits of reappraisal.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

A19 - Neural Mechanisms of a Brief, Short Body Scan Meditation and the Influence on Cognitive Performance & Perceived Stress

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Introduction: Stress may contribute to cognitive dysfunction in higher education environments. Adaptive coping strategies are essential to buffer effects of stress. Body scan meditation is a quick, easy mental training that could alleviate some forms of acute stress. The aim of the study is to investigate potential buffering effects of body scan meditation on perceived stress. Methods: Fifty-four undergraduate and graduate students from Middle Tennessee State University will undergo continuous EEG recording. Stress will be examined before and after protocol via State-Trait Anxiety Inventory. Resting state EEG will be taken at the beginning and end of experiment in both groups. The experimental group will receive 17-minute body scan meditation followed by an Operations Span (OSPAN) task. The control group will undergo 17 minutes of active listening followed by an OSPAN task. Results: Data collection is in progress for this study. Resting-state EEG band power will be compared across groups to determine if alpha and theta band power has a significant interaction from pre- to post-intervention. Alpha and theta band power will also be compared between experimental and control groups during each listening task, respectively. A difference would suggest that the meditation intervention elicited a modulation in underlying brain network activity associated with relaxation and alertness. Potential buffer effects for stress will be measured with a difference in STAI pre- and post-intervention. Conclusions: Study is in progress; conclusions will be added to poster upon completion.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

A20 - The ADHD Emotion Trap: Is It Reactivity or Attention?

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Emotional dysregulation (ED) is a core feature of ADHD, affecting functioning and well-being. Individuals with ADHD exhibit enhanced reactivity to emotional stimuli, which may make it harder for them to flexibly transition between emotional states in daily situations. These difficulties likely stem from deficits in emotional and attentional processing, making emotional regulation more effortful. To examine

these processes, we conducted two studies using a Picture-Picture Priming Task. Study 1 included 30 adults with ADHD and 30 neurotypical controls who evaluated the valence of a target picture preceded by a prime (100 ms). Primes varied in valence (positive/negative/neutral), creating congruent, incongruent, and neutral conditions. Results showed that ADHD participants had greater difficulty transitioning between emotions, particularly when a negative prime preceded a positive target. Study 2 (N = 70, 35 ADHD) replicated these findings and examined the role of attentional functioning. Attentional abilities were assessed via self-reports and an attention task. Our findings highlight the complex interplay between emotional and attentional mechanisms in ADHD, suggesting that emotional dysregulation may arise from multiple, interacting sources. Understanding these mechanisms may inform more targeted interventions in the future.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

A21 - The intersection of art and grief as a model for probing the neurophysiologic mechanisms of mediating bereavement.

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The trans-disciplinary field of neuroaesthetics has developed over the past two decades, ambitiously attempting to bridge cognitive neuroscience and aesthetics. An important subdivision of neuroaesthetics is the development of therapeutic applications, extending from individual to public health. This study entails a systematic literature review and meta-analysis interrogating the therapeutic value of visual art creation in the clinical management of grief, focusing on bereavement as a useful model for the near-universal experience of loss. Preliminary analyses demonstrate that grief responses and creative cognition in adults activate overlapping neural substrates (including the nucleus accumbens and medial prefrontal regions), and are both associated with elevated oxytocin levels. Converging neurophysiologic and epidemiologic data suggest potential unifying neurophysiologic mechanisms for why negative emotion and creative cognition often intersect, and why emotional positivity and art quality may be inversely related. If these convergent findings are supported by completed analyses, they would indicate that bereavement art creation represents a neurobiologically coherent pathway for grief adaptation, as the activity simultaneously engages reward, regulatory, and self-reflective systems. Such outcomes would provide empirical support for art-based bereavement interventions, which may facilitate emotional integration at the biological level. In that vein, the potential role of oxytocin in the experience of bereavement art has significant implications for developing community-based mediations that leverage collective aesthetic experiences as approaches to grief support. This study will serve as a helpful methodology for future explorations into managing varying types of loss, from interpersonal relationships to national developments which threaten the livelihood of the present-day artistic workforce.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

A22 - Preliminary investigation of emotional voice judgment in healthy young adults using fNIRS: A foundation for future MCI research

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Mild Cognitive Impairment (MCI) is a pre-dementia condition characterized by cognitive decline without significant interference in daily life. While some individuals with MCI progress to dementia, others exhibit cognitive recovery, emphasizing the importance of early identification and intervention. Although deficits in emotional judgment have been reported in dementia, little is known about this ability in individuals with MCI. Identifying changes in emotional judgment and differences from healthy adults may help detect early signs of MCI, as well as declines in social connectedness and psychological well-being associated with impaired emotion recognition. This study represents the first phase of a four-step project ultimately aiming to examine whether pharmacological interventions such as lecanemab (an anti-amyloid- β antibody drug) can help maintain emotional judgment ability in MCI. As a preliminary step, the present study investigates brain activation during emotional voice judgment in university students using functional Near-Infrared Spectroscopy (fNIRS). Screening will ensure that participants are right-handed and have no symptoms of depression or cognitive decline, based on standardized questionnaires validated in previous studies. During an event-related Go/No-go task, participants will respond to nonverbal emotional voices from the Montreal and Tokyo Affective Voice databases. We hypothesize that the bilateral superior temporal gyrus will be activated during emotional voice judgment, with no significant differences across emotional categories. The results will provide baseline data for validating the experimental design in future studies involving older adults and individuals with MCI.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

A23 - Modeling Context Similarity in Fear Renewal

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Exposure therapy for anxiety and stress disorders relies on Pavlovian fear extinction, yet extinction is context-specific and generalizes only partially to new environments depending on their similarity to the extinction context. Understanding the computational basis of this generalization is critical for improving therapeutic outcomes, since patients rarely experience triggers in the exact therapy setting. Building on a neurally constrained model of fear extinction, we introduce the Context-Similarity Adjusted Fear Extinction and Renewal (C-SAFER) model. C-SAFER embeds contexts in a Euclidean representational space, consistent with hippocampal encoding of multidimensional concepts, where similarity decreases with distance

via a Gaussian kernel. During extinction, hippocampal representations of each context form independent associations with a cue-specific extinction memory in the amygdala, countering the fear memory established during acquisition. At renewal, all prior extinction contexts partially activate the extinction engram, with their contributions weighted by similarity to the test context. Using only five free parameters, C-SAFER reproduces three hallmark findings: weaker renewal when extinction and test contexts are more similar, weaker renewal when extinction spans multiple contexts, and near elimination of renewal following extinction across multiple similar contexts. The model also generates two clinically relevant hypotheses: (1) the number of contexts required to suppress renewal increases exponentially with decreasing similarity with the test context, and (2) exposure therapy in a near-identical context is less effective than therapy distributed across two or more moderately similar contexts. C-SAFER provides a mechanistic account of context similarity in fear renewal and advances testable hypotheses for leveraging it to strengthen extinction.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

A24 - Assessing the Ability of Virtual Reality Environments to Change Brain State: An Electroencephalographic Investigation

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Virtual reality has been shown to alter mental states, particularly by reducing stress, alleviating anxiety, and improving mood regulation (Riches et al., 2023). A key question however, is whether a virtual reality experience can actually change mental state. Here, we examined whether or not mobile electroencephalography (mEEG) could be used to differentiate between two different virtual reality experiences designed to create two different mental states. Specifically, we had thirty participants complete Float VR's "relax" and "energize" experiences while EEG data was recorded via a CGX Dev Kit using PEER software run off of an Apple iPad Pro. Our behavioural results indicated that the two virtual experiences had their intended effect. In terms of the EEG data, we found that the relax experience increased posterior alpha power relative to the energize experience ($p < 0.05$). Given that prior research has demonstrated that increased alpha power is associated with increased relaxation (e.g., Magosso et al., 2019), we posit that the relax virtual experience achieved its intended effect. We also found that the energize experience increased frontal beta power relative to the relax condition ($p < 0.05$). In terms of increases in beta power, prior work has shown that increased beta power is associated with greater arousal and alertness (Basar et al., 2001) which is in line with the goal of the energize experience. In sum, our results suggest that virtual reality can modify mental states and that mEEG is a viable methodology for tracking these changes in mental state

Topic Area: EMOTION & SOCIAL: Emotional responding

A25 - Face Your Feelings: A higher burden of unattended negative facial stimuli may increase startle arousal.

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Attentional biases towards emotional stimuli shape physiological reactivity, with a high sensitivity to facial cues (Dandeneau & Baldwin, 2004; Bublatzky, 2019). The current study investigated the effects of emotional face-searches on a subsequent startle reactivity. During training, 32 undergraduates completed a 4x4 matrix, prompted to locate a single face-type among 15 distractors (smile-among-frowns or frowns-among-smiles). After testing, participants listened to white noise for a total duration of 5 minutes, with an auditory startle (105dB) injected at 2 minutes. Outcome variables included matrix reaction-times and continuous measures of skin conductance (SC), eye electromyography, and heart rate. Participants completed the Rosenberg Self-Esteem and Beck Anxiety scales, as common modulators of attentional bias. Physiological measures did not reflect hypotheses suggesting potential find-frown modulations on startle reactivity and recovery. All measures except SC were non-significant, with higher startle SC for find-smile ($U=59.00$, $p=0.048$). While this seems counterintuitive to literature indicating higher sympathetic arousal with negative-exposure (Reagh & Knight, 2013), find-smile cohorts were exposed to higher negative burdens (15 frowns + 1 smile), which may explain higher arousal. Meanwhile, self-esteem and anxiety did not modulate reactivity. Matrix outcomes showed faster reaction times for find-smile matrices ($t(32)=-2.602$, $p=0.014$), likely influenced by morphological distinctness of smiles resulting in a pop-out effect (Theobald, 2009). In conclusion, attentional-training can influence sympathetic reactivity to sudden stressors, but it may be most modulated by stimuli-type burden rather than conscious search focus. This research supports that passive exposure to emotional stimuli can influence attentional bias, and thereby physiological reactivity.

Topic Area: EMOTION & SOCIAL: Emotional responding

A26 - Neural representations of faces are widely distributed and highly individualized

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There is a historical assumption that our brains are a modular system— where discrete areas handle particular aspects of processing, with perhaps the most famous example being the FFA (fusiform face area) for face processing (Kanwisher & Yovel, 2006). While there is no doubt that certain areas are involved in face processing, increasing evidence suggests that face processing relies on distributed cortical networks beyond traditional face-selective regions (Cox & Rogers, 2021; Nestor et al., 2011). In this work, we gathered neural representations for a set of highly controlled faces, places, and objects from 17 people in a slow event-related functional

MRI design. Using a multivariate decoding technique called Iterated LASSO, we found— separately for each participant, and across two scans per person— anatomically distributed patterns of voxels that reliably distinguish stimulus categories. We used these signal-carrying voxels as candidate stimulation areas in a transcranial magnetic stimulation task to examine whether brain areas outside of canonical face-processing areas causally contribute to participants' face processing. We show that (a) information about faces is encoded throughout the cortex, (b) where exactly it is encoded is variable across individuals, (c) these differences are stable over time, and (d) stimulation of these areas shows similar behavioral patterns to stimulation of established face processing areas. Together, these results suggest that neural representations of faces may be more widely distributed and individualized than previously thought.

Topic Area: EMOTION & SOCIAL: Person perception

A27 - Spatial navigation in childhood is linked to age differences in hippocampal subfield volumes

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Accurate representation in navigation relies on the hippocampus. Given spatial navigation improvements across childhood and hippocampal development during that age, we hypothesized a link between hippocampal development and the development of accurate representation of navigated environments. We examined spatial navigation ability and its relation to hippocampal subfield volumes in 33 typically developing 5-7 year-old children ($M=6.19$ years, $SD=0.55$; 13 female) who completed a virtual Morris Water Maze task. Children learned the hidden platform's location across 15 trials and were later tested on the precision by which they recalled the platform location. Hippocampal subfield volumes (subiculum, CA1-2, CA3-DG) were derived using ASHS from high-resolution structural MR images (0.4×0.4 mm² in-plane resolution). We found an age difference ($F(1,30)=8.71$, $p<.05$) in the precision of marking the platform location, with older children being more precise. Age differences were identified in hippocampal subfield volumes such that volumes of CA1-2 ($F(1, 32)= 4.97$, $p=0.03$) and CA3-DG ($F(1, 32)= 5.05$, $p=0.03$) were larger in the older compared to the younger participants. There was a significant interaction of age and CA3-DG volume such that, in younger children those with larger volumes were more precise ($F(1,28)=6.63$, $p=0.02$). A similar pattern was observed for CA1-2 volume ($F(1,28)=3.73$, $p=0.06$). Overall, this preliminary evidence suggests that the development of hippocampal subfields supports age-related differences in the representation of navigated environments.

Topic Area: EXECUTIVE PROCESSES: Development & aging

A28 - Disrupted glial-mediated synaptic refinement and lipid signaling in Fragile X syndrome

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Fragile X syndrome (FXS) is the most common inherited cause of intellectual disability and autism, resulting from mutations in the FMR1 gene that encodes fragile X mental retardation protein (FMRP). FMRP is an RNA binding protein that is known to regulate transcription in neurons; thus, studies of FMRP in FXS have focused on neurons. However, FMRP is also highly expressed in glial cells, where its role in neural development is poorly defined. To address this gap, a multi-omic approach was applied to Fmr1 knockout (KO) mice at postnatal day 7, a critical period for synaptic refinement. Single nucleus RNA sequencing of wildtype and Fmr1 KO mice revealed transcriptional changes in astrocytes, microglia, and neurons in genes that regulate phagocytosis and synaptic pruning. Consistent with these findings, Fmr1 KO mice exhibited reduced retinogeniculate synapse size, accelerated eye-specific segregation, and increased glial engulfment of synaptic material, as assessed by confocal imaging-based quantification of synapse morphology and glial colocalization with synaptic markers. To investigate the mechanisms underlying these abnormalities, computational modeling of ligand-receptor interactions showed increased predicted astrocyte-to-microglia signaling in Fmr1 KO mice via the Ephrin A (EPHA) and semaphorin pathways. Given the dependence of these pathways on membrane lipid composition, lipidomic profiling was performed which showed reduced EPHA-associated lipid species in Fmr1 KO mice that was reversed with Lovastatin. Together, these findings suggest that altered membrane composition contributes to dysregulated pruning-related signaling in FXS and highlight lipid metabolism and glial function as potential therapeutic interventions for FXS during early circuit development.

Topic Area: EXECUTIVE PROCESSES: Development &aging

A29 - Characterizing Verbal and Non-Verbal Executive Functions in Chronic Post-Stroke Aphasia

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Executive functions (EFs)— skills needed to coordinate multiple cognitive processes to achieve goals— are commonly assessed using the Berg Card Sort Task (BCST). The BCST assesses three non-verbal EF domains: inhibiting habituated responses, sustaining attention, and shifting between tasks. It's also important to index verbal EFs, especially in clinical populations with co-occurring EF and language deficits (i.e. people with aphasia; PWA). Tasks for assessing verbal EFs are scarce, though evidence suggests verbal EFs may better predict language abilities in PWA. The present study applies a recently published verbal adaptation of the BCST, the VCST, to measure verbal EFs in PWA. Thirty PWA and 19 age-matched controls completed the BCST and VCST. Exploratory principal component analysis largely confirmed a three-component structure for both tasks, corresponding to inhibition, sustained attention, and shifting. Results

further indicated that PWA had poorer inhibition and shifting than the control group on both tasks, however no differences in sustained attention were observed. Inhibition and shifting were comparable across the BCST and VCST for the control group, but only shifting correlated across the two tasks in PWA. These findings demonstrate that inhibition and shifting are impaired in PWA compared to controls, and that sustained attention is comparable across the two groups. The non-significant Group × Task interaction indicates that verbal and nonverbal executive functions are similarly impaired in PWA. Although future work should link VCST and BCST performance to language outcomes in aphasia, these results suggest the two tasks tap comparable constructs, likely reflecting a domain-general executive resource.

Topic Area: EXECUTIVE PROCESSES: Goal maintenance & switching

A30 - A Single Bout of Intermittent Hypoxia Benefits Executive Function Independent of Cardiorespiratory Fitness

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Exposure to alternating intervals of breathing normoxic and hypoxic gas (intermittent hypoxia;IH) increases cerebral blood flow (CBF) and improves oxygen extraction, changes linked to transient post-intervention enhancements in executive function (EF). However, it remains unclear whether cardiorespiratory fitness (CRF) influences the magnitude of a post-IH EF benefit. This is a salient question because individuals with higher CRF typically exhibit enhanced cerebrovascular reactivity and oxygen delivery – a distinction that may potentiate or mask the effects of IH on cortical oxygen extraction and EF performance. Here, healthy young adults (target N=36, current n=7) completed a gold-standard assessment of CRF (VO₂peak) and two randomized 60-minute interventions: (1) 12 alternating 5-min intervals of hypoxic (FiO₂=10%) and normoxic (FiO₂=20%) gas (IH-condition), and (2) continuous normoxic breathing (control). Functional near-infrared spectroscopy (fNIRS) and transcranial Doppler ultrasound (TCD) measured cortical and cerebral hemodynamics, while EF was assessed at baseline (T0), immediately post (T1), and 30 minutes post (T2) via the antisaccade task. As expected, the IH condition elicited a 3% increase in CBF and a 16% increase in deoxygenated hemoglobin, with no such changes observed in the control condition. Notably, a significant Condition × Time interaction ($p<.03$) indicated reduced antisaccade reaction times (~4%) at T2 for IH but not control; however, the magnitude of improvement was unrelated to cortical hemodynamic changes or CRF. These preliminary findings suggest that a single bout of IH elicits a transient EF benefit independent of CBF and CRF, supporting its potential as an intervention to elicit a transient “boost” to EF.

Topic Area: EXECUTIVE PROCESSES: Monitoring & inhibitory control

A31 - Effects of acoustic environment and task difficulty on children's attention and inhibitory control

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Loud acoustics in learning environments can disrupt school-aged children's attention and inhibition, with downstream consequences for academic performance. Yet, the combined effects of acoustic level and task difficulty on these critical skills remain poorly understood. This study examines the effects of both acoustic level and task difficulty on children's attention and inhibitory control using behavioral and EEG measures. Approximately 20 children (7-12 years) will complete three Go/No-Go tasks that vary in difficulty (easy; medium; hard) under three counterbalanced acoustic conditions (increases in dB and reverberation time across quiet, moderate, and loud levels). Behavioral measures of attention and inhibition include sensitivity indices (A' and d'). Children's EEG is also measured during the task using a 32-channel actiCAP with actiCHamp Plus amplifier. Preliminary behavioral analyses ($N=11$) using A' shows overall good sensitivity across conditions ($A'=0.75-0.89$). A linear mixed-effects model reveals a significant interaction between task difficulty and acoustic level ($b=-0.22$, $SE=0.07$, $p=.009$). In the easy task, sensitivity is highest in the loud condition, suggesting that increased arousal from noise may enhance attention. However, as task difficulty increases, sensitivity is higher in the quiet and moderate conditions, implying that noise may disrupt attention when cognitive demands rise. Proposed EEG analyses will examine changes in theta- and alpha-band power, particularly in the midline frontal regions. We hypothesize increases in theta power during No-Go versus Go trials, with greater increases in theta and decreases in alpha power as task demands and noise levels increase – reflecting inhibitory control and attention.

Topic Area: EXECUTIVE PROCESSES: Monitoring & inhibitory control

A32 - Preliminary Exploration of the Efficacy and Cognitive Neural Mechanisms of Group Natural Psychotherapy for Obsessive-Compulsive Disorder

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Background: Obsessive-Compulsive Disorder (OCD) is a common mental disorder that significantly impair daily life and social functioning. To explore more effective interventions for OCD, this study investigated the therapeutic efficacy of a group natural psychotherapy and its underlying cognitive neural mechanisms. Methods: Forty Chinese patients with mild-to-moderate OCD participated in an 8-week group natural psychotherapy program, consisting of 8 in-person group sessions and daily homework assignments. OCD symptoms were assessed at baseline (week 0), post-intervention (week 8), and follow-up (week 12). Inclusion criteria were: meeting DSM-5 diagnostic

criteria for OCD and aged between 18 and 60 years. Efficacy was measured using the Yale-Brown Obsessive Compulsive Scale (Y-BOCS). Cognitive function and task-state neural activity were assessed using event-related potentials (ERPs) combined with an emotional Stroop task and a stop-signal task (SST). Resting-state neural activity was recorded using fMRI. Results: Following the group intervention, patients exhibited a significant reduction in Y-BOCS scores. The response rate was 60% (24/40) at week 8 and 57.5% (23/40) at week 12, with a dropout rate of 2.5%. Regarding cognitive inhibition, patients showed significantly reduced reaction times and a decreased Stroop effect post-intervention; these cognitive changes positively correlated with symptom improvement. For behavioral inhibition, functional connectivity significantly increased between the right anterior insula and the right superior temporal gyrus, and between the right thalamus and midbrain. Changes in right thalamus-midbrain connectivity were associated with improvements in behavioral inhibition ability ($\beta=0.103$, $p=0.023$, $R^2=0.106$). Conclusion: This study demonstrates that group natural psychotherapy holds promise for improving OCD symptoms.

Topic Area: EXECUTIVE PROCESSES: Monitoring & inhibitory control

A33 - Sense of Agency as a Gate for Cognitive Control: Insights from EEG and Behaviour

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Sense of agency (SoA), the experience of controlling one's actions and their consequences, is crucial for self-representation and adaptive goal-directed behaviour, yet the mechanisms by which it shapes cognitive processing remain debated. While comparator models emphasize the role of prediction-outcome matching, Bayesian accounts propose that SoA arises from probabilistic cue integration weighted by reliability. We investigated how feedback-based manipulations of agency reliability affect preparatory investment, decision dynamics, and outcome monitoring using EEG time-frequency analysis, EZ-diffusion modelling, and thought probes. Thirty-five participants performed a calibrated colour-discrimination task under three within-subject feedback conditions varying the perceived outcome controllability: veridical feedback, self-attributed errors, and system-attributed errors. Results showed that compromised SoA impaired task performance: compared to veridical feedback, system-attributed errors elicited slower responses, lower accuracy, reduced drift rate, and longer non-decision times, while boundary separation was unchanged, ruling out a speed-accuracy trade-off. EEG revealed parallel effects: both alpha- and beta-ERD during task preparation were attenuated under reduced agency, indicating diminished attentional engagement and motor readiness. Monitoring dissociations emerged in theta: intact SoA amplified theta power for self-generated errors, whereas corrupted feedback increased theta power for action-feedback conflicts. Reward effects

were minimal. Thought probes mirrored these neural and behavioural costs. These findings demonstrate that perceived SoA dynamically modulates preparatory oscillations, decision evidence quality, and outcome monitoring. SoA thereby functions as a reliability prior guiding control allocation: reliable feedback strengthens preparatory engagement, while compromised agency triggers disengagement and adaptive monitoring, embedding comparator mechanisms within a broader Bayesian control-allocation framework.

Topic Area: EXECUTIVE PROCESSES: Monitoring & inhibitory control

A34 - Modulation of the effects of amphetamine use on inhibitory control and error monitoring by smoking

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Methamphetamine is a widely used drug of abuse and while studies have looked at differences in cognition associated with its use, there are fewer studies looking at effects when it is used in conjunction with other substances of abuse. Here, differences in inhibitory control and error monitoring were investigated in recently abstinent amphetamine users with no other drug use (non-smoking methamphetamine users, NSA), amphetamine users who also smoked (i.e., nicotine users, smoking methamphetamine users, SA), and non-smoking control participants (NSC) using an image (drug-use related or neutral) cued stop-signal task with concurrent electroencephalographic recording. Both SA and NSA groups performed worse than NSC group but only the NSA group showed significantly worse inhibitory control. For the SA group, correlation analyses showed a negative relationship between smoking frequency and both the N2 event-related potential (ERP) component amplitude and SSRT, supporting a link between smoking behavior and improved inhibitory control. For error-related effects, the SA group showed enhanced Pe ERP responses with drug-related cues, suggesting greater error awareness in high-risk contexts. Overall, the SA group showed better inhibitory control and error monitoring than the NSA group, suggesting that smoking may moderate some cognitive deficits associated with amphetamine use. These findings highlight the importance of the overall pattern of substance use when investigating the effects of amphetamine use specifically, and drug use more generally. This is particularly important given the frequent suggestion of links between drug use/addiction and inhibitory control ability.

Topic Area: EXECUTIVE PROCESSES: Monitoring & inhibitory control

A35 - The association between self-reported sleep quality, physical activity and cognition in middle-aged females

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Cognitive control is affected by neurodegenerative diseases, including Alzheimer's disease (AD). Two-thirds of AD cases are diagnosed in females, and AD-related pathology is hypothesized to be present at midlife. As such, midlife is a critical period for studying sex-specific experiences, like menopause, to help with early detection and prevention of AD and related dementias. Lifestyle factors, like physical activity and sleep quality, are key protective modifiers of midlife brain and cognitive health. However, limited studies have examined whether and how these factors may mitigate age-related decline in cognitive control in middle-aged females. This study aims to investigate the interaction between menopause status and lifestyle factors on cognitive control in middle-aged females (40–65 years). It utilizes data from the ongoing Brain Health at Midlife and Menopause (BHMM) study. BHMM is a cross-sectional study examining brain and cognitive health at midlife. Through secure online platforms, participants complete questionnaires assessing sleep quality and physical activity, followed by a neuropsychological assessment. This study includes 211 middle-aged females (mean age = 51.59). It is hypothesized that cognitive performance will correlate negatively with age and positively with sleep quality and physical activity, suggesting that lifestyle factors may buffer menopause-related cognitive decline. Furthermore, a stronger negative association between age and cognitive performance is expected in the post- compared to the pre-menopausal group, and the positive effects of sleep quality and physical activity are expected to be more pronounced in the post-menopausal group. Identifying lifestyle factors that promote cognitive resilience during midlife is crucial for early prevention strategies.

Topic Area: EXECUTIVE PROCESSES: Monitoring & inhibitory control

A36 - The (un)connected brain. A preliminary investigation of effective connectivity as a measure of mental fatigue

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Mental fatigue (MF) is omnipresent in society and can impair productivity and safety in various settings, yet its objective assessment, and our understanding of the phenomena is limited. Our aim in this pilot investigation was to evaluate if electroencephalography (EEG) measures of effective connectivity within the frontoparietal network are disrupted after a prolonged cognitive task. Data from 82 participants (40 females, 33.5±8.6y) who participated in a larger randomised crossover trial, consisting of a familiarization, intervention and control visit were used for this analysis. MF was induced using a 45 min Stroop task, while the control condition consisted of a documentary of the same duration. A 32-electrode EEG was captured during a pre/post GoNoGo task. Effective

connectivity in the theta band was estimated using directed transfer function between F3, F4, P3, and P4 electrodes, as a proxy for the frontoparietal network. ANOVA's were conducted to evaluate changes in connectivity and cognitive performance from pre to post in control and intervention conditions. Of the 24 potential connectivity directions analysed, four revealed significant interaction effects with connectivity increasing from pre- to post-test in the control but remaining stable or decreasing in the mental fatigue condition. These results mirrored the worsening of Go stimuli reaction time/accuracy and MVAS values from pre to post in the intervention group, with no specific changes to these variables in the control group. This pilot work provides initial evidence that mental fatigue impacts frontoparietal networks, and that effective connectivity may provide a useful objective marker of fatigue.

Topic Area: EXECUTIVE PROCESSES: Monitoring & inhibitory control

A37 - Adaptive Thalamocortical Gating Reconfigures Low-Dimensional Connectivity Motifs to Support Cognitive Flexibility

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Flexible cognition has been hypothesized to be supported by dynamic routing information processing across large-scale brain networks. The thalamus is a known central, integrative hub for functional brain networks in humans; however, it is unclear how it contributes to network reconfiguration. To investigate its dynamic functional connectivity, we developed and validated a task-related functional connectivity method to be able to reliably capture how task manipulations modulate thalamocortical functional connectivity. We then decomposed the estimated functional connectivity matrices into low-dimensional subspaces and discovered a set of low-dimensional thalamocortical functional connectivity motifs that are shared across different task conditions. We further found that the thalamus implements adaptive gating, dynamically reweighting thalamocortical functional connectivity within stable, low-dimensional communication backbone motifs. Across a resting-state and two independent cognitive control fMRI datasets, this architecture supports flexible behavior by remapping motif couplings rather than forming new functional networks. We found common and distinct modulation profiles for several cognitive control operations including processing the uncertainty of inputs, encoding, predication error, and enable contextually driven task-switching. Finally, we characterized these motif modulations as two complementary network operations: gain modulation, which scales the strength of existing thalamocortical motifs, and recoupling, which reconfigures their coupling structure. We found distinct thalamic activity structure that is involved in these two operations in the anterior, medial, and posterior medial thalamic nuclei. Together, these results suggest that the thalamus supports flexible cognition by adaptively gating a shared, low-rank communication backbone, allowing task-specific reconfiguration for flexible cognition.

Topic Area: EXECUTIVE PROCESSES: Other

A38 - Weather on the Mind: An Examination of the Relationship between Weather and Cognition

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Past research has found that chronic heat exposure negatively impacts cognition in older adults (Keller et al., 2005; Qian et al., 2014; Laurent et al., 2018). However, it remains unclear how smaller, day-to-day fluctuations in weather might influence everyday cognition in younger adults. The present project aims to investigate the extent to which daily weather variability affects daily cognitive variability in young populations. We are conducting a correlational, between-group study with undergraduate students examining relationships among precipitation, sunlight, temperature, and changes in executive function. Each participant completes a backward digit span task and a questionnaire assessing subjective ratings of their executive function as measures of cognition. Weather data are collected from a University of British Columbia-run weather station next to the University of British Columbia psychology building. We will analyze relationships between cognition and weather variables using multiple regression. We hypothesize that 1) higher temperatures are correlated with worse executive function, 2) more precipitation correlates with lower executive function, and 3) more sunlight correlates with better executive function. This study has three major implications. First, greater cognitive variability is often associated with worse cognitive outcomes in older adults (Gamaldo, 2015), suggesting that studying daily variability can help predict long-term cognitive change. Second, the study extends Gamaldo's (2015) findings by examining whether cognitive variability can also predict cognitive outcomes in younger, cognitively healthy populations. Finally, understanding these relationships in young populations may help identify early markers of individual differences in cognitive stability that could later indicate cognitive vulnerability in aging.

Topic Area: EXECUTIVE PROCESSES: Other

A39 - Spontaneous eye-blinks align with the updating of visual working memory

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Visual working memory (WM) maintains task-relevant sensory information but dynamically interacts with action planning. In a delayed match-to-sample task, participants encoded the orientations of two bars from lateralized positions. The upcoming motor response could be predicted only for one of the two orientations, which was also signaled by a contralateral suppression of mu and beta (~10-30 Hz) oscillatory power at centro-parietal electrodes prior to memory probe presentation. In contrast, a robust contralateral delay activity (CDA) emerged when a retro-cue indicated the orientation for which no motor code could be created in advance. This is consistent with the reliance on visuo-spatial WM content in the absence of prospective motor codes. On this basis, we further investigated whether spontaneous

eye-blinks, which occur naturally during task performance, are temporally related to these internal updating processes. Eye-blinks occurring after the cue and prior to the first memory probe were used as time-locking events. Remarkably, CDA-like lateralized activity reappeared as a phasic posterior asymmetry shortly after the blink. The effect was comparable in strength to that observed in the stimulus-locked analyses. This pattern suggests that spontaneous blinks are more likely to occur at moments of representational updating or refocusing within WM, rather than being purely random physiological events. Because blinks are easy to detect and occur continuously, they might provide a promising behavioral marker for tracking WM processes, especially in more naturalistic experimental contexts without repetitive trial structures.

Topic Area: EXECUTIVE PROCESSES: Working memory

A40 - Neurophysiological mechanisms of math anxiety and working memory: An ERP study

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Math anxiety can impair cognitive performance, but the neural mechanisms underlying this interference remain unclear. We examined the neurophysiological mechanisms of math anxiety during a delayed match-to-sample paradigm using event-related potentials (ERPs). Forty-four undergraduate participants were categorized into high and low math-anxiety groups using the short Mathematics Anxiety Rating Scale. Participants verified arithmetic equations of varying difficulty, and then performed a working memory task while their brain activity was recorded. ERPs were time-locked to the onset of the target number in the working memory task. The low-anxiety group demonstrated better accuracy in both arithmetic and working memory tasks but showed larger reaction time costs for complex equations, suggesting a speed-accuracy trade-off. ERP analysis focused on fronto-central electrodes and revealed three distinct processing stages affected by math anxiety. Compared to low-anxious participants, high-anxious participants showed reduced P2 (160–240 ms) sensitivity to equation difficulty and heightened N2 (240–300 ms) amplitudes for difficult equations. Additionally, high-anxious individuals showed more pronounced difficulty-related P3b (300–360 ms) decreases. These findings reveal a cascading effect of math anxiety on neural processes: reduced attention to stimulus properties (P2), followed by heightened conflict detection (N2), and diminished resource allocation for memory operations (P3b). Math anxiety thus disrupts multiple stages of information processing, explaining performance deficits in mathematical contexts. Our results provide novel insights into the neurocognitive mechanisms of math anxiety and suggest potential targets for interventions to mitigate its negative effects.

Topic Area: EXECUTIVE PROCESSES: Working memory

A41 - The Spark of Memory: When a Neuron Whispers, I Remember

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How does the brain link one moment to the next? Although cortical neurons respond rapidly to stimulation, it remains unclear whether a single activation leaves a short-lived intracellular “residue” that later influences subsequent activity. This project investigates whether individual cortical neurons retain fast, measurable traces of recent stimulation, functional signatures that could represent one of the smallest building blocks of time-binding in neural systems. To examine this, we combine high-resolution calcium imaging with rapid early-gene expression analysis. Using GCaMP-based fluorescence and confocal microscopy, we track intracellular calcium dynamics following controlled stimulation and quantify whether a detectable after-signal lingers beyond the immediate response window. Additionally, we perform qRT-PCR on established immediate-early genes like c-fos and Arc to determine whether molecular markers of recent activation display similar short-interval changes. Together, these approaches allow us to analyze both fast biochemical events and early transcriptional events associated with neuronal activity. Our analysis compares responses across brief delay intervals in both isolated neurons and small network cultures. To organize these effects, we utilize two quantitative measures: a Residual Response Index capturing changes in calcium decay dynamics, and a Calcium Residue Index describing post-stimulus persistence. Evidence of even a subtle, rapid residue supports the hypothesis that cortical neurons possess intrinsic mechanisms for linking closely spaced events, providing insight into how the brain organizes continuous experience. This work contributes to broader efforts to understand neural plasticity, time-binding, and memory feedback.

Topic Area: EXECUTIVE PROCESSES: Working memory

A42 - Neural differentiation during rapid auditory processing supports infant language learning

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Targeted acoustic intervention during early infancy, from 4 to 7 months of age, enhances rapid auditory processing (RAP) skills essential for learning language. RAP is the ability to detect and process subtle sequential differences in sound and is critical for establishing phonological frameworks. Dense-array electroencephalography has identified underlying temporal processing enhancement in 7-month-old infants following the intervention (e.g. reduced latency in sensory and discriminatory processing). Through beamformer source reconstruction, using age-appropriate infant head models, we now investigate cortical maturation and experience-related plasticity in the spatial domain. We hypothesized that at 4 months of age, typically developing infants require widespread recruitment of brain areas for RAP, whereas at 7 months of age, a more spatially defined acoustic

map emerges. We additionally hypothesized that this spatial specialization is further enhanced in infants who receive the intervention. The spread of significant regions contributing to auditory stimuli detection, discrimination, and additional pre-attentive processing was quantified for 4- and 7-month intervention infants (n=30) and 7-month cross-sectional naïve controls (n=27). As expected, we observed reduced neural recruitment from 4 to 7 months of age, along with an enhancement of this trajectory by the intervention. This suggests differentiation and specialization of RAP activity patterns with age and intervention, contributing to the inverted U-shaped trend of modular organization across the lifespan. The increased efficiency demonstrated in infants who received the intervention promotes its use in supporting early brain development. Sophisticated neural recording and analysis techniques expand developmental research, promoting methods to assess experience-related plasticity during this sensitive period.

Topic Area: LANGUAGE: Development & aging

A43 - Neural Signatures of Language and Cognition in Bilingual and Monolingual Children: Insights from the Meta-analyses of Pediatric Neuroimaging Studies

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Understanding the neural basis of bilingual language and cognition in children is a growing area of research. Following PRISMA guidelines, we conducted a systematic review of 26 neuroimaging studies comparing bilingual and monolingual children during linguistic and cognitive tasks. Six fMRI studies met criteria for inclusion in an exploratory coordinate-based meta-analysis. fNIRS studies were reviewed qualitatively due to insufficient statistical and methodological reporting. Meta-analytic findings revealed activation clusters in classical language regions, with notable differences based on bilinguals' age of acquisition. Specifically, comparisons between bilingual subgroups and age-matched monolinguals identified differential activation in the inferior frontal gyrus (IFG)—the only region consistently emerging across fMRI studies—as well as additional regions spanning the frontal, temporal, and parietal lobes. These patterns mirror findings from adult bilingual neuroimaging literature, suggesting developmental continuity in the recruitment of key frontal and temporal areas for language and cognitive processing. However, the limited number of studies and substantial heterogeneity in participant characteristics, task paradigms, and imaging protocols constrain generalizability. Our review underscores the need for greater methodological consistency and transparency across neuroimaging modalities to support future meta-analytic efforts and advance understanding of bilingual brain development.

Topic Area: LANGUAGE: Development & aging

A44 - Reduced Neural Tracking of Speech in Noisy Classroom Environments

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The ability to comprehend speech in everyday acoustic environments is essential for classroom learning. Although background noise is known to disrupt speech perception (Bradley & Sato, 2008), how realistic classroom acoustics influence the neural encoding of continuous speech remains unclear. In this study, 25 school-aged children (7–12 years) will listen to short excerpts from *The Story of Doctor Dolittle* while their EEG is recorded. Stories are presented in two counterbalanced conditions: quiet and noisy, with the latter containing background noise recorded from real classrooms (dB = 55 dB, Reverberation Time = 0.9 sec). Following each story, children answer comprehension questions to assess understanding. We apply a backward (decoder) model using the multivariate temporal response function (mTRF) framework to reconstruct the acoustic speech envelope from neural activity. The model's reconstruction accuracy serves as an index of how strongly the brain tracks the speech signal over time. Preliminary analyses (N = 9) revealed greater neural tracking in the quiet compared to noisy condition ($b = 1.48$, $SE = 6.20$, $p = .02$). Although not statistically significant, comprehension performance showed a similar trend, with higher accuracy in quiet ($M = 100\%$) than in noise ($M = 92\%$; $t(9) = -1.31$, $p = .22$). These findings suggest that realistic classroom noise diminishes the fidelity of neural entrainment to speech and may contribute to subtle decrements in language comprehension, highlighting the need to consider acoustic environments in both educational practice and cognitive models of speech perception.

Topic Area: LANGUAGE: Development & aging

A45 - Using Representational Similarity Analysis to Examine Print-Speech Integration in Struggling Readers Using fMRI

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The present study examines how struggling readers integrate and represent print and speech information in the brain, and whether this is related to reading ability. Prior behavioural and neuroimaging studies suggest that children with reading difficulty fail to integrate print and speech, with marked differences in cortical response to print-speech congruency. We aim to build on this existing literature by employing multivariate analyses to extract orthographic and phonologic neural representations. Here we focus on pseudoword recognition, to isolate phonological processes, allowing us to address print-speech integration with larger word-like stimuli without activating associated semantic networks. Monolingual English-speaking children ages 7 - 10 (N = 53) performed a pseudoword detection task in the auditory, visual, and audio-visual modalities during fMRI. Using

representational similarity analysis, we identified orthographic representations in the bilateral occipital lobe, right SPL, and right SFG. Phonological representations were distributed throughout the brain, notably the bilateral occipital lobe, left ITG, right IPL, right IFG, and more. We further identified patterns of activity reflecting both orthographic and phonological structure in the bilateral occipital cortex and right SFG, potentially indicating shared neural representations. Importantly, stronger phonologic representations in the left posterior STS were related to better phonemic decoding efficiency measured outside the scanner. These findings support theories of literacy acquisition in which early readers rely heavily on phonological representations, with individual differences in these representations predicting phonemic decoding efficiency. Furthermore, it highlights emerging evidence that children maintain partially shared orthographic and phonologic representations for word recognition.

Topic Area: LANGUAGE: Development & aging

A46 - How Causal Are Language-Related fMRI Activations? Evidence from Awake Direct Electro cortical Stimulation (DES)

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Activation of a common set of frontotemporal regions during any kind of language processing is a well-replicated finding and has led to the characterization of the language network. However, the extent to which these regions are causally necessary is not fully understood. For patients with tumors near language regions, intraoperative direct electrocortical stimulation (DES) during awake surgery is the key to identifying brain regions causally needed for language ability. For eight right-handed brain-tumor patients (2 females; 19–48 years) undergoing awake surgery, we located fMRI activation blobs in the language network using a variety of language localizer tasks, then did DES on these and surrounding regions to quantify causal necessity. Across 98 cortical points stimulated with DES, 50 produced language deficits (51%). Of 38 DES stimulations delivered within fMRI activation clusters, including but not limited to those within the language network, 20 caused language impairment, indicating a positive predictive value of 52.6%. Of the 50 DES-positive points, 17 lay within fMRI activation blobs, yielding 34% sensitivity. We then limited our analysis to language network regions. Thirty-five stimulation sites lay within these regions, and 13 led to deficits (37.1% positive predictive value), and 13 of 41 DES-positive points fell within language-network clusters (31.7% sensitivity). Because this analysis was restricted to the language network regions, one patient had no DES-positive sites within these regions, so the analysis included 41 rather than 50 DES-positive points. We thus found that most fMRI activation blobs are not

causally necessary, including blobs within the supposed language network.

Topic Area: LANGUAGE: Other

A47 - Simultaneous representation of multiple object-states in language is supported by left temporal theta-gamma phase-amplitude coupling

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Consider the sentence: “The chef will chop the onion, and then he will smell it.” Comprehending this requires us to represent the same onion token in multiple distinct states (Hindy et al., 2012; Solomon et al., 2015). How do we simultaneously maintain these object-states in the brain? Here, we examine one possible neural signal: left temporal theta-gamma phase-amplitude coupling (TG-PAC). TG-PAC strength increases with visual working memory load (e.g. Axmacher et al., 2010) and performance (e.g. Reinhart & Nguyen, 2019), and is thus a strong candidate mechanism for how the brain maintains distinct object-states online. We ran two EEG experiments testing this hypothesis. In Experiment 1 (N=79; aggregated across 3 prior studies), participants read sentences where the object changed substantially or minimally (“chop” vs “weigh the onion”) then was cued for retrieval (“then he will smell it.”). TG-PAC was calculated across the sentences using a Driven Auto-Regressive model (Dupré la Tour et al., 2017). We identified a left temporal cluster showing numerically greater TG-PAC for substantial change sentences, but it was not statistically significant per a cluster-based permutation test (Maris and Oostenveld, 2007). In Experiment 2 (N=40), we added a visual working memory task as a localizer to improve sensitivity for the sentence comprehension task. Within the ROI identified by our localizer, TG-PAC increased with degree of change to the sentential object ($\beta = 0.14$, $p < 0.01$). We thus conclude that maintaining multiple object-states online shares a neural process with holding objects in visual working memory: left temporal TG-PAC.

Topic Area: LANGUAGE: Other

A48 - Predictive processing of written and visual narratives in adults across the autism spectrum

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The “Visual Ease Assumption” (VEA) refers to the idea that pictures are “easier” to understand than language. This idea underlies many educational and clinical interventions for individuals with autism. However, visual advantages in single image-processing in Autism may not extend to comprehension of image sequences, like visual narratives (stories told through pictures). Comprehension relies on using story context to predict upcoming events, however, predictive abilities are shown to be affected in linguistic and visual domains in

Autism. Such differences may contribute to difficulties with narrative comprehension. Prediction can be examined through cloze probability, the expectancy of a given word or event in a story. In studies using event-related potentials (ERPs), highly predictable (“high-cloze”) words or panels elicit smaller N400 amplitudes compared to less predictable (“low-cloze”) ones. We used a cloze probability ERP paradigm to examine predictive processing in visual and linguistic narratives in 87 adults (ages 18-65, mean-age = 28, SD=14), with language and IQ scores within normal ranges. Autistic traits were measured as a continuous variable using the Autism Quotient (AQ; range = 4-44, mean = 24, SD=11). Participants with higher autistic traits showed larger differences between high- and low-cloze conditions, driven by enhanced negative amplitudes in the low-cloze condition, in both visual and linguistic conditions. These results suggest that, contrary to previous literature, predictive abilities are not impaired in Autism and they may be even more sensitive to cloze probability. Furthermore, the similar results across modalities contradict the VEA and suggest similar narrative processing mechanisms across modalities.

Topic Area: LANGUAGE: Other

A49 - When words paint fainter pictures: L2 usage and the vividness of mental imagery

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Mental imagery allows us to simulate events and experiences and plays a crucial role in language comprehension. Vividness, defined as the subjective richness and clarity of these simulations, varies across individuals and contexts. Whether mental imagery vividness decreases when processing in a non-native (L2) compared to a native (L1) language remains debated (Montero-Melis et al., 2020). Reductions in L2 vividness have been attributed either to intrinsic limitations of L2 processing or factors such as proficiency, usage, and linguistic distance (Blazhenkova et al., 2023; Hayakawa & Keysar, 2018). From a neurocognitive perspective, diminished imagery vividness in L2 may reflect weaker engagement of emotional and sensory-motor systems, together with greater reliance on executive control processes that support effortful language use. We tested these accounts by examining how L1-L2 vividness is modulated by L2 usage and L1 background in a cross-linguistic design. Fifty-eight proficient users of English (L2) with either Swedish (N = 29) or Finnish (N = 29) L1 listened to narratives in both their L1 and L2 while providing vividness ratings. L2 usage was quantified as the proportion of self-reported L2 versus L1 use (LEAP-Q questionnaire). Results revealed significantly lower vividness in L2, modulated by both L1 background and L2 usage. Finnish L1 participants showed a larger L1-L2 vividness gap, consistent with greater linguistic distance. Crucially, this gap decreased with higher L2 use across both language groups. These findings demonstrate that the degree of L2 usage is key to understanding how linguistic processing shapes the experiential quality of mental imagery.

Topic Area: LANGUAGE: Other

A50 - Frontal Eye Field in the Interaction of Reading and Attention: Exploring Functional Activation and Structural Connectivity

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Visual attentional processes are crucial to successful reading skills, with some theories of dyslexia focusing on their dysfunction. Our recent research points to oculomotor control as one attentional mechanism behind reading performance. Given the known role of the frontal-eye-field (FEF) in oculomotor control, the goals of this study were to localize a region of the FEF where reading and attention interact, and examine its connectivity. In Experiment 1, we examined FEF fMRI BOLD activation from a previous hybrid reading and attention study (Ekstrand, Neudorf, Kress & Borowsky, 2019, Cortex). An interaction, specifically in the ventrolateral portion of Brodmann's Area 6 (A6vl) in the FEF, showed that orthographic lexical processing of exception words (eg. yacht) elicited greater activation during voluntary compared to reflexive attention, whereas phonological lexical processing of pseudohomophones (eg. yawt) showed no difference, suggesting that the FEF-A6vl has orthographic visual word form sensitivity that is heightened during voluntary attention. In Experiment 2, Human Connectome Project diffusion tensor imaging data showed high communicability between the FEF-A6vl and basal ganglia (which plays a role in rhythm during syllabic processing). These connections support tract clusters which terminate in the cerebellar Crus I/II (which play roles in eye movements and semantics) and cerebral superior parietal lobule (which plays a role in attentional orienting and phonetic decoding). Taken together, this research elucidates the involvement of the FEF-A6vl in the interaction of reading and attention, informs the development of integrative models, and can guide reading interventions that target oculomotor control.

Topic Area: LANGUAGE: Other

A51 - Subcortical contributions to prediction and reward in language processing

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Language is at the core of human experience, from basic communication to artistic expression, and it has been proposed that interactions between subcortical reward mechanisms and cortical learning systems might be essential to language acquisition and learning. A number of studies have suggested that successful symbolic matching and linguistic insight activate dopaminergic reward circuits. The striatum is known to be crucial for processing of expectations and rewards or outcomes, and there is some evidence

that the ventral striatum may be involved in natural story comprehension. In the current study, we investigated the role of the striatum in sentence processing and memory as functions of predictability and prediction error. Forty healthy adults underwent fMRI scanning while making probability judgements (expected, unexpected, neither) about sentence endings. Sentences were first presented with the final word blanked out and the ending was presented 6s later. Outside the scanner, participants completed a surprise memory task. ROI analyses revealed that the ventral striatum showed significantly greater activity for highly predictive sentence frames compared to less predictive ones. It also exhibited u-shaped activity as a function of prediction error, with greatest activation for predicted endings, followed by unexpected endings, followed by neutral endings. Functional connectivity with other sub-cortical regions (dorsal striatum and hippocampus) varied with expectancy and subsequent memory. Results indicate involvement of the ventral striatum in predictive processing of language, with reward and novelty responses for fulfilled/violated predictions. This supports and extends previous evidence for the role of striatal systems in linguistic processing and memory.

Topic Area: LANGUAGE: Semantic

A52 - Sound-Shape Correspondences for Pseudowords in People with Aphasia

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Speech sounds themselves can convey certain meanings, a phenomenon referred to as sound symbolism. For example, neurologically intact people typically indicate that the pseudowords 'bouba' and 'kiki' sound rounded and pointed, respectively. Sound symbolism in people with aphasia is under-studied, but we recently reported that people with aphasia were above chance in two-alternative forced-choice tasks classifying pseudowords as sounding rounded or pointed (Dorsi et al., Poster LBA008.095 presented at the Annual Meeting of the Society for Neuroscience, 2024). Here we build on this work by comparing neurologically intact people and people with aphasia on ratings of how rounded/pointed pseudowords sound. Ten people with post-stroke aphasia (5 female, 5 male; mean age = 57) and six age-matched neurologically intact people (2 female, 4 male; mean age = 52) listened to fifty consonant-vowel-consonant-vowel pseudowords. These pseudowords were drawn from a larger stimulus set with prior rounded/pointed ratings (McCormick et al., Proceedings 37th Annual Meeting Cognitive Science Society, 2015). The pseudowords selected for the current study were chosen to range from sounding "Very Rounded" to sounding "Very Pointed". Participants rated how rounded/pointed each pseudoword sounded using a five-point scale. We found a strong correlation between the ratings from neurologically intact people and people with aphasia ($r = 0.76$, $p < .001$), indicating that the pattern of sound-symbolic shape mappings is

substantially preserved in aphasia. This offers important evidence in support of the viability of developing an aphasia rehabilitation tool based on sound symbolism.

Topic Area: LANGUAGE: Semantic

A53 - On the contributions of frontoparietal regions to false memory production irrespective of age and memoranda domain.

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False memories occur when novel information is erroneously accepted as having been previously experienced. Work has linked false memory production with heightened recruitment of cognitive control processes, mediated by frontoparietal regions, necessary for evaluating and monitoring internal memory signals relative to a novel stimulus. While false memories are ubiquitous across younger and older adults, older adults typically exhibit higher rates of false memories, irrespective of domain or task. Given these behavioral differences, it is unknown whether the cognitive and neural processes underlying false memories are common across processing domains and age groups. Using fMRI, we examined neural activity underlying false memories produced across two memory tasks – one dependent upon the perceptual processing domain and the other on the semantic processing domain – in a sample of younger and older adults. We conducted whole-brain univariate conjunction analyses to evaluate the overlap in neural activity between the two age groups and domains. Mirroring previous results found in the younger cohort (West, Dubec et al., 2025), results showed that older adults also exhibited overlapping activity within the left inferior parietal cortex, superior medial frontal lobe, and left lateral inferior frontal cortex when producing false memories. These findings replicate and expand on previous work, suggesting that these frontoparietal regions and their associated cognitive processes play a fundamental role in false memory production irrespective of domain and age. This work provides insight into the foundation of false memories and highlights the pervasive contributions of cognitive processes mediated by frontoparietal regions to false memory production.

Topic Area: LONG-TERM MEMORY: Development & aging

A54 - Everything, everywhere, not as one: A high-resolution investigation of the neural correlates of unitization in aging within the medial temporal lobe

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Unitization is a process by which the constituents of an associative pair are posited to be encoded as a single, cohesive unit rather than a set of discrete items. Unitization enhances associative memory performance compared to traditional associative encoding, and it has been argued that this is because unitization allows item processing

resources to support encoding and retrieval. This is a particularly useful strategy for older adults, as associative memory declines exist alongside relatively stable item memory capabilities in healthy aging. To this point, behavioral and neural evidence demonstrates increased recruitment of familiarity and item-based neural resources during the processing of unitized relative to non-unitized items. However, it remains unclear how unitized items directly compare to single items at the neural level. The current study employs pattern similarity analysis (PSA) to compare the neural correlates of item (single words), unitized (compound words), and non-unitized (unrelated word pairs) encoding and retrieval in a sample of healthy younger and older adults. Results suggest that, in subregions of the medial temporal lobe (MTL), unitized stimuli are processed more similarly to non-unitized stimuli than they are to single items at both encoding and retrieval. These findings suggest that, although unitization promotes integrative processing between discrete items, this does not necessarily shift their neural correlates to be more similar to that of single items than discrete pairs, and this is even the case for extremely well-unitized stimuli such as compound words.

Topic Area: LONG-TERM MEMORY: Development & aging

A55 - Frontoparietal network segregation and associative memory in aging

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Successful aging is associated with the maintenance of segregated brain networks. Measures in the frontoparietal cognitive control network (FPCN) have been identified as mechanisms supporting cognitive resilience in healthy and pathological aging. Aging is associated with changes in dopamine function, which have been linked to altered FPCN functional connectivity and are proposed to contribute to declines in associative memory in older age. We examined associations among FPCN segregation, dopamine, and associative memory in 44 cognitively unimpaired older adults (mean age=69, range 60 – 82, 24 female). Participants underwent MR-PET scanning to measure FPCN segregation (resting state) and D2/3 receptor availability ([11C]raclopride). Outside of the scanner, participants completed the Face-Name Associative Memory Exam, which is a sensitive tool for screening clinically relevant age-related decline. In our sample, women showed superior associative memory performance ($t=2.55$, $p=0.01$) and higher FPCN network segregation ($t=2.42$, $p=.02$). We tested the sensitivity of FPCN segregation to endogenous dopamine function and responsivity to dopamine augmentation (20 mg oral methylphenidate). FPCN segregation was not correlated with D2/3 receptor availability ($t=0.25$, $p=.81$) and did

not significantly change on methylphenidate relative to placebo ($t=-0.71$, $p=0.49$). However, higher FPCN segregation was associated with better associative memory ($t=2.51$, $p=.01$), and this relationship did not differ by drug condition ($t=-1.24$, $p=0.22$). Though our analyses do not support a role of dopamine, our findings link FPCN segregation with memory in aging and point to differences in FPCN segregation as a candidate mechanism underlying sex differences in associative memory.

Topic Area: LONG-TERM MEMORY: Development & aging

A56 - Exploring age-related changes in schema-based memory precision

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Evidence indicates that older adults exhibit a greater reliance on prior knowledge during memory formation, such that age differences in memory are minimized when knowledge is task relevant. Yet, how prior knowledge biases memory representations and precision in aging remains poorly understood. The present study aims to explore this question by manipulating the congruence of a study item's visual appearance with prior knowledge. Young and older adults will study everyday objects (e.g., a tomato) presented with colour overlays that are congruent (e.g., red), incongruent (e.g., blue), or nearly congruent (e.g., orange) with prior knowledge. Memory will be assessed through a colour retrieval task in which participants recall each object's colour by selecting it from a colour wheel. Memory precision / distortion will be evaluated by comparing studied and retrieved hues, with shifts toward congruent colours in nearly congruent and incongruent conditions indicating reliance on prior knowledge. We predict larger age differences in the near-congruent and incongruent conditions, with older adults showing a bias toward congruency particularly in the near-congruent condition. This would suggest that prior knowledge can distort memory representations in older adults when new information only partially aligns with existing knowledge.

Topic Area: LONG-TERM MEMORY: Development & aging

A57 - The Brain Resilience Study: Cognitive performance on a test of pattern separation is associated with cortical thickness in older adults

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Pattern separation is a neural process by which similar inputs are transformed into discrete representations and is critical for reducing interference amongst stored episodic memories. Ineffective pattern separation is hypothesized to underlie some of the early memory

impairments associated with Alzheimer's disease (AD). A well-established pattern of cortical thinning has been shown to predict the development of AD in cognitively healthy individuals. Here, we examined whether performance on a cognitive task designed to assess pattern separation was associated with the AD cortical signature. 63 older adults (Mean age = 69.74 years, 31F/32M) completed the Montreal Cognitive Assessment (MoCA), Paired Associates Learning (PAL) task, Mnemonic Similarity Task (MST), and structural T1-weighted MRI. The AD cortical thickness signature was calculated as the average cortical thickness across the medial, inferior, and temporal pole regions of the temporal lobe, angular gyrus, superior and inferior frontal lobes, superior parietal lobule, supramarginal gyrus, and precuneus. The results indicate that better performance on the MST, a task designed to assess pattern separation, was associated with greater cortical thickness ($b=0.25$, $p=.044$). Greater cortical thickness in the AD signature was also related to measures of global cognition and episodic memory, as demonstrated by higher total scores on the MoCA ($b=8.49$, $p<.001$) and better performance on the PAL task ($b=-15.09$, $p=.030$). Our findings indicate that performance on a cognitive task designed to assess pattern separation is associated with cortical thickness in brain regions vulnerable to AD-related changes, suggesting that it could be sensitive to neurodegeneration in older adults.

Topic Area: LONG-TERM MEMORY: Development & aging

A58 - REM sleep's role in emotional memory changes in middle age

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Rapid Eye Movement (REM) sleep is associated with the selective preservation of emotional, especially negative, memory in young adults. Much less is known about whether this relationship is preserved with age when both sleep and memory change. While emotional memory and REM sleep are relatively preserved with age, older adults often show a positivity bias, and a few studies have linked this shift with sleep processes. However, whether the relationship between sleep and emotional memory is preserved or changes in middle age is unknown with limited research finding mixed results. In the current study, participants (18-59 years old) were tested on their memory for the components of negative and neutral scenes after a night of sleep while undergoing EEG recording, or a typical day awake. We found that while age was associated with worse memory overall, the relative prioritization of negative compared to neutral information was preserved in middle age. However, while younger adults showed the expected positive relationship between REM sleep and negative memory, middle-aged adults' REM sleep was associated with better neutral memory. The relationship was driven by the most-positively-rated neutral scenes and no such relationship emerged with deep sleep. Together these results suggest REM sleep may begin to shift toward prioritizing positive information in middle age but that this shift

precedes the behavioral changes in emotional memory consolidation that may emerge later in life.

Topic Area: LONG-TERM MEMORY: Development & aging

A59 - A Meta-Analysis of Age-related Differences in Hippocampal Size and Navigation and Memory Abilities

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As the global population ages, understanding the neural basis of cognitive differences in healthy adults has become crucial for promoting healthy aging. Prior studies show inconsistent relationships between hippocampal volume and cognitive performance, with age-related differences in hippocampal structural integrity proposed as a potential moderator of this relationship. We conducted a systematic review and meta-analysis investigating associations between hippocampal volume and cognitive performance across adulthood. Following PRISMA guidelines, we screened 2,865 articles, identifying studies reporting quantitative associations between hippocampal volume and spatial navigation/episodic memory performance. Using random-effects meta-analysis with multilevel modeling to account for dependencies between effect sizes, we synthesized correlations across the adult lifespan. Preliminary meta-analysis revealed a significant positive correlation between hippocampal volume and cognitive performance ($r = 0.25$, 95% CI [0.18, 0.32], $p < .001$), representing a small-to-medium effect size. Heterogeneity was low ($I^2 = 24\%$), suggesting relatively consistent findings. Publication bias tests showed minimal asymmetry, with trim-and-fill analysis yielding a similar adjusted estimate ($r = 0.20$). Age moderation analysis showed a non-significant trend toward stronger correlations in older samples. Importantly, many reviewed studies reported null findings without providing sufficient statistics for inclusion, suggesting potential overestimation of the true effect and highlighting a critical reporting gap in the literature. This study provides the first comprehensive quantitative summary of hippocampal-cognitive relationships across healthy adulthood, establishing a reference for distinguishing normal aging from pathological decline. Results support a modest but reliable association between hippocampal structure and memory/navigation performance, with implications for predictive models of cognitive aging.

Topic Area: LONG-TERM MEMORY: Development & aging

A60 - Stability and Change in Autobiographical Memory Narratives

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Humans have a proclivity for storytelling. Some of the most common stories we tell are our autobiographical memories, the stories we have for our own lived experience. Memory is a remarkably malleable system though: we forget and even embellish our stories of the past

over time. Here, we examine the dynamic interplay of stability and transformation in narrative recall. In two large datasets, we use standardized human coding and natural language processing to show that what we narrate changes substantially over time. We further demonstrate that the emotionality of the event offers memory some preservation, with negative events showing greater consistency than neutral events. We then demonstrate that the way we narrative our past is remarkably consistent. We plot the trajectory of mnemonic details across memory narratives to show that memory narratives reliably begin with contextual details, progressing with details of the event itself that then taper off towards a coda of emotional reflections. Crucially, even differences in emotionality of the event do not erode the structure of story that anchors recall. This duality—malleable content within a stable form—suggests that memory is both adaptive and constrained. Flexibility in what we recall may allow us to tailor our memories to different audiences while stability in how we recall may encourage conformity to culturally shared storytelling norms. The marrying of malleable content and stable structure may be crucial for memory to facilitate social connection and meaning-making.

Topic Area: LONG-TERM MEMORY: Episodic

A61 - Cognitive Mechanisms Shaping Autobiographical Memory Specificity in Schizophrenia

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Autobiographical memory (AM) allows people to recall personal experiences, shaping identity, supporting relationships, and guiding future decisions. In schizophrenia, AM is often impaired, particularly in the specificity of recalled events. However, the mechanisms underlying these deficits remain poorly understood. This gap is especially pressing in forensic mental health populations, where impaired memory recall may be a problem. This study investigated the cognitive, clinical, and linguistic predictors of AM specificity in 53 individuals with schizophrenia detained in forensic mental health settings. Participants completed working memory and verbal fluency tasks (WAIS-IV, FAS, semantic fluency), the Autobiographical Memory Interview (AMI), the Thematic Apperception Test (TAT), and selected items from the Positive and Negative Syndrome Scale (PANSS). Results showed that working memory was a significant predictor of memory specificity, while symptom severity and linguistic features showed additional influence. Memory specificity also varied across life periods, specifically in childhood memories. These findings highlight the role of cognitive and linguistic processes in autobiographical recall within forensic schizophrenia populations, offering new insight into the mechanisms underlying memory deficits in clinical groups.

Topic Area: LONG-TERM MEMORY: Episodic

A62 - Influence of Involuntary Autobiographical Memories on Episodic Memory

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Introduction: Involuntary autobiographical memories (IAMs) are memories for personal experiences that come to mind effortlessly and without intention of their retrieval. These memories are ubiquitous, but their role in memory encoding and retrieval dynamics is far less understood than voluntary memories. IAMs are emotionally impactful, and emotion has a well-established influence on encoding. Therefore, this research investigated the influence of IAMs on one's ability to simultaneously encode incoming information. Methods: 68 undergraduate students watched positive, neutral, and negative videos and reported whether they retrieved an IAM while watching. Later, participants recalled the videos, including each video's emotional valence. Participants also provided details of their IAMs. Results: A linear mixed effects regression revealed that when participants had IAMs while watching neutral videos, they rated the videos more positively, and when participants had IAMs while watching negative videos, they rated the videos more negatively. An ordinal mixed effects regression found that overall, the more positively participants rated their IAMs, the more positively they rated the videos. There were no differences in the number of accurate or inaccurate details participants recalled according to whether they recalled an IAM during encoding. Conclusions: Experiencing an IAM while encoding neutral and negative material can influence memory for the emotional tone of the material. This effect may be related to associative network processes driven by the amygdala and hippocampal complex. Future research should validate the underlying neural correlates of this association using neuroimaging techniques.

Topic Area: LONG-TERM MEMORY: Episodic

A63 - Eye movements at encoding predict episodic memory in distinct ways for social and non-social information

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It is intuitive that we remember what we look at most directly better than what we glance at only briefly. Yet studies of associative memory, where participants are asked to remember arbitrary associations between images, show that this relationship is more complex. While eye fixations do predict item memory, associative memory is either not related to fixations or predicted by them to a limited extent. One possibility is that the eye fixations reflect multiple cognitive processes, making it challenging to find simple links between looking and remembering. To address this possibility, we compared memory for images of people whose facial expressions and body postures were informative for picture understanding (social) or not (non-social). Half the images in each set were either emotionally neutral or negative. In addition to measuring picture recognition, we used two novel eye-tracking indices: gaze binding (saccades between the target and context images) and processing complexity (fixation duration). The results replicated the emotional memory tunneling effect found in many previous studies, but also yielded two novel findings. First, social images revealed lower processing complexity and were recognized and contextualized more accurately than non-social images. Second,

gaze binding was predictive of associative memory for social, but not non-social images. Among non-social images, complexity of processing best predicted associative memory. We propose that social images are processed more efficiently than non-social images, and that associative retention depends less on the eye fixations made to the images than on the ease and the kind of information processing elicited by them.

Topic Area: LONG-TERM MEMORY: Episodic

A64 - Investigating the neural signature of individual differences in emotional episodic memory

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Most individuals will experience at least one traumatic event in their lifetime, but only some will develop PTSD. One possibility is that individual differences in memory encoding and recall account for this. In this study, we record EEG while participants complete two experiments, a trauma analog paradigm and an autobiographical memory interview. We hypothesized that increased gamma activity will uniquely characterize negative emotional memory. We found increased gamma activity during encoding of a negative event (car accident video) relative to a neutral event (windmill video), and increased gamma activity during recall of a personal negative event, relative to a positive event. These results suggest that gamma activity is a neural signature underlying negative emotional memory. Further, individual differences in the strength of this state may predict intrusions and symptoms of PTSD following a negative experience.

Topic Area: LONG-TERM MEMORY: Episodic

A65 - A meta-analysis of hippocampal indirectly targeted stimulation (HITS) effects on episodic memory

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Episodic memory is critically dependent on the hippocampal network and is frequently impaired in many clinical disorders. Hippocampal Indirectly Targeted Stimulation (HITS) is a promising, noninvasive transcranial magnetic stimulation (TMS) intervention to enhance episodic memory performance. We present a comprehensive meta-analysis of HITS effects on episodic memory, encompassing 253 statistical comparisons (effects) from 38 published studies of N = 1,009 subjects, including healthy individuals and clinical populations. Meta-regression was used to assess the overall effect of HITS on episodic memory versus tests of other cognitive abilities, as well as to assess whether effects were modulated by study design factors such as the population assessed, the memory test format, and the stimulation parameters. HITS robustly improved episodic memory overall ($P < 0.001$), with effects selective for episodic memory versus other non-memory cognitive domains. Efficacy was significantly greater

when memory performance was assessed using memory tasks sensitive to recollection, which is strongly linked to hippocampal network function, compared to recognition or other types of episodic memory tasks ($P = 0.006$). Efficacy was also significantly greater when HITS was delivered before versus after the period of memory encoding ($P < 0.001$). No serious adverse events were reported. These findings establish HITS as a safe and effective approach for episodic memory enhancement, with potential for clinical translation in memory disorders. Selectivity of effects for episodic memory generally and for recollection-format tests in particular indicates cognitive and mechanistic specificity, supporting the potential for targeted and selective neuromodulation of hippocampal networks and their associated functions.

Topic Area: LONG-TERM MEMORY: Episodic

A66 - Effects of Social Stress on Direct and Inferential Learning

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The ability to learn and integrate connected pieces of information to generate novel inferences is important for building deep, conceptual knowledge. Prior research has explored how acute stress impacts memory, but not many studies have explored how prolonged social stress affects inferential learning. To examine the effects of stress on inference, this research study utilized the Paired Associate Inference paradigm and the Trier Social Stress Task. Participants were randomly assigned to either control ($n = 28$) or stress ($n = 28$) group. Those in the stress group were told at the beginning of the session that they will present a class topic at the end of the session. Those in the control group were told that they will engage in a non-graded writing task at the end of the session. After the stress induction, participants completed a memory task where they learned overlapping pairs of images (e.g., apple-trumpet and trumpet-jacket) and were tested on direct paired images and the ability to make indirect connections (apple-jacket). We found higher levels of subjective stress and lower inference performance in the stress group compared to the control group. Participants also completed a retention test around 24 hours after the first session, and we saw a trending detrimental effect of stress on inference learning, which became more detrimental when controlling the accuracy of direct learning. In conclusion, stress negatively affects inferential ability more than it affects direct learning.

Topic Area: LONG-TERM MEMORY: Episodic

A67 - Neural mechanisms of insight: nonlinear cortical representational change with hippocampal and catecholamine engagement

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"Aha!" moments—sudden insights marked by a lasting memory trace—are central to creativity and learning, yet their mechanisms remain elusive. Our recent account proposes that "Aha!" reflects a

sharp, non-linear update of an internal model when sustained prediction errors collapse, engaging catecholaminergic systems and hippocampal encoding to boost memory (Becker & Cabeza, 2025). We tested this account in two studies using hard-to-identify Mooney images. In a preregistered online experiment, we manipulated update steepness by showing participants a series of identical images going from degraded to clear. We varied only reveal timing for the same images (late rapid reveal vs gradual reveal). The steeper (non-linear) schedule reliably increased self-reported Aha! intensity. In a separate fMRI–pupillometry study with delayed memory, trial-wise insight modulated temporal trajectories in object-selective cortex and prefrontal control regions: we found a sustained positive ramp beginning ~2 s pre-response in both temporal multivoxel pattern change and model-based representational strength, indexing a more non-linear solution update. Pupil dilation exhibited a phasic, non-linear increase in the same window, consistent with noradrenergic arousal. Univariate analyses showed Aha!-scaled responses in hippocampus and canonical catecholamine-recipient areas (SN/VTA, Nucleus Accumbens, Locus coeruleus). Finally, structural equation models indicated that steep cortical update, hippocampal responses, and catecholaminergic proxies jointly accounted for Aha! intensity, with both Aha! and hippocampus predicting insight-related better memory. Together, convergent behavioral, neural, and pupillary evidence indicates that insight reflects a non-linear solution-model update synchronized with catecholaminergic signaling and hippocampal encoding, offering a mechanistic bridge between the phenomenology of “Aha!” and its mnemonic benefits.

Topic Area: LONG-TERM MEMORY: Episodic

A68 - Retrieval Practice Drives Integration Across Related Memories: A Candidate Mechanism for the Testing Effect

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Retrieval practice may strengthen targets by integrating them with related memories, yet empirical evidence for this mechanism is limited. We tested this account of the “testing effect” (enhanced memory after retrieval practice, versus restudy) in a two-day behavioural study (N=37). Participants encoded events in which one person interacted with one object in a specific location. Importantly, “related event pairs” constituted two different events sharing an identical object and scene-type (e.g., park). Each pair was assigned to one of three within-participant conditions, with events reviewed individually: retrieval practice (reimagining the event from a face cue, with feedback), restudy (full re-exposure), or control (no review). During retrieval and restudy, participants also answered questions probing each event’s location and object category (“directly-reviewed associations”). On Day 2, we tested memory for directly-reviewed associations (assessing the “testing effect”) and examined changes in associative structure across related event pairs (assessing integration). Although retrieval and restudy yielded similar accuracy for directly-reviewed associations (both outperforming no-review control), retrieval uniquely

integrated related event pairs across multiple measures. Relative to restudy and control, retrieval promoted erroneous recombination of background details, enhanced the ability to infer links between individuals across related events, and increased co-dependence in memory for directly-reviewed associations of related events (i.e., associations were co-remembered or co-forgotten). Moreover, greater event integration predicted stronger retention of directly-reviewed associations. Results indicate that retrieval practice preferentially integrates reviewed content with related memories, suggesting that the “testing effect”, when observed, reflects not merely mnemonic enhancement, but a broader restructuring of relational memory networks.

Topic Area: LONG-TERM MEMORY: Episodic

A69 - Do Item-Context Bindings Distort Subsequent Memory for Details of the Source Context?

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The context in which we learn new information can greatly shape the content of new episodic memories. However, how newly learned content alters our memory for details of the context itself is less clear. Theories of item-context binding suggest that context representations update as new items are studied and recalled, but these theories largely focus on how this updating facilitates recall of items bound to the context. We investigated the reverse: whether the details of a spatial context in memory are updated by the items bound to it. Participants studied items bound to 4 birds-eye-view scene contexts (e.g., apartment) with 4 subsections each (e.g., bedroom, bathroom, living room and kitchen). Participants associated items to each context by dragging them into the subsection they would most likely occur. Items were selected so that some subsections were schematically linked to items more frequently than others. At test, participants drew the studied contexts, and these drawings were evaluated for the number of details. Data from 49 participants was evaluated by a separate group of over 900 raters. Data revealed that scene subsections with more associated items were drawn with greater accuracy, as they included more scene details. Moreover, subsections with no associated items were occasionally absent from drawings entirely. The precision of subsection size estimates was also impacted by the frequency manipulation, but with unexpected variability that we plan to further investigate. Results suggests that memory for the details of a context can be distorted based on whether items are bound to it.

Topic Area: LONG-TERM MEMORY: Episodic

A70 - Music-evoked memory engages similar behavioural and neurophysiological patterns in mild cognitive impairment and healthy controls

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Autobiographically salient (ABS) music engages memory processes more efficiently than familiar (FAM) music. Our prior research in healthy older adults revealed distinct neural correlates of music-evoked familiarity and recollection. Here, we tested whether similar memory-related processes occur in older adults with mild cognitive impairment (MCI). Neural responses to ABS, FAM, and unfamiliar (UFAM) music in MCI ($n = 18$, 72.2 ± 8.35 yrs, 6 F) and healthy controls (HC) ($n = 36$, 70.7 ± 6.65 yrs, 20 F) were compared. In Experiment 1, we tested whether MCI and HC differed in response times when identifying ABS, FAM, and UFAM excerpts. Both groups identified ABS the fastest (2.07 ± 0.55 s), followed by FAM (2.95 ± 1.16 s), then UFAM (3.84 ± 0.99 s), indicating faster recollection for ABS than FAM and UFAM music. In Experiment 2, we measured event-related potentials while participants listened to the same stimuli. Mean amplitudes were extracted from right frontal-central and left parietal-occipital regions of interest. Both groups showed similar neural patterns when listening to musical excerpts, though amplitude and scalp distribution varied by condition. ABS music elicited the greatest frontal positivity, consistent with self-referential and evaluative processes, while ABS and FAM elicited greater parietal positivity than UFAM excerpts, suggesting stronger retrieval and/or imagery. The MCI group exhibited larger amplitudes, possibly reflecting compensatory recruitment, yet scalp distributions remained consistent with HC. Together, behavioural and neurophysiological findings suggest that MCI adults show comparable responses to HC when listening to ABS, FAM, and UFAM music, despite cognitive impairment.

Topic Area: LONG-TERM MEMORY: Episodic

A71 - Sleep enhances haptic memory of novel objects

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Sleep is known to strengthen visual perceptual learning, but its role in non-visual perceptual learning remains largely unexplored. The present study addresses this gap by examining the effect of sleep on haptic memory for objects. We used a between-subject design in which participants were randomly assigned to either a sleep or wake condition. All participants completed training and an immediate test on a non-visual perceptual learning task, followed by a delayed test 12-hours later—after either a period of daytime wakefulness or overnight sleep. During the task, participants were blindfolded and asked to use their dominant (right) hand to learn 12 unique “Greebles,” novel 3D-printed objects that differed in the shape of their bodies and appendages. Each Greeble was introduced by name, and participants had 15 seconds to haptically explore it while describing its features. Training consisted of four consecutive learning blocks with randomized object presentation. Memory was assessed immediately and after the 12-hour delay. During test, participants completed an old/new recognition task, recalled each Greeble's name, and rated

their confidence in their responses. Results revealed that participants in the sleep condition showed a smaller decline in memory accuracy compared to those who remained awake. Our findings suggest that sleep helps preserve haptic object memory over time, extending evidence for sleep-dependent consolidation beyond the visual domain to include haptic perception of objects.

Topic Area: LONG-TERM MEMORY: Episodic

A72 - Can Machine Learning Predict Naturalistic Episodic Memory Performance?

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Episodic autobiographical memory performance varies widely across individuals, especially when recalling stressful experiences. Consistent with theories of expertise-driven schema formation, prior analyses of this dataset suggest that experience moderates memory performance under stress. However, other individual difference measures likely contribute to the complexity of this relationship. In this work-in-progress project, we employ supervised machine-learning models to investigate whether measures such as personality, risk propensity, stress mindset, subjective stress appraisal, and activity-based identity can predict episodic richness in a naturalistic autobiographical memory dataset. Participants ($N \approx 70$) provided written narratives describing “stressful, intense, or demanding” and “non-stressful” whitewater paddling events (≈ 420 memories total). Narratives were automatically scored for episodic (“internal”) and semantic (“external”) detail using a validated transformer-based classifier (van Genugten & Schacter, 2024). We are currently developing and benchmarking predictive models of episodic detail using linear (ElasticNet) and tree-based approaches (Random Forest, XGBoost), with grouped train/test/validation splits to prevent overfitting. Planned analyses include permutation- or SHAP-based feature-importance mapping, as well as exploratory theory-driven feature engineering to test whether derived variables (e.g., identity $\times$ personality) improve model performance. The expected outcome is a ranked account of which psychological and contextual features most strongly predict episodic memory performance, and an evaluation of whether such prediction is feasible in this dataset at all. This project aims to demonstrate a scalable computational framework for linking individual differences to autobiographical memory, and illustrate how machine-learning tools can complement cognitive-theory-driven models of stress, self, and memory. Preliminary model performance comparisons and feature-importance visualizations will be presented.

Topic Area: LONG-TERM MEMORY: Episodic

A73 - Hippocampal and cortical coding of relational memory types

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Classic relational memory paradigms ask generally whether two items co-occurred (i.e., paired during encoding) or whether an item was bound to some context. However, in everyday decisions, people rarely need to only recall that two items appeared together. Rather, people often care about why they appeared together and what features of their relationship were goal-(or task-) relevant. Our research focuses on this issue. With fMRI data recorded, participants encoded pairs of object words while judging how similar the two objects were along one of four relational dimensions: color, sound, touch, or price. Participants later completed two memory tests: (i) an identical/recombined recognition task, where they were shown a pair of words and asked whether it had been presented previously, and (ii) a four-alternative-forced-choice task, where participants were asked to retrieve which relation type they used to compare the words during encoding. Univariate analyses found robust subsequent memory effects in both tests overall, with hippocampal activation showing greater sensitivity to retrieval accuracy of relation-type than generic pair recognition accuracy. Representational similarity analyses (RSA) showed that relation type is represented broadly across cortex, particularly within the Frontoparietal Control Network regions. Together, these results put forth a new perspective on relational memory that better aligns with how memory is used in other cognitive functions.

Topic Area: LONG-TERM MEMORY: Episodic

A74 - Memory Without Imagery: Episodic Recall And Meta-Cognitive Performance in Individuals with Aphantasia

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Visual imagery is thought to enhance episodic memory retrieval, yet individuals with aphantasia—the inability to generate visual mental images—challenge this notion. This study examined memory performance in aphantasic individuals following immersive virtual reality (VR) experiences. Participants (N = 62; 23 aphantasic, 20 hypophantasic, 14 control, 5 hyperphantasic) explored two photorealistic VR environments for 5 minutes. Memory was assessed via free recall immediately or after a 24-hour delay. Mixed-effects analyses revealed environment was the strongest predictor of memory performance, accounting for 19-33% of variance on accuracy measures ($p < .001$). Group differences emerged with marginal to significant effects: aphantasic and hypophantasic participants differed from controls in item accuracy ($p = .038$), while hyperphantasic individuals demonstrated paradoxically lower confidence despite vivid imagery ($p = .033$). A significant three-way interaction (Group $\times$ Recall Type $\times$ Environment, $p = .024$, $\eta^2 p = .14$) revealed imagery ability groups responded differently to immediate versus delayed testing depending on environment. Critically, groups did not significantly differ in total incorrect items ($p = .738$), indicating overall accuracy is maintained despite variability during retrieval. Thus, visual imagery does not determine memory performance, as individuals with

aphantasia retrieve memories effectively under varying environmental and retrieval conditions. The three-way interaction indicates distinct encoding mechanisms across imagery phenotypes. Aphantasic individuals may achieve accurate recall through compensatory mechanisms, while hyperphantasic individuals' lower confidence suggests a dissociation between vivid phenomenology and metacognitive accuracy. Results challenge unitary accounts of episodic memory, suggesting instead multiple, dissociable memory systems adaptable to individual cognitive profiles and environmental demands.

Topic Area: LONG-TERM MEMORY: Episodic

A75 - Individual Differences in Memory Generalization

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Memory generalization is a critical process that involves linking of information across experiences and deriving new knowledge. Many tasks have been developed to measure generalization, from similarity-based generalization (such as categorization tasks) to relational generalization (such as inferring A-C, from A-B and B-C). While initially studied in distinct lines of research, recent research and theories suggest that many forms of generalization may rely on a shared mechanism. However, the extent to which different generalization tasks measure a shared process, and the degree to which is generalization dissociable from memory for specific individual experiences, has not been established. Here, we address these questions by examining performance on multiple memory and memory generalization tasks in a large-scale individual differences study (N ~ 200). Results from a confirmatory factor analysis indicate that all 8 putative generalization tasks load on a single underlying factor. Furthermore, including both putative specific memory and generalization measures (14 measures), we found a two-factor model, with generalization and specificity as two distinct factors, best characterizes the nature of performance across tasks, albeit the underlying factors were highly correlated. These findings indicate that a range of memory generalization tasks measure the same underlying ability to integrate information across experiences and that putative memory specificity and generalization task rely on dissociable cognitive processes. Further, this project facilitates future memory generalization research through shared task code and data made available to the public.

Topic Area: LONG-TERM MEMORY: Episodic

A76 - Important real-life events temporally organize our memories and dilate remembered time

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How well do people recall and temporally place the events of their own lives? We used participants' posts from the 1 Second Everyday app,

where they uploaded daily clips of their everyday lives spanning years of usage. Participants (N=50) first answered questions about 100 of their recorded memories, including when the event occurred as well as the emotionality, uniqueness, and memorability of the event. Then they ordered their memories on a timeline, using distance on the line to represent elapsed time between the posts. Finally, they provided information about important events that occurred during the time span of their app usage. When asking participants to identify memories, we found that higher emotional intensity, memorability, and uniqueness increased accuracy for when the post actually occurred. When placing their posts on a timeline, we found that if a significant life event had occurred between two posts, there was better ordering accuracy and increased temporal dilation. Our findings suggest that important life events organize our memories and dilate our subjective sense of time.

Topic Area: LONG-TERM MEMORY: Episodic

A77 - Effects of transcranial alternating current stimulation and context reinstatement on wakeful episodic memory consolidation

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Previous research has shown that the application of theta-frequency transcranial alternating current stimulation (tACS) to frontal midline brain areas during a period of wakeful rest immediately following memory encoding can boost subsequent recall (Shtoots et al., 2024). A putative mechanism for the beneficial effect of theta tACS is that it entrains neural activity conducive to awake hippocampal replay. If this is the case, it might be possible to influence which recently encoded memories benefit most from stimulation through targeted reactivation during consolidation, as has been demonstrated in prior sleep studies. In the present double-blind tACS experiment, healthy adult participants studied two sets of 30 visual objects, with each set associated with a unique video background context. After two study/test cycles of each set, participants received frontal midline theta-frequency (N=30) or sham (N=32) stimulation for 20 minutes as one of the two video contexts was played. After a 2-hour break, participants returned to complete a free recall test, followed by a four-alternative forced-choice recognition task. Contrary to expectations, neither theta stimulation nor context reinstatement yielded a significant increase in subsequent memory recall or recognition. Preliminary results from an in-progress follow-up study isolating the effect of stimulation by removing the context reinstatement factor seems to replicate this null result. Ultimately, the results of this project suggest that the effect of theta-frequency tACS on waking post-encoding memory consolidation is more difficult to capture than previously thought, and that a more robust effect could potentially emerge after sleep-dependent consolidation processes occur.

Topic Area: LONG-TERM MEMORY: Episodic

A78 - Long-term memory never turns itself off: Evidence for long-term memory potentials related to change-detection performance

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Researchers believe that our ability to detect changes in the environment across brief interruptions in view relies almost completely on the visual working memory system. Here we test an alternative view that long-term memory representations support change-detection performance. We had a group of healthy young adults perform change detection while remembering sets of colors on each trial that frequently repeated, such that proactive interference was maximized, minimizing the utility of long-term memory. Despite this, we found that the first potentials to detect changes in the human brain are those related to long-term memory mechanisms (i.e., anterior P1/FN400). The change-detection activity measured over visual cortex was weaker and later than those measured at frontal electrodes where long-term memory potentials are maximal in amplitude. Our findings demonstrate that the human brain produces electrophysiological activity consistent with the proposal that long-term memory is encoding, storing, and retrieving information during color change-detection experiments thought to isolate and measure only storage in visual working memory.

Topic Area: LONG-TERM MEMORY: Other

A79 - Medial temporal default mode network selectively encodes autobiographical visual imagery

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The human brain's capacity to imagine visual scenes from memory is thought to rely on the medial temporal subsystem of the default mode network, yet the neural codes supporting this ability remain poorly understood. We combined functional magnetic resonance imaging (fMRI) with artificial intelligence models to characterize these codes during autobiographical imagination. Fifty participants imagined re-experiencing twenty natural scenarios while undergoing fMRI, when cued by generic text prompts (e.g., party, funeral, driving, exercising). Individual scenes were modeled using Stable Diffusion to generate personalized images from verbal descriptions of the scenarios imagined, collected before participants underwent fMRI. These depictions were then transformed into image-recognition network embeddings. Representational Similarity Analysis revealed that the medial temporal default mode network encoded participant-specific representational structure of visual embeddings, even when controlling for semantic features derived from a large language model. This effect was absent in other networks and during reading without imagination, identifying the MT-DMN as a core substrate for self-generated visual scene reconstruction.

Topic Area: LONG-TERM MEMORY: Other

A80 - Depth-of-processing-like computations explain visually-evoked activity in the human medial temporal lobe

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Decades of research have shown that spontaneous visually-evoked activity in the Medial Temporal Lobe (MTL) is consequential for later memory performance. Yet, the computational basis of such visually evoked processing in the MTL remains unclear. Existing modeling work has focused on standard visual object recognition systems and their variants fine-tuned on human memory performance, without addressing how visual processing influences the strength of memory traces. In contrast, here we take a reverse-engineering approach that explicitly links a priori computational principles with neurobiological plausibility. We propose that visually evoked processing in the MTL can be understood through the lens of Craik and Lockhart's depth-of-processing hypothesis—a foundational account of the perception-to-memory interface. Drawing on recent modeling work, we used compression-based reconstruction error from autoencoders as an image-computable signature of depth-of-processing, with the idea that images with harder-to-reconstruct representations evoke greater processing in the MTL (and vice-versa). We computed reconstruction error from two autoencoders corresponding to the extrema of category decodability within the compressed code: category-agnostic and category-informed models. We analyzed single-cell intracranial MTL recordings in human participants (n=15), comprising 362 hippocampal and 446 amygdala neurons, while they passively viewed 500 real-world images spanning 50 categories. Reconstruction error yielded an interpretable, functional window onto MTL activity, revealing a robust double dissociation: category-informed reconstruction error correlated significantly only with hippocampal activity, whereas category-agnostic reconstruction error correlated significantly only with amygdala. Moreover, reconstruction error outperformed alternatives in each MTL subregion. These findings suggest depth-of-processing as an algorithmic-level account of stimulus-driven visual processing in the MTL.

Topic Area: LONG-TERM MEMORY: Other

A81 - Catastrophizing is associated with subjective, but not objective, prospective memory in treatment-seeking veterans

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Prospective memory (PM), the ability to remember and act on future intentions, is often impaired in treatment-seeking veterans. However, the specific mechanisms underlying these PM difficulties remain unclear. In this study, we used linear regressions to investigate

whether objective and self-reported PM correlates with the severity of several common comorbidities experienced by this population, including posttraumatic stress disorder (PTSD), depression, anxiety, cognitive catastrophizing, and history of traumatic brain injury (TBI). We used the Prospective Memory Concerns Questionnaire (PMCQ) to measure self-reported PM and a modified Royal Prince Alfred Prospective Memory Test (RPA) to measure objective PM. We found that cognitive catastrophizing (modified version of the post-concussion symptom catastrophizing scale) was the sole significant predictor of self-reported PM performance, whereas nothing correlated with objective PM performance. Among the PMCQ subscales, cognitive catastrophizing best predicted the Memory Concerns and Forgetting Behaviors subscales, but not Retrieval Failures. Among the cognitive catastrophizing subscales, Helplessness was the strongest predictor of PMCQ scores. These findings highlight the potential role of problematic thinking patterns, particularly helplessness, in shaping veterans' subjective experiences of prospective memory difficulties. Interventions that target catastrophic thinking may therefore alleviate perceived cognitive dysfunction, even when objective PM ability may remain intact. Overall, this study underscores the importance of distinguishing between subjective and objective PM impairments and suggests that catastrophizing represents a key psychological factor contributing to perceived memory problems in clinical veteran populations.

Topic Area: LONG-TERM MEMORY: Other

A82 - Examining the diversity of repeated events, single instances of repeated events, and unique events

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Autobiographical memory research has begun to conceptualize memories as falling along a continuum (or continua) from semantic memory (general knowledge of facts/information) to episodic memory (single events localized in time and place). Different memory types (repeated events, unique events, etc.) are thought to fall at different points along this continuum. Yet, few studies have applied the continuum perspective to investigate diversity within particular memory types. For example, are all unique events the same, or are there different types of unique events with different patterns of reliance on semantic and episodic memory? In a previous study, we used exploratory Latent Profile Analysis to answer this question for repeated events, finding three distinct types of repeated event memories. In the present study, we extend this investigation to memories of unique events and single instances of repeated events, while replicating our previous findings concerning repeated events. Across two samples (Discovery: N1 = 600, Replication: N2 = 567) we found evidence for distinct profiles across all three event types, all of which differed on participant's reliance ratings of semantic memory, a single episode, and a mixture of episodes. Follow-up analyses highlighted similarity and the use of an observer visual perspective as two key factors

associated with differences amongst the profiles in all the three memory types, across both samples. These findings shed light on the diversity within different memory types, underscoring a potentially fruitful avenue for future research and furthering the refinement of existing theories of memory.

Topic Area: LONG-TERM MEMORY: Other

A83 - Remembered but Absent Landmarks Enhance Path Integration

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Three hypotheses were evaluated to determine whether path integration, updating one's position using self-motion cues, can be facilitated by remembered but currently absent landmarks. The dominant account, exogenous resetting, assumes that familiar landmarks reduce accumulated path integration error only when they are directly perceived. In contrast, two endogenous mechanisms predict facilitation from remembered landmarks: on-path resetting, which proposes that stepping onto a remembered landmark's location yields maximal benefit, and a coupling-scaffold mechanism, in which path integration and spatial memory remain continuously coupled so that remembered environmental structure scaffolds ongoing updating. Across three immersive virtual environment experiments, participants walked a four-leg outbound path and then pointed to its origin. In Experiment 1, half of the participants previewed landmarks before each path whereas the other half never saw landmarks. In Experiment 2, participants learned landmark locations between two blocks of homing trials conducted without landmarks. In Experiment 3, participants pointed to visible landmarks between the homing blocks, eliminating the need to remember their locations. Previewing landmarks reliably enhanced homing accuracy, but walking over or near remembered landmark locations produced no additional benefit, and merely pointing to visible landmarks did not improve performance. These findings indicate that remembered landmarks facilitate path integration through ongoing memory-action coupling, supporting a more integrated framework of cue interaction during navigation.

Topic Area: LONG-TERM MEMORY: Other

A84 - Schematic prior knowledge modulates covert visual attention

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Schemas are sets of expectations built through repeated experiences of certain environments. They help us navigate the complex world around us with remarkable ease. Research suggests that schematic prior knowledge (e.g., hand soap belongs next to the sink) plays an important role in memory and overt attention over long time scales, but less is known about how schemas can direct covert attention over very short time scales (e.g., within hundreds of milliseconds). In this study, we modified an attentional orienting paradigm, which has previously

shown that object-location associations can enhance covert attention (Summerfield et al., 2006), by instead using schematic associations learned over a lifetime of experience. In an online experiment, participants (n = 50) were tasked with detecting the presence of briefly presented target objects in related scenes. While maintaining central fixation, participants were prompted with the name of a target object (e.g., soap bottle) and then shown a highly schematic everyday scene (e.g., bathroom). The target object was then superimposed on the scene for 100 ms in either a schema congruent (e.g., beside the sink) or incongruent location (e.g., on the floor) and participants responded via key press when they detected the object. As predicted, reaction times were significantly faster when objects appeared in schema congruent locations as compared to incongruent locations, suggesting that schematic prior knowledge rapidly directs covert visual attention. Broadly, these results suggest that schemas may facilitate cognition and behaviour by guiding visual attention and perception.

Topic Area: LONG-TERM MEMORY: Semantic

A85 - Disentangling exposure- and retrieval-based mechanisms of word-image associative learning through repeated recognition practice

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Repeated practice enhances explicit memory, a strategy well-known as rote learning but which has not been incorporated into neuroscience-based models of memory within the medial temporal lobe. Practice administered through forced-choice recognition memory tests allows for several learning opportunities: exposure to the item and answer choices, reactivating previously acquired knowledge for response selection, and receiving feedback about accuracy. Here, we examined memory performance for 40 novel molecule image-name associations over 12 cycles of four-alternative forced-choice (4AFC) recognition practice (60 minutes). In a first study (n=28), performance increased reliably across repetitions and was fit by a simple maximum-likelihood model with a single learning parameter that seemingly combined all facets of memory strengthening. This suggested that a substantial contribution to learning may occur during initial exposure to the image when it is presented with the correct answer and three foils, even before participants attempt to answer or receive feedback. In a second study (n=63), half the participants completed practice repetitions in a condition in which two of the foils frequently reappeared with the correct answer. These recurring foils tended to be selected despite feedback that they were incorrect, leading to slower overall learning. An updated quantitative model with these data was able to separately estimate the amount of associative learning from exposure to the image and answer options versus memory strengthening from retrieval and subsequent feedback. These findings offer a mechanistic explanation of explicit memory strengthening during repeated forced-choice recognition practice, describing learning from both passive exposure and active retrieval with feedback.

Topic Area: LONG-TERM MEMORY: Semantic

A86 - A cluster-based method for the detection of planar traveling waves in the EEG

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Recent years have seen an increasing interest in the spatiotemporal dynamics of oscillatory brain activity. Recordings at various scales have shown oscillations propagating as waves over cortical space, both at small and large scales. The most common waves observed in the EEG are planar waves, formed by a synchronized wavefront propagating in a consistent direction (e.g., posterior-anterior). These waves have been linked to diverse perceptual and cognitive measures. However, their quantification has faced challenges due to the inherently noisy EEG signal and its ambiguous spatial localization. Existing methods either employ restrictive windows of analysis (e.g., lines of electrodes) or rely on wave motifs extracted from the data. A specific algorithm for detecting planar waves is still lacking. Here, we present a comprehensive analysis pipeline for this purpose, comprising three steps: first, genuine oscillatory activity is extracted from the EEG as clusters. The spatial phase gradient is then fit using a spherical wave model. Finally, stable waves are extracted from the time-series of fits. We validate our method using simulations over a physiological range of parameters. Using a forward model, we test EEG wave detection for propagation along different pathways at the source-level. Lastly, we apply our analysis to real EEG recordings, targeting alpha oscillations during visual stimulation and at rest. In summary, our method provides a reliable algorithm for detecting planar traveling waves in the EEG. Given the emerging functional roles of traveling waves in perception and cognition, this could potentially be utilized in a wide range of future studies.

Topic Area: METHODS: Electrophysiology

A87 - Studying cognitive processes using mobile EEG in VR: studying possible artifacts and signal validation

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Event-related potentials (ERPs), measured via electroencephalography (EEG), are central to studying cognitive processes, especially attention, in cognitive neuroscience. Yet, traditional paradigms relying on static displays and minimal movement may limit ecological validity. Integrating virtual reality (VR) technologies with mobile EEG systems enables more naturalistic interaction but raises concerns about the impact of VR head-mounted displays (HMDs) on EEG signal integrity. The present study examines potential disturbances in the P3 component (ERP component related to attention) and overall EEG signal quality caused by the mechanical and electrical impact of VR HMDs on electrodes. Two HMDs (Pimax Innovation Inc., China; Meta, USA) are being tested with two EEG systems (g.tec, Austria; ANT Neuro, Netherlands). The experiment

includes two phases. In the first phase, we have evaluated how the HMD affects EEG signals by comparing the P3 waveform and EEG power spectrum during a visual oddball task across two conditions: stimuli presented on a standard computer screen versus within a VR HMD. The second phase will investigate motion artifacts using a dynamic 3D VR environment. Preliminary findings suggest similar P3 waveforms across conditions. Electrical interference from the HMD appears negligible and outside the range of interest, leaving the P3 component unaffected. While we anticipate some artifacts in mobile, dynamic testing, these are expected to be correctable through suitable preprocessing. Such an evaluation of the impact of VR headsets on EEG signal quality is critical for accurate interpretation of data in attention research employing VR-based simulations of real-world cognitive processes.

Topic Area: METHODS: Electrophysiology

A88 - NeuroVLM: A Bi-Directional Vision-Language Framework Linking Brain Activation Maps and Cognitive Functions

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Human neuroimaging studies have generated vast multimodal datasets pairing textual descriptions with spatial brain activation coordinates, yet existing approaches remain limited in bridging these modalities. We introduce NeuroVLM, a bi-directional, generative vision-language framework that unifies neuroimaging and natural language to enable both text-to-brain and brain-to-text decoding for arbitrary (non-dictionary-based) natural language text or brain images. Our NeuroVLM model integrates 27,000 coordinate-based activation maps, 27,000 neuroscience publications and 3,000 common neuroscience articles into a shared latent space. This extension implements the inverse pathway, translating neuroimages into interpretable textual, cognitive, and functional outputs. Our architecture combines a fine-tuned transformer-based language encoder with a novel 3D neuro-autoencoder that compresses activation likelihood maps into 768-dimensional embeddings. Both modalities are aligned through contrastive and reconstruction objectives, allowing accurate retrieval, decoding, and similarity-based reasoning. Training leveraged large open-access repositories including PubMed Central and Neurosynth, with ten-fold cross-validation assessing reconstruction fidelity (MSE, SSIM, Dice) and semantic retrieval. Results show that NeuroVLM-Inverse achieves decoding and ranking performance comparable to large-scale models while maintaining greater computational efficiency. Beyond methodological innovation, the system enables lesion-to-function inference, cognitive-state classification, network labeling, and a neuroscience-specific search engine linking patient scans to literature. By bridging natural language, brain representations, and large-scale data, NeuroVLM-Inverse advances toward interpretable, accessible, and clinically relevant brain-language alignment, offering a step toward the next generation of cognitive and computational neuroscience tools.

Topic Area: METHODS: Neuroimaging

A89 - What effect sizes can we expect in functional neuroimaging?

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Emerging reports suggest that sample sizes commonly used in functional neuroimaging studies may be too small to detect many brain-behavior relationships, posing a major barrier to progress in brain and mental health research. Determining adequate sample sizes requires knowledge of what effect sizes to expect a priori, yet this is notoriously difficult to estimate in practice, leading researchers to rely on ad hoc assumptions and study planning procedures. To address this problem, we performed 63 effect size analyses in seven large, publicly available datasets ($n = 100\text{--}40,000$; 52,979 total participants) to obtain effect size estimates for 'typical' fMRI study designs. These included brain-behavior correlations, one-sample t-tests, two-sample t-tests, and multivariate versions of each test for functional connectivity and task-based activation maps. We then developed a principled approach to estimate the "true" population effect size distributions across the brain for these common fMRI study designs. We found that between-subject effects were exceedingly small at the majority of brain areas, requiring sample sizes beyond typical consortia ($n > 5,000$; 80% power) to detect even the largest voxel- or edge-level effects. However, multivariate analyses and within-subject task designs yielded substantially larger effect sizes that can be detected at sample sizes within reach of most labs ($n < 25\text{--}50$). By establishing data-driven effect size benchmarks, these findings lay the groundwork for more informed study planning in neuroscience and further contextualize shared challenges facing high-dimensional biomedical research.

Topic Area: METHODS: Neuroimaging

A90 - The Impact of Age on the Cortical Excitatory/Inhibitory Ratio Across the Lifespan

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The balance of excitatory and inhibitory neural activity, the so-called E/I ratio, is thought to be critical for normal neural functioning. Prior human work has primarily focused on changes that occur during early development, with some reports linking changes in the E/I ratio to cognitive development. Despite this, variations in regional E/I ratios across the lifespan remain unknown. Herein, we aimed to address this using a large, lifespan sample of 883 healthy participants ($F = 446$, ages 8-87). The Schaefer-400 atlas was used to extract regional data from resting-state fMRI scans, which were then used to calculate the Hurst exponent (reflective of the inverse of E/I ratio) per region. Regions were then grouped according to network membership and generalized additive models were run using age as a predictor for network E/I ratio. A smoothed term for age was included in the models to assess nonlinearity. Results showed that each network exhibited increases in the E/I ratio with age. Specific similarities included three patterns with: 1) steeper increases in early development until ~30 years followed by a plateau throughout aging, seen in the somatomotor and limbic networks; 2) steeper increases until ~30 years followed by more gradual increases, seen in the visual and dorsal attention networks; and 3) more consistent increases, seen in the ventral attention, executive functioning, and default mode networks. While prior literature has focused on early development, these findings add novel insights into E/I ratio trajectories across the lifespan on a network level.

Topic Area: METHODS: Neuroimaging

A91 - Heterogeneity of Thalamus-Default Mode Network Connectivity in Schizophrenia

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Schizophrenia has increasingly been recognized as a heterogeneous disorder. However, most functional connectivity (FC) studies have focused on mean group differences relative to healthy controls. In this study, we quantified pattern similarity between subject-specific thalamus-to-default mode network (DMN) connectivity profiles and group-level templates to examine the individual-level organization of thalamic connectivity, thereby complementing traditional mean-based FC analyses in schizophrenia. We used preprocessed COBRE resting-state fMRI data (Figshare). We contrasted 74 healthy controls (HC) with 72 patients with schizophrenia (SZ) by modeling mean thalamus-to-DMN functional connectivity (FC) as the dependent variable, group (HC vs. SZ) as a between-subject factor, and hemisphere (left vs. right thalamus) as a within-subject factor in a linear mixed-effects model. We calculated pattern similarity separately for each hemisphere by computing the correlation coefficient between each subject's connectivity vector and the corresponding group-level template; to reduce circularity, templates were computed in a leave-one-out manner. We also assessed inter-individual heterogeneity in pattern similarity using Levene's test for equality of variance between groups. Mean thalamus-DMN FC did not differ significantly between HC and SZ ($p=0.787$), although a main effect of hemisphere was observed ($p=0.022$), with no group-by-hemisphere interaction

($p=0.412$). In contrast, SZ showed a statistically significant reduction in thalamus–DMN pattern similarity relative to HC (LOO + Fisher z : $p=0.000402$), with no significant group-by-hemisphere interaction ($p=0.368$). SZ also demonstrated increased inter-individual heterogeneity in pattern similarity, especially in the right hemisphere (Levene: left $p = 0.0118$; right $p=0.000004$), suggesting that group-average connectivity patterns may poorly represent individual thalamus–DMN organization in schizophrenia.

Topic Area: METHODS: Neuroimaging

A92 - Reproducibility Crisis in Functional Connectivity Analyses of EEG and MEG: An Approach to Reduce False Connectivity Findings

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The reproducibility crisis in neuroscience has exposed fundamental limitations in functional connectivity (FC) analyses of electroencephalography and magnetoencephalography data. FC aims to quantify interactions among brain regions but is confounded by signal mixing and spatial spread, producing spurious zero-lag phase relationships and inflated false positive FC findings. Source reconstruction using inverse solutions partially mitigates these effects, but source leakage remains pervasive and can generate false connectivity even between distant regions. We evaluated how different inverse modeling approaches affect FC accuracy when ground truth is known. Using the SimMEEG framework, realistic EEG datasets were simulated with known source connectivity. Inverse modeling was performed using common single-source inverse solutions (e.g., LCMV, MNE, SLORETA) and a multisource beamformer designed to reduce source mixing. Localization and FC performances of inverse solutions were assessed using multiple metrics, including source localization and orientation errors, waveform reconstruction error, and FC detection accuracy. Because true source-level FC connectivity were simulated and thus known, true-positive and false-positive FC detection rates were compared across inverse solutions. Results showed that multisource beamforming consistently outperformed all single-source inverse solutions. It achieved very high localization accuracy with minimal false-positive localizations. It also had the highest sensitivity and specificity for FC detection. In contrast, single-source inverse solutions exhibited substantial source leakage and high false-positive FC detections, even when non-zero-lag measures were applied. These findings demonstrate that unresolved source leakage is a critical contributor to finding false FCs and that multisource beamforming offers a potential solution for improving reliability and reproducibility among FC studies.

Topic Area: METHODS: Neuroimaging

A93 - Validation of SpAM for product packaging: a comparative analysis with PRaM

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Similarity is considered fundamental to basic cognitive processes such as classification and generalization in object recognition. In marketing, perceived similarity influences categorization memory and consumer decision making, supporting market segmentation and competitive positioning. The Pairwise Rating Method (PRaM) measures similarity by presenting two items side-by-side for Likert-scale evaluation, producing precise data but becoming increasingly time-consuming as the number of stimuli increases. This study evaluates whether the Spatial Arrangement Method (SpAM) can be effectively applied in marketing research, where it presents all stimuli simultaneously and captures perceived similarity from participants' spatial arrangements. This approach is expected to reduce task duration and participant fatigue while still generating valid similarity data for marketing-relevant insights. Sixteen green tea package images will be used, standardized in size and background. In PRaM, image pairs will be shown in random order and rated for similarity (1 = very different, 7 = very similar). In SpAM, free spatial arrangement will be recorded and inter-item distances will be converted to dissimilarity values. Similarity data from both methods will be analyzed using two-dimensional Multidimensional Scaling (MDS). Procrustes analysis will quantify the correspondence between the two spatial configurations, and permutation testing will evaluate the statistical significance of the disparity metric. We expect small Procrustes disparity and the emergence of similar clusters related to product features such as brand or package color. If confirmed, these results would indicate that SpAM offers a more efficient yet valid alternative to traditional pairwise similarity assessment methods in marketing research.

Topic Area: METHODS: Other

A94 - A proof-of-concept (POC) study for using Phybrata sensing for assessing sensory reweighting and cognitive associations in neurodivergent youth

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Background: Postural control (PC) differs in neurodivergent youth and is linked to their complex cognitive, motor, and behavioral profiles. Sensory reweighting —the brain's dynamic integration of visual, vestibular, and proprioceptive inputs based on reliability—is a key component of PC. PC is commonly assessed with traditional methods in special-needs settings for progress monitoring. Aims: This proof-of-concept study leverages a novel, practical, non-invasive method - phybrata sensing (physiological vibration acceleration) - to quantify relationships among sensory reweighting, brain activity, and cognitive ability across key developmental stages. Methods. 30 children and adolescents will complete cognitive (WASI-II), attentional (CPT-3), and motor coordination (BOT-2) measures. Sensory reweighting will be

assessed with phybrata sensing for four 1-minute standing conditions: eyes open on hard floor, eyes closed on hard floor, eyes open on soft floor and eyes closed on soft floor. EEG activity will be recorded from 10 regions implicated in vestibular/somatosensory processing. Results: In pilot data from four neurotypical adults, EC conditions showed higher 0.1–0.5 Hz power in phybrata-derived power spectral density (PSD) than their respective EO conditions across both surfaces, consistent with increased vestibular weighting when visual and/or proprioceptive cues are less reliable. In EEG-derived PSD, posterior alpha was lower in EC than EO for both surfaces, indicating occipital-parietal alpha desynchronization during visual deprivation. Discussion: Findings support phybrata sensing as a practical, sensitive measure of sensory reweighting that aligns with sensory-specific neural activity. Within an integrated developmental framework, phybrata sensing has potential to improve assessment protocols for professionals working with neurodivergent youth.

Topic Area: METHODS: Other

A95 - Reimagining the Measurement of Mental Imagery

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Mental imagery has been studied in conjunction with a variety of cognitive processes, including memory, creativity, and spatial thinking, and has important implications in clinical psychology. Nevertheless, it remains difficult to quantify. Currently, most measures of mental imagery, such as the Vividness of Visual Imagery Questionnaire (VVIQ) and Plymouth Sensory Imagery Questionnaire (PSIQ), ask participants to self-report their mental imagery vividness. However, outdated language and ambiguity in prompts can limit their usefulness as measures, especially if participants are unclear on what vividness means. This project aims to develop a novel measure of mental imagery through two phases of study. First, we are investigating how the prompt characteristics, specifically the number of details and level of novelty/familiarity, impact perceived vividness ratings. This will inform future attempts at creating mental imagery survey measures and tasks eliciting mental visualization. Second, we have developed the Mental Imagery Tuning Task (MITT), a new interactive online tool that measures and depicts mental images. It allows participants to select an image to approximate their visualization, and to adjust its saturation, contrast, blur, and opacity so that it matches their internal mental image as closely as possible. In addition to utilizing technology to provide an alternative measure, the MITT outputs image files depicting perceived vividness, providing an opportunity to visually compare internal experiences that can be difficult to verbally describe. Preliminary results (N=22) show a statistically significant correlation between VVIQ and MITT scores ($r=.47$, $p=.03$). An investigation of reliability and validity is planned.

Topic Area: METHODS: Other

A96 - Beyond the Test Room: Performance Validity Tests and Real-World Functioning

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Background: Ecological validity in neuropsychological testing refers to the extent to which a test's performance predicts real-world functioning, a commonly accepted focus on the inferences drawn from test results rather than the test itself. Despite the widespread clinical and forensic use of Performance Validity Tests (PVTs) to assess performance credibility, their relationship to real-world functioning remains poorly understood. Much of the existing research relies on simulated feigning paradigms, which do not adequately reflect real patient contexts. As a result, PVTs are frequently validated using other neuropsychological measures rather than real-world outcomes. Aim: This review examines the ecological validity of commonly used PVTs and identifies gaps in functional outcome data within the literature. We hypothesized that PVTs would show limited association with real-world functioning. Method: A systematic review was conducted across clinical samples and forensic populations. Studies were examined for evidence linking PVT performance to everyday cognitive, behavioural, or functional outcomes, including daily functioning and work capacity. Results: Across studies, PVTs generally demonstrated good diagnostic accuracy in controlled simulation contexts. However, there was minimal modern evidence linking PVT scores to real-world functional outcomes, and few studies incorporated ecologically meaningful criteria. Conclusion: While PVTs inform diagnostic and treatment decisions, limited ecological validation increases the risk of misclassifying response validity and function. These findings underscore the need for future research that integrates ecologically grounded outcome measures into the validation of PVTs. Funding: This research received no external funding.

Topic Area: METHODS: Other

A97 - A no-brainer! A general education neuroscience course for non-STEM undergraduates.

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Neuroscience is pop-culture prevalent and attracts public interest. However, general field understanding is lacking, so accessible education offerings should be considered and promoted. Twenty-six Belmont University predominantly non-STEM undergraduates (22F) enrolled in general neuroscience courses. Upon entry, 100% revealed feeling scared and most mentioned interest in the topic but worried about their capacity. The course first introduced biological machinery, with labs navigating microscope images, an online c-elegan dissection, a 3-D brain and excitatory/inhibitory neural-networks. Students examined dinosaur endocasts, emphasizing cross-species challenges. Later, students probed complex systems, through online engagement with a cocaine-dosed rat, as well as a series of activities demonstrating vision, audition and movement/sensation functions.

Last, there were flipped classroom opportunities; notably one asking to create a 2-minute video on a personal neuroscience topic. Learning outcomes included examinations, laboratory submissions, active-learning questions and case-study analyses. Course average was 82.31% (SD 10.89, max 97.82, min 60). A final paper requested a reflection discussing current neuroscience knowledge and what this field means to them now. A thematic essay analysis revealed 10 themes, mostly centering around the transformation from initial anxiety to genuine engagement, and personal connections to course content. Consistently, students described feeling surprised about the field's complexity and reported that hands-on laboratory experiences reinforced abstract concepts. Interdisciplinary applications were valued, emphasizing links between neuroscience and their own field-of-study. Overall, results reveal that when neuroscience education connects abstract concepts to personal/practical experiences, it can be transformative across disciplines. Neuroscience education is approachable and should not be limited to STEM students.

Topic Area: OTHER

A98 - Discrete resting-state functional connectivity patterns predict premorbid eating attitudes in healthy adults

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Introduction: Eating disorders (EDs) and obesity are multifaceted conditions that reflect extremes of over- and under-nutrition and may cause significant life-altering complications. The individual susceptibility to potential development of EDs or obesity is determined by specific eating behaviors and attitudes toward food. Whether this behavioural vulnerability is also associated with specific neural connectivity patterns is unknown. This study aimed to investigate associations between resting-state functional connectivity (rs-FC) and nonpathological premorbid attitudes toward food in healthy adults. **Methods:** Forty-eight healthy adults (mean age = 61.79±11.07) underwent structural and functional MRI acquisitions on a 3-Tesla scanner. Eating dimensions were assessed using the Adult Eating Behaviour Questionnaire (AEBQ). The relationship between seed-based connectivity and appetitive traits derived from the AEBQ was examined with general linear model group-level inferences, focusing on brain regions involved in behavioral control and salience processing. Results were age-adjusted and familywise-corrected ($p < 0.05$ cluster-size threshold). **Results:** Overeating susceptibility was associated with stronger rs-FC between the right inferior frontal gyrus and the posterior cingulate/precuneus, as well as greater coupling between limbic/peri-limbic areas and reward-salience and prefrontal-control regions. Greater food fussiness was associated with stronger coupling between bilateral superior-frontal and prefrontal regions. Higher undereating vulnerability was associated with enhanced

connectivity between right hippocampus and left opercular-insular regions. **Conclusions:** Our findings suggest that increased rs-FC, specifically between regions involved in executive control, decision making, salience, reward evaluation and self-referential processing, predict premorbid eating attitudes toward food that may increase individual susceptibility to EDs and obesity in healthy adults.

Topic Area: OTHER

A99 - Using The Virtual Brain to probe the effects of senescence-driven alterations in neuronal firing activity on brain dynamics in Alzheimer's disease

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Cellular senescence is a distinctive change in cell state that is characterized by permanent cell cycle arrest and dramatic phenotypic changes. The senescence of neurons, termed neuronal senescence (NS), displays intimate associations with the pathology of Alzheimer's disease (AD) and is proposed to contribute to its development and progression. Critically, recent in vitro findings reveal that the induction of senescence in neurons significantly reduces their spontaneous firing rate (SFR) – suggesting a direct mechanism by which NS may contribute to altered brain dynamics in AD. Challenges in studying NS in vivo have however limited further investigation of this proposed mechanism, leaving its consequences on AD brain dynamics unclear. This study proposes a multiscale computational modelling approach to address these gaps. Specifically, it is hypothesized here that these NS-driven SFR changes will affect local excitation-inhibition balance and, consequently, result in altered brain dynamics seen in AD, such as neural slowing and functional connectivity changes. To probe this hypothesis, the brain simulation platform The Virtual Brain will be used to launch corresponding simulations both at the local, neural circuit level and the large-scale, whole-cortex level. In doing so, this approach is expected to provide novel insight into the yet examined consequences of NS-driven SFR changes on AD brain dynamics. In addition to informing on NS and its involvement in AD, the multiscale modelling approach proposed here will address growing interest in efforts to bridge insights across the field of AD research to produce more integrated and unified models of AD.

Topic Area: OTHER

A100 - Precision Aging: Profiles of Risk Related to Cognitive Impairment Among Older Adults

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Numerous factors are associated with increased risk for age-related cognitive impairment, including cardiovascular risks such as hypertension, obesity, and heart disease, as well as diabetes, inflammation, and immune dysfunction, among many others. But each factor generally explains only a small portion of the variance in

cognitive functioning, and few studies have considered combinations of risk factors in order to understand their collective impact on age-related cognitive functioning (Ryan et al. 2019, 2025). Drawing on data from 555 participants, ages 50-79, enrolled in the Precision Aging Network study (<https://precisionagingnetwork.org/>), we employed cluster analysis methods to determine profiles of factors (including genetics, blood biomarkers, medical diagnoses, and medication use) from five risk categories: cardiovascular health, glucose regulation, neuropathology, immune function, and inflammation. We identified four relatively independent clusters that reflected high risk for glucose dysregulation, immune dysfunction, neuropathology, and inflammation. Interestingly, cardiovascular risks did not cluster separately, but instead were spread relatively equally across the four high risk clusters, as well as a 'low risk' cluster with few risks relative to the other groups. Importantly, each of the high risk clusters differed from the low risk group on measures of memory, executive functions (working memory, switching inhibition), and choice reaction time, controlling for age, education, and sex. The results highlight the importance of taking an individualized approach to determining factors that impact brain aging and risk for age-related cognitive impairment, in order to develop personalized interventions that optimize brain health and cognitive health across the adult lifespan.

Topic Area: OTHER

A101 - Associations Between Longitudinal Handgrip Strength and Striatal Dopamine in Aging

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Handgrip strength (HGS) is considered an indicator of overall health and a predictor of cognitive function in old age. Emerging evidence has linked HGS to neural factors and has suggested that its relationship to cognition may result from shared age-related neural changes. However, the neural substrates of HGS remain understudied. Aging is associated with changes in striatal dopamine, which has been implicated in both motor and cognitive performance, particularly for executive function tasks. Thus, the integrity of striatal dopamine systems represents a candidate neurochemical factor underlying HGS-cognition associations in aging. We examined the relationship between striatal dopamine function and longitudinal HGS among cognitively unimpaired right-handed older adults (n=45, mean age=70.3, 25 female). Complementary analyses of longitudinal HGS data in a larger sample (n=159, mean age=70.9, 89 female) confirmed HGS decline was associated with poorer executive function as measured by the digit span test (t=2.00, p=.047). Participants completed MR-PET scanning with [18F]fluoro-L-m-tyrosine ([18F]FMT; n=31, mean age=70.1, 17 female) or [11C]raclopride (n=20, mean

age=69.4, 10 female) to assess striatal dopamine synthesis capacity or D2/3 receptor availability respectively. We found significant interaction effects of [18F]FMT x Time and [11C]raclopride x Time such that lower dopamine synthesis capacity (t=3.91, p<.001) and lower D2/3 receptor availability (t=3.12, p=.006) in the left ventral striatum were both associated with steeper HGS decline. Additionally, lower D2/3 receptor availability was associated with longitudinal increases in handgrip fatigue (t=-2.70, p=0.02). Though correlational, our analyses suggest dopamine function may be a critical factor underlying maintenance of handgrip strength in older age.

Topic Area: OTHER

A102 - Exploring the interplay between age-related hearing loss and cognitive decline through the lens of sensory and cognitive event-related potentials.

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Age-related hearing loss (ARHL) is the gradual decline in hearing ability that occurs as adults age. It is thought to be the most prevalent sensory impairment in older adults, with an estimated 63% of those over 70 experiencing deficits severe enough to impair their ability to communicate. Evidence suggests that ARHL has a multifaceted impact on long-term health, psychosocial well-being, and long-term broad cognitive outcomes in older adults. However, few studies have assessed specific cognitive function and its relationship to neural activity in response to auditory stimuli in older adults with ARHL. Auditory evoked responses were measured in 59 participants (mean age = 71.4 years, 47% female) with bilateral mild-to-moderate ARHL, using 64-channel electroencephalography. Participants underwent a pure tone audiometry test, followed by the Toronto Cognitive Assessment (TorCA). Participants completed an auditory target detection task, in which they were presented with the English consonant-vowel phonemes /ba/, /pa/ and /ta/, and asked to respond with a button press to the syllable /ta/. They then completed a word-pair semantic priming task, in which they were asked to judge the semantic relatedness of word pairs. Analysis is ongoing. Preliminary findings indicate that neural responses to speech stimuli (e.g., the P100, mismatch negativity, and P3b event-related potential components) are significantly predicted by TorCA scores and ARHL severity. Next steps will include proposing structural equation models that explore the relative contributions of ARHL and cognitive impairment to the age-related changes in neural activity and speech processing ability displayed by older adults.

Topic Area: PERCEPTION & ACTION: Audition

A103 - Pure-Tone Audiometry Fails to Predict Real-World Speech-in-Noise Perception: Insights From a Multi-Talker Spatial Attention Paradigm

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Traditional audiology assessments often fail to explain why individuals with “normal” hearing struggle to understand speech in noise. Standard measures like pure-tone averages (PTA) primarily assess peripheral sensitivity, overlooking cognitive and perceptual demands of everyday listening, and contributing to this diagnostic gap known as hidden hearing loss. We investigated whether conventional audiological metrics predict speech-in-noise (SIN) performance in 116 Veterans (ages 20–70) with hearing ranging from normal to mild–moderate loss. Participants completed PTA, self-reported hearing ability (Speech, Spatial, and Qualities of Hearing Scale; SSQ), and a novel multi-talker spatial attention task in single- and dual-talker conditions with sound separated by space. Participants pressed the spacebar when they heard a naturally embedded color word in the target story, and we extracted word hit accuracy and reaction time as measures of their speech and SIN perception. Regression analyses evaluated relationships among traditional and novel measures. Results showed that performance on the novel task correlated with validated SIN assessments, confirming its ecological validity. However, PTA did not predict perception in both quiet and noisy listening environments, underscoring its limited utility for assessing functional hearing. Interestingly, the SIN condition of our novel task predicted PTA, suggesting it may be more sensitive to individual differences in perception across listening conditions. These findings demonstrate that pure tone thresholds provide limited insight into real-world listening ability, especially under complex auditory conditions. Incorporating SIN and attention-based tasks into clinical assessments may enhance detection of functional hearing deficits and better reflect the multifaceted, dynamic nature of speech perception.

Topic Area: PERCEPTION & ACTION: Audition

A104 - Predicting Pure Tone Audiometry using Auditory Brainstem Responses to Continuous Speech

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Pure tone averages (PTA) are well established and informative measures for diagnosing major forms of hearing loss. However, the relation of PTA to real-world auditory processing, especially in complex environments, is not well established. This study aims to validate this universally standard audiological measure against an ecologically relevant, brain-based hearing loss diagnostic. Specifically, we aim to estimate the PTA of a large cohort of military Veteran participants – a population with abundant and varied hearing loss – using only their neural activity, derived from electroencephalography (EEG). To accomplish this, 109 Veterans participated in a novel spatial attention continuous speech task where they would attend to a narrative with no background noise or attend to a narrative with a spatially separate distractor story. Both narratives utilize our specially engineered chirped speech (Cheech) stimulus designed to elicit auditory brainstem responses (ABR). ABR was recorded from both target and distractor narratives. We used multiple regression models to predict PTA values using event-related potential (ERP) morphology of ABR components elicited by the Cheech stimulus. PTA values were negatively correlated with Wave V peak amplitudes across different task conditions, demonstrating that increased hearing ability (low PTA values) is directly related to greater neural activity to speech (higher Wave V amplitude) in the auditory brainstem. This relationship demonstrates the potential of neural measures from an ecologically relevant listening task to predict PTA values, providing an additional tool for clinicians to characterize real-world hearing function.

Topic Area: PERCEPTION & ACTION: Audition

A105 - Age-related Changes in Brain Connectivity: Cross-sectional and Longitudinal Effects

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Age-related changes in functional communication within and between brain networks may contribute to cognitive and behavioral decline in aging. Prior research has consistently reported declines in within-network connectivity with age, though findings on between-network connectivity change have been mixed. Most studies have relied on cross-sectional designs, making it difficult to disentangle age-related effects from confounding cohort effects. Therefore, this study utilizes both cross-sectional (between-subject) and longitudinal (within-subject) data sets and employs mixed-effects models to elucidate age-related changes in resting-state functional connectivity across eight large-scale brain networks. Using resting-state fMRI data from 60

young adults and 162 healthy older adults—including a longitudinal subsample of 48 older adults assessed approximately four years apart—we examined whole-brain within-network connectivity, between-network connectivity, and network segregation. Cross-sectional analyses showed a trend toward reduced within-network connectivity with increasing age ($p = .052$), with age $\times$ network interactions suggesting selective network vulnerability. Longitudinal analyses revealed robust within-person declines in within-network connectivity in older adults over approximately four years. Follow-up analyses identified the Salience and Frontoparietal networks as particularly vulnerable to aging. No significant age-related changes were found in between-network connectivity or network segregation.

Topic Area: PERCEPTION & ACTION: Development & aging

A106 - Parkinson's Disease impairs motor imagery performance: An oscillatory investigation

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Parkinson's Disease (PD) impairs the physical execution of action sequences. This impairment may stem in part from impaired processing of action representations, which are integral to the planning, monitoring, and execution of voluntary movement. Action representations can be investigated using motor imagery. Here we examine whether PD affects motor imagery of action sequences at the level of behaviour and neural oscillations. In particular, 20 people with PD and 20 controls completed a motor imagery task while electroencephalographic activity was recorded. Our data analysis focused on activity in the mu rhythm (8-14 Hz) as suppression in this rhythm is associated with sensorimotor network activation and the theta rhythm (3.5 - 7 Hz), which is proposed to support sensorimotor integration. The PD group was significantly less accurate when imagining action sequences as compared to controls. In the control group, successful trials were accompanied by more mu suppression. However, there were no significant differences between the two groups in overall mu activity. As compared to controls, the PD group exhibited significantly more theta oscillations over the temporo-occipital region, which may represent greater activity in the extrastriate body area. These results suggest that motor cortical regions do not support the accurate imagination of action sequences to the same extent in people with PD as compared to healthy adults. Disease-related changes to the sensorimotor network may subsequently lead people with PD to recruit additional visual regions when imagining action sequences.

Topic Area: PERCEPTION & ACTION: Motor control

A107 - Obligatory Co-opting of Motor Control by Awareness

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What is awareness good for? Nowhere has this question been more debated than in the context of volition, with some arguing that awareness has a causal (predictive) role and others favoring an interpretative (postdictive) function. This question has been difficult to answer because awareness and motor control are normally tightly intertwined. Here we used blinking as a novel paradigm to tease apart the role of awareness in volition as that motor act is readily performed under either conscious or unconscious command. The first two behavioral experiments (each $n=24$) assessed whether merely monitoring one's blinking influence that behavior by comparing video analyses of blinks' global statistics (e.g. blinking rate) and local kinematics (e.g. blinking amplitude) under spontaneous (participants are unaware of their blinks), conscious (participants report when they blink) and voluntary (participants blink at their own will) conditions. The results revealed that conscious blinks are kinematically different from spontaneous blinks but are indistinguishable from voluntary blinks. The functional convergence between conscious and voluntary blinks is not facultative: it is impervious to explicit instructions and incentives to blink spontaneously (Experiment 3) and does not habituate to multiple session repetitions (Experiment 4). Finally, two EEG experiments show that a component of a well-known electrophysiological marker of voluntary motor preparation, the readiness potential, is present in both voluntary and conscious blinks but absent in spontaneous blinks. Evidently, we cannot be passive observers of our own blinking behavior: mere awareness of that impending motor act inevitably seizes its control.

Topic Area: PERCEPTION & ACTION: Motor control

A108 - Cerebellar Cognition: Cerebellar Prediction Errors in Reinforcement and Statistical Learning

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A prominent theory of cerebellar learning posits that the cerebellum acts as an internal model for our motor system, generating predictions about action outcomes and using prediction errors to refine actions. Cerebellar circuitry associated with prediction-error-based learning has been extensively described in the motor domain. Yet, whether this function extends to non-motor learning is unclear. Here, we investigate cerebellar encoding of prediction errors in two forms of non-motor learning: reinforcement learning (RL) and statistical learning (SL). Participants executed an RL ($N = 32$) and an SL ($N = 20$) task while undergoing fMRI. During RL, participants won points by choosing between stimuli with different reward probabilities (a standard "two-

arm bandit" task). During SL, participants passively viewed a sequence of individually presented fractals, where certain fractal-fractal transitions were more likely than others. We manipulated the delay (.8s or 3s) between participant choices and reward feedback during RL and between fractal presentations during SL to test the hypothesis that cerebellar involvement would be limited to short timescales. Our results support the hypothesis that the cerebellum encodes generalized prediction errors during non-motor learning: We found evidence of reward prediction errors in Crus I/II of the human cerebellum (Trach, Ou, & McDougle, under review), closely aligning with results in model organisms. During SL, Crus I showed increased activation to surprising stimulus transitions (i.e., statistical prediction errors). These signals increased gradually with learning and were weakened with delayed feedback. These results suggest a general function of the cerebellum in predictive processing with domain-general temporal constraints.

Topic Area: PERCEPTION & ACTION: Motor control

A109 - Concurrently tracking two rhythms with eye and finger movements

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Eye-hand coordination is essential in everyday life. This suggests that the motor systems controlling ocular and manual movements may be strongly coupled. To evaluate this possibility, we investigated whether concurrent engagement of eye and finger movements was facilitated when tracking the same rhythm and disrupted (due to interference) when tracking separate (incongruent) rhythms. Participants performed a continuous visual tracking task in which they fixated on a target which appeared at a constant temporal interval at either predictable or random locations, eliciting predictive or reactive saccades. At the same time, participants synchronized their finger tapping to an auditory metronome which was either synchronized to the rhythm of the visual target or desynchronized (25% faster or slower than the visual rhythm). Participants robustly synchronized their finger tapping to the auditory metronome, maintaining their tapping rhythm regardless of its congruency with the visual rhythm. Participants also robustly synchronized their saccades to the visual rhythm. They initiated (predictive) saccades to predictable target locations at or before target onsets and initiated (reactive) saccades to random target locations with a relatively constant delay. Importantly, the timing of both predictive and reactive saccades was little affected by the concurrent rhythmic tapping regardless of its congruency with the visual rhythm. These results demonstrate that people can concurrently track two incongruent rhythms in parallel, tracking a visual rhythm with eye movements and a different auditory rhythm with finger tapping, with surprisingly little cost. This suggests the existence of partially independent timing mechanisms controlling saccades and finger tapping.

Topic Area: PERCEPTION & ACTION: Motor control

A110 - Neural and Behavioural Correlates of Audiovisual Gaze-Orienting in Common Marmosets

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Multisensory integration (MSI), the brains' ability to combine multiple senses, is critical for perception; Disrupted MSI alters decision-making, illusion susceptibility, language learning and social development. I use the common marmoset (*Callithrix jacchus*) due to their behavioural and genetic homology with humans, sharing brain organization like humans, but little is known about marmoset MSI properties. I hypothesize that marmosets MSI of audiovisual signals is localized to the superior temporal sulcus (STS), superior colliculus (SC), and ventral intraparietal area (VIP), demonstrating superadditive responses, functional connectivity (FC), and blood oxygen level dependent activity (BOLD) to multisensory stimuli. I have collected behavioral and neuroimaging data in marmosets to examine MSI's effect on signal detection, gaze-orienting, decision-making, BOLD, and FC related to MSI. Behavioural data is collected during in-cage touch-screen interaction using a custom testing platform. For imaging, I used a non-invasive MRI animal holder and custom coil built for marmoset imaging at 7T (Yazdanbakhsh et al., 2025). I recorded BOLD signal changes during a three-alternative spatial orienting task (n = 2). Subjects attended to audiovisual cues over noise while stimulus reliability, temporal synchrony, and spatial congruency were manipulated. In touch screen, subjects touch the location of the audiovisual cue after a short delay. Here, I demonstrate subject's ability to autonomously train and test on audiovisual touch screen cognitive tasks. As well, preliminary imaging data demonstrates increased activation during multisensory conditions in the SC, STS, and VIP, supporting my hypotheses regarding localization of MSI function and aligning with previous rodent and macaque findings.

Topic Area: PERCEPTION & ACTION: Multisensory

A111 - Neural State Segmentation in Naturalistic Goal-directed Activities

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Human brain activity exhibits stable patterns that shift at boundaries between events. This process has been characterized through two main approaches: (1) time-locking multivoxel pattern changes to behaviorally identified event boundaries (Nguyen et al., 2025), and (2) data-driven neural pattern shift detection (Baldassano et al., 2018; Geerligs et al., 2022). However, results from these two approaches have rarely been compared. Moreover, most studies using data-driven approaches used Hollywood-style movies, leaving open whether prior findings in neural state segmentation persist without editing. Here, we analyzed fMRI data collected while participants viewed videos of everyday activities free of cuts or camera transitions, using the Greedy

State Boundary Search algorithm (Geerligs et al., 2021). Replicating previous findings, we found longer neural states in higher-level associative regions and shorter states in lower-level sensory cortices. The range of neural states identified (20-70s) was generally longer than those reported previously, suggesting possible influences of continuity editing. In addition, regions with longer states overlapped with those identified by Nguyen and colleagues (2025) as exhibiting pattern shifts prior to behavioral event boundaries, providing converging evidence across analytical approaches. We observed alignment between neural state boundaries and behavioral event boundaries across the cortical hierarchy, with early visual, somatomotor, and medial prefrontal regions showing significant alignment for fine-level behavioral boundaries, and a near-subset of regions mostly in association cortex showing significant alignment for coarse-level boundaries. In sum, the nested hierarchical structure of brain patterns during movie viewing is present in unedited movies, and it corresponds to human subjective event boundaries.

Topic Area: PERCEPTION & ACTION: Multisensory

A112 - Audiovisual temporal synchrony modulates fast sensorimotor transformation in smooth pursuit eye movements

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Being able to respond to novel events can be adaptive, such as quickly stepping on the brakes to avoid colliding with an unexpected cyclist while driving. Interestingly, such adaptive orienting can also be reflected as a temporary inhibition of eye movements. For instance, in pursuit inhibition, as an observer smoothly tracks a moving object, their tracking velocity slows shortly after a transient stimulus is presented. Although pursuit inhibition to a multisensory transient has been shown to be more robust, whether it adheres to established rules of multisensory orienting, such as temporal synchrony, remains poorly understood. Here, we tested whether pursuit inhibition is stronger when the multisensory transient is presented simultaneously than asynchronously. Twenty-eight participants were instructed to track a slowly moving visual target on the screen while visual (a pair of Gabor strips) and/or auditory (white noise) transients occurred at unexpected times. Their eye positions were recorded using a video-based eye tracker. Results from most participants show a reliable drop in pursuit velocity around 100 ms following transient onset, which was stronger with an audiovisual transient than with visual-only or audio-only transients, replicating previous effects. This inhibitory effect seems relatively automatic, as adding a secondary task (pressing a button when a transient was presented) did not affect it. Finally, pursuit inhibition was stronger when audiovisual transients were presented simultaneously than when presented with a 150-ms lag. Our findings support the notion that pursuit inhibition is sensitive in revealing how the brain performs rapid sensorimotor transformations in a multisensory context.

Topic Area: PERCEPTION & ACTION: Multisensory

A113 - Dissociating Predictive and Postdictive Audiovisual Inference

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Our brains have the remarkable ability to use contextual information to resolve perceptual uncertainty. This reliance on context has been demonstrated when information is presented before a stimulus (supporting predictive inference) and after it (supporting postdictive inference). However, it remains unclear whether these two forms of inference rely on overlapping or distinct mechanisms. We addressed this question using an audiovisual working memory task designed to test how category-level auditory cues influence visual face perception during both preparatory attention and decision-making. On each trial, participants (N=31) briefly viewed a face morphed along a female-male continuum (100 ms) and later reconstructed it after a short retention interval (1900 ms) using a continuous morph slider. To manipulate auditory context, either a male or female voice was presented 1000 ms before (pre-cue) or after (post-cue) face onset. Mixed-effects modelling revealed that the voice cue biased face reconstructions toward the gender of the voice in both pre- and post-cue conditions. While auditory context reliably shaped visual memory reports in both a predictive and postdictive manner, these effects were not correlated within individuals, suggesting that different mechanisms may be employed. Moreover, initial evidence suggests that the effect of auditory context increases with increasing ambiguity of the visual input. We are currently expanding the sample (target N=84) to test this relationship more robustly. Taken together, our results suggest that distinct mechanisms underlie predictive and postdictive inference, each dynamically leveraging context to disambiguate visual input, especially when the fidelity of this input is low.

Topic Area: PERCEPTION & ACTION: Multisensory

A114 - Comparing cognitive modes underlying pain experience and pain empathy

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Introduction: Pain empathy involves witnessing another individual experiencing pain, and involves theory-of-mind processes. This study aimed to use functional magnetic resonance imaging (fMRI) to study the cognitive modes associated with experiencing pain and employing pain empathy. Methods: An open-source empathic pain task was analyzed, whereby 54 participants were administered pressurized pain on their finger nail, and then watched another individual experience the pain. This was crossed with cues prompting future pain or not. Constrained Principal Component Analysis for fMRI (fMRI-CPCA) was used to extract components from the fMRI data, and task-induced blood-oxygen-level-dependent (BOLD) signals were analyzed. Results: Response (RESP) mode activation (pain network) and Focus

on Visual Features (FVF) deactivation (avoid visual pain stimulus) was strong only when pain stimulation took place, for both experiencing and observing pain. In contrast, the default network (DM) showed a dissociation, activating when observing pain, but deactivating when experiencing pain, strongest when a pain stimulus was actually delivered. Discussion: The findings show a dissociation of cognitive modes, whereby RESP activates when experiencing and observing pain, FVF deactivates under the same conditions, and DM activates while observing others experiencing pain, but deactivates when experiencing pain. This confirms RESP as the pain network, FVF as deactivating when not attending to visual stimuli is beneficial, and DM involvement in engagement of theory-of-mind/mental projection.

Topic Area: PERCEPTION & ACTION: Multisensory

A115 - Investigating Leakage in Visual Perceptual Decision-Making

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Previous research demonstrates that perceptual decision-making involves integrating noisy signals over time to a threshold. Such accumulator models may include leakage - the tendency for the decision variable to decay to zero in the absence of evidence. Although behavioral and brain data during perceptual decision-making can be well accounted for without leakage, this might be linked to common choices of stimulus and task. We investigate a possible role for leakage in visual perception, introducing a novel stimulus and task context where the behavior of a human observer will vary in a predictable way if the mechanism is leaky. Each frame of our dynamic noise stimulus consists of an oriented Gabor patch rendered using error-diffusion dither, with each pixel being either black or white depending, probabilistically, on the intensity of the corresponding pixel in the original Gabor. This allows us to precisely control the rate of information delivery without changing the physical intensity. The stimulus sequence consists of 20 unique noisy renderings of the same Gabor, presented at a certain rate and at a threshold-level information intensity. The task is to identify the orientation of the Gabor from among two options: leaning left or leaning right. If the visual system is inherently leaky then a percept will form only when the rate of evidence delivery overcomes the leakage, allowing the decision variable to reach threshold. Trial-by-trial accuracy and confidence judgments both decreased significantly as the evidence update interval increased. These results demonstrate a role for leakage in visual perceptual decision making.

Topic Area: PERCEPTION & ACTION: Vision

A116 - Neural responses in the macaque inferotemporal cortex to translucent-object images

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The appearance of translucency is a key visual cue for inferring an object's material, yet the neural substrate supporting its processing remains unknown. Here, we recorded neural activity from the macaque inferotemporal (IT) cortex, spanning TEO to TE, in response to images of objects varying in translucency. Images were generated by three different methods: (i) images produced by an unsupervised generative model trained on natural object images, systematically varying in both object shape and levels of translucency (grayscale; mean luminance equalized); (ii) scrambled control images produced by randomizing pixels within each object silhouette of (i); and (iii) computer-generated (CG) images with translucent objects rendered by manipulating multiple optical parameters. We obtained human subjective ratings of transparency for each image and directly compared these ratings with macaque IT responses. Representational dissimilarity matrices (RDMs) of IT responses for model-generated images showed significant correlations with the RDM derived from human ratings and exceeded those obtained for scrambled images. Furthermore, a linear discriminant analysis (LDA) classifier trained on IT responses to model-generated images predicted human ratings and generalized to the CG-rendered images, some of whose rating values were outside the range covered by the model-generated set. Both RDM and LDA analyses suggested shape-independent coding of translucency, particularly in posterior IT. Our findings show that macaque IT population activity encodes information related to the appearance of translucency that aligns with human perception, with some sites exhibiting shape-independent responses. These patterns are neither reducible to low-level image features (e.g., mean luminance) nor contingent on image-generation methods.

Topic Area: PERCEPTION & ACTION: Vision

A117 - Neural Correlates of Visual Awareness and Unconscious Visual Processing: A Concurrent TMS-EEG Study

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Accurate discrimination of visual features (e.g., orientation) can occur even when awareness is suppressed by transcranial magnetic stimulation (TMS) of the early visual cortex, demonstrating unconscious visual processing without the phenomenal experience of perception. However, little is known about the neural dynamics underlying this TMS-induced blindsight, limiting the understanding of processes that give rise to the subjective and objective outcomes of visual perception. Our study examines the electrophysiological correlates of visual awareness and unconscious processing by measuring electroencephalography (EEG) activity during TMS-induced blindsight. On each trial, TMS is delivered to the early visual cortex to suppress awareness of an oriented stimulus. Participants report whether they saw the orientation and what the orientation was. We expect participants to respond with above-chance discrimination

accuracy even when they report not seeing the orientation, as established in previous studies. Importantly, we will compare the early, middle, and late visual-evoked potentials between conscious correct and unconscious correct trials to examine the neural correlates of visual awareness, and between unconscious correct and unconscious incorrect trials for unconscious visual processing. The findings will reveal the temporal dynamics of neural activity associated with the formation of visual awareness and will also provide insights into how TMS disrupts neural activity in early visual cortex.

Topic Area: PERCEPTION & ACTION: Vision

A118 - Alpha phase dependence of orientation adaptation revealed by a closed-loop EEG system

Ryohei Nakayama¹, Kyuto Uno¹, Kaoru Amano¹; ¹The University of Tokyo

The phase of ongoing alpha oscillations (8–13 Hz) has been suggested to correlate with perceptual detection performance, consistent with reduced cortical excitability at the alpha peak. Phase dependence has also been reported for simultaneous spatial-contrast effects in orientation perception. The present study investigated whether alpha phase modulates adaptation-induced changes in orientation perception, using a closed-loop EEG system that predicted each participant's alpha phase in real time. Individual alpha frequency (IAF) was estimated from eyes-open resting EEG collected in a prerun, which was defined as the frequency yielding maximal occipital alpha power. In each trial, a sequence of adaptor gratings tilted clockwise or counterclockwise was presented time-locked to either the alpha peak or trough. A test grating was subsequently presented likewise time-locked to the alpha peak or trough; its tilt was varied using a staircase in a two-alternative forced-choice (2AFC) judgment of clockwise versus counterclockwise tilt. Aftereffect magnitude was quantified as the shift in the test's subjective verticality. The results from twelve participants showed a significant difference in repulsive aftereffect by the adaptor's phase. No reliable effect was observed for the test's phase. These findings suggest that alpha phase influences not only instantaneous spatial interactions but also history-dependent dynamics in orientation perception.

Topic Area: PERCEPTION & ACTION: Vision

A119 - Decoding the grating position and orientation under lateral eye position using optically pumped magnetometers (OPMs)

Yuri Takaki¹ (pon9q9@g.ecc.u-tokyo.ac.jp), Ryohei Nakayama¹, Tsuda Tomoaki², Koki Yoshida², Kazunori Takahashi², Tomohiro Gomi², Sadamu Tomita², Ayumu Yamashita¹, Jiro Saikawa², Tatsuya Munaka², Kaoru Amano¹; ¹The University of Tokyo, ²Technology Research Laboratory, Shimadzu Corporation

Optically pumped magnetometers (OPMs) have recently emerged as a new class of magnetic sensors for magnetoencephalography (MEG), enabling recordings in physically unconstrained conditions and

allowing the investigation of brain activity in naturalistic environments. This technological advancement opens new possibilities for studying cognitive processes difficult to assess with conventional head-fixed SQUID-MEG. During lateral gaze, where gaze and head directions differ, higher task accuracy was reported for stimuli located toward the head direction than for a retinotopically matched but more peripheral-to-the-head stimuli. However, how head direction influences visual cortical processing at the neural level remains unclear, particularly regarding its temporal characteristics in humans, largely due to the head-fixation requirements of conventional MEG systems. To leverage the advantages for studying gaze-related modulations, we employed OPM-based MEG to record brain activity while participants viewed gratings of different positions and orientations during lateral gaze; gaze was fixed at screen center with various head directions. Multivariate pattern analysis was applied to decode stimulus position and orientation from OPM signals, and decoding accuracy was compared across head directions. The results showed that position decoding exhibited high accuracy regardless of head direction, indicating stable positional encoding. In contrast, orientation decoding was significantly above chance in most conditions, with slightly higher performance for stimuli presented near the central visual field than in the periphery, and a trend toward improved classification when the head faced the stimulus. Taken together, these findings suggest that head direction during lateral gaze may influence orientation-related neural representations, while positional encoding remains robust.

Topic Area: PERCEPTION & ACTION: Vision

A120 - The role of schemas in extrapolating beyond visual boundaries

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We sample the world through our vision and can quickly (and automatically) extrapolate beyond what is right in front of us to form a coherent, continuous understanding of a scene. This extrapolation process draws on conceptual knowledge structures or schemas to guide perceptual processing, leading an observer to remember more than what was available from the visual sample of a given scene. Boundary extension (BE) is an error in scene memory, such that participants retrieve details beyond the boundaries of a scene image, thus “extending” the view in their internal representation. Schemas inform expectations about what likely exists beyond the arbitrary boundaries of a scene image, contributing to predictive processing. To test the role of schemas in BE, participants were presented with a set of images in which there is a focal object placed within a scene that is either matched (scene-congruent) or mismatched to the scene context (scene-incongruent). BE was measured with a recognition task in which participants rated whether the view of the test scene image was the same or different than a target scene image. Participants exhibited greater BE for scene-congruent scene images, remembering additional details beyond the boundaries of the original image

compared to when the focal object was scene-incongruent. The mismatch between the focal object and surrounding context may disrupt the extrapolation process supported by schemas. These findings show that scene context can influence reconstructive processes necessary for BE.

Topic Area: PERCEPTION & ACTION: Vision

A121 - A dominant exploration-exploitation axis shapes individual differences in sequential decision-making

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People vary widely in how they make decisions under uncertainty. Although many studies use this variability to estimate differences in specific cognitive parameters, the core dimension(s) that organize individual differences in uncertain decision-making remain unclear. Here, we analyzed behavioral data from 1001 participants performing a restless three-armed bandit task in which reward probabilities changed unpredictably over time. Using a novel analytical approach that accounts for the intrinsic stochasticity of this task, we identified a dominant, nonlinear axis of individual variability. This principal axis was strongly and selectively associated with the probability of exploration, as estimated by a latent-state model. Thus, the main driver of individual differences in bandit task performance appears to be the tendency to explore versus exploit, rather than personality traits, reinforcement-learning model parameters, or simple low-level strategies. Demographic factors also predicted position along this axis: participants at the exploratory end tended to be younger, and self-identified men were overrepresented at both extremes. Together, these findings provide a principled framework for characterizing individual differences in task behavior and highlight the cognitive and demographic factors that shape decision-making under uncertainty.

Topic Area: THINKING: Decision making

A122 - Common electrophysiological dynamics of human posterior cingulate cortex engagement during memory and value based decisions

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Human neuroimaging routinely implicates distinct subregions of the posterior cingulate cortex (PCC) with specific tasks of episodic memory retrieval: while dorsal PCC (dPCC) is responsive during item-recognition decisions, the ventral PCC (vPCC) responds primarily during autobiographical retrieval. Interestingly, dPCC has also been linked to value-based decision-making, suggesting contributions of the region to processes shared by value- and memory-based decisions.

However, the timing and behavioral correlates of dPCC involvement in decision-making remain unclear. To address this question, we obtained invasive electrophysiological recordings of local field potentials (LFP) and single-neuron activity from the human PCC during temporally matched risky value- and memory-based decision-making tasks (n = 16). For both tasks, participants earned points by selecting between a fixed low-reward option and a risky high-reward option. For the value-based task, the chance of reward was indicated by a displayed probability, while for the memory-based task, the chance of reward depended on stimulus memory. Across tasks in dPCC, but not vPCC, amplitude of LFP broadband gamma (BBG; 70-150Hz) increased from trial onset through decision feedback. In contrast to LFPs, cluster analysis revealed single-neuron firing in dPCC was more temporally circumscribed, with some neurons selectively responsive during a pre-decision window, whereas others were primarily responsive post-decision. Additionally in dPCC, BBG amplitude, as well as firing rates from post-decision responsive neurons, were elevated following risky compared to safe decisions. These findings indicate a shared role for dPCC in monitoring both value- and memory-based decisions, and suggest that distinct dPCC subpopulations support specific stages of decisional processing.

Topic Area: THINKING: Decision making

A123 - Focal Human CA1 Lesion Potentiates Avoidance Behaviour During Approach-Avoidance Conflict Decision-Making

Willem Le Duc¹, Rutsuko Ito¹, Andy Lee^{1,2}; ¹University of Toronto Scarborough, ²Rotman Research Institute, Baycrest Centre, Toronto, Canada

Approach-avoidance conflict (AAC) occurs when a goal stimulus is associated with both rewarding and aversive outcomes simultaneously, and an organism must resolve competing tendencies to engage with or evade it. Rodent work has implicated the ventral hippocampus (vHPC) in resolving AAC: gross vHPC lesions have been shown to potentiate approach behaviour, and selective inactivation of the CA1 or CA3 subfields within the vHPC result in increased avoidance and approach behaviour, respectively. Human patient studies have similarly shown that large anterior HPC (aHPC; the human vHPC analogue) lesions result in greater approach behaviour under motivational conflict. However, there has been no human patient work investigating the roles of subfields within the aHPC, as in rodents. In the current study, we recruited a patient with a focal CA1 lesion (female; age = 43) and 12 controls (all female; age: M = 42.46, SD = 3.07). We administered an AAC task to all participants, in which they first learned to associate individual images with either reward or punishment, and were later asked to approach or avoid combined pairs of these images, with pairs with conflicting outcomes designed to elicit AAC. Consistent with prior rodent research, the CA1 patient was significantly more avoidant than controls under conflict, a difference that was not attributable to differences in learning rates of stimulus valences. These findings

provide causal evidence that rodent hippocampal subfield-specific AAC behavioural findings extend to humans and furthers our understanding of the role of the HPC in resolving AAC.

Topic Area: THINKING: Decision making

A124 - Gender Differences Across Age in Financial Positive-Skew Bias Under Dual-Task Cognitive Load

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Positive-skew bias refers to a preference for high-upside, low-probability financial gambles. Older adults often show a stronger positive-skew bias in financial decision-making (Seaman et al., 2017), and men weigh positive evidence more than women (Karmarkar, 2023). Age-related changes in affective processing differ by gender, with women showing steeper declines in negative affect across adulthood (Liao, 2025). Under dual-task conditions, reduced executive resources may increase reliance on intuitive strategies, potentially altering age and gender-related differences in decisions. However, it remains unclear whether these differences change linearly or quadratically across adulthood. Secondary analysis was performed using a pre-existing dataset (N=116 adults, ages 25-85). After exclusions, the analytic sample included 65 participants, providing adequate power to detect medium-to-large effects. Participants completed skewed-gamble choices while performing a simultaneous numerical Stroop task that increased attentional load. Positive-skew bias was computed as the proportion of positively- minus negatively-skewed gambles chosen. Two confirmatory multiple-regression models were utilized, as pre-registered: (1) Gender × Age, and (2) Gender × Age + Gender × Age². Contrary to expectations, both regression models revealed no significant main effects of gender or age and no evidence of linear or nonlinear gender-by-age interactions. This implies that there was no reliable support that men and women differ in how they weigh positively versus negatively skewed options under cognitive load. Visual trends, model estimates, and confidence intervals suggest that any true moderation effects are small. Thus, any subtle gendered differences that influence older adults' vulnerability to risky fraudulent schemes will require larger samples to detect.

Topic Area: THINKING: Decision making

A125 - Investigating the Neural Dynamics Underlying Different Modes of Thought using Precision fMRI

Desmond Wood-Anderson¹ (dwoodanderson@psych.ubc.ca), Andre

Zamani¹, Jennifer Burrell¹, Douglas Forrest¹, Kalina Christoff

Hadjiilieva¹; ¹University of British Columbia

Human thought can be understood in terms of both its dynamics (the way thoughts unfold over time) and its content (the modality through which a thought is experienced), as described by the Dynamic Framework of Thought. However, very little neuroimaging work has been done to investigate how naturalistic fluctuations in subjective

thought dynamics and contents correspond to time-varying neural activity. This study combines precision functional MRI (fMRI) with momentary experience-sampling to observe the neural dynamics underlying subjective experiences of thought. Participants attended multiple fMRI scanning sessions where they performed an experience sampling task. In this task, thought probes were delivered at pseudorandom intervals, and participants were asked to report subjective features of thought. At each probe, three questions were asked about thought dynamics, including the degree to which thoughts were freely moving, actively directed, and pulled towards something in particular. Another three questions asked about thought contents, including the presence of inner speech, visual imagery, and bodily sensations. Functional brain networks were estimated at the individual level using Multi-Session Hierarchical Bayesian Modeling. Dynamic functional connectivity of large-scale functional networks was computed and compared across different subjective features of thought.

Topic Area: THINKING: Other

A126 - Investigating the effects of Alpha and Gamma band EEG oscillations over parietal cortex on creative cognition using tACS

Gian Nouel¹ (nouelgian@gmail.com), Necla Ece Yilmaz¹, Evangelia G. Chrysikou¹; ¹Drexel University

Alpha-band and gamma-band synchronization have been shown to be linked to the generation and evaluation of creative ideas, respectively. This study examined the causal role of alpha band (10Hz) and gamma band (40Hz) neural oscillations for creative problem solving through transcranial alternating current stimulation (tACS), a technique that delivers electrical currents to the scalp non-invasively. Prior work from our lab has shown that 10hz alpha-band tACS stimulation over frontal regions, specifically F3 and F4, leads to increased originality scores on a creativity task. Building on these findings, in this study participants completed three counterbalanced sessions undergoing either 10Hz alpha, or 40Hz gamma, or sham stimulation over P3 and P4 electrode positions per the 10/20 EEG system, targeting parietal regions, bilaterally. Each session included pre-stimulation and post-stimulation EEG measures. During each session, participants performed a version of the Uncommon Uses Task (UUT), where they generated creative uses for 60 objects with different stimuli for each condition. Responses were scored for originality, appropriateness, and fluency with both human raters and AI (OSCAI). Performance on the UUT showed improvements under the 40Hz alpha stimulation condition, whereas no effects were observed for the 10Hz gamma stimulation or sham conditions. Performance on a negative control arithmetic task remained unchanged across conditions. The results provide deeper insight into the role of gamma oscillations for creative cognition, as well as shed light on neural network dynamics in support of creative thinking.

Topic Area: THINKING: Problem solving

A127 - The impact of learning preferences, perceptual differences, and cognitive control for fixation to pictorial examples in design problem solving

Evangelia G. Chrysikou¹ (lilachrysikou@gmail.com), Leah Downie¹, Alexandra E. Kelly¹, Hannah Maisano¹, Dong Ho Kim², John Gero¹; ¹Drexel University, ²Northwestern University

Using pictures as examples during problem solving can lead to fixation, wherein solvers tend to replicate the solutions included in the examples even when they involve errors or are clearly suboptimal. Despite the significance of this finding for many educational and professional contexts where creative solutions are critical, very little research has examined the neurocognitive bases of this phenomenon. In this study, we hypothesized that individual differences in learning tendencies, perceptual processing, and cognitive control may contribute to the likelihood of a participant experiencing fixation during design problem solving. To examine this prediction, in two behavioral sessions lasting approximately 2 hours each, we administered healthy young adults learning, perceptual processing, and cognitive control tasks, and design problem solving tasks that either included a pictorial example or did not include an example. We evaluated participant solutions for evidence of fixation and creative problem solving, per established procedures. Participants' performance on the learning, perceptual, and cognitive control measures was scored per established procedures for each scale or measure. Analyses of variance offered preliminary support for our predictions, showing that individual differences in learning, perceptual processing, and executive function abilities partially accounting for the observed fixation effects. We discuss the implications of these findings for theories of creative problem solving and functional fixedness. Given the prevalence of pictorial examples in many educational and professional settings across STEM disciplines and beyond, we note how our findings can offer recommendations for incorporating learning differences in instructional approaches.

Topic Area: THINKING: Problem solving

A128 - Creativity and the Hypnagogic State

Alissa Gomez¹ (alissagomez@u.northwestern.edu), Nia McClendon¹, Mark Beeman¹; ¹Northwestern University

Prior research has suggested that N1 sleep, also known as the hypnagogic state, facilitates creative insight (Lacaux et al., 2021). We sought to expand on this research by examining whether hypnagogia could enhance performance across a broad range of creativity tasks. Participants (n = 65) first attempted an Alternative Uses Tasks (AUT), a set of matchstick puzzles, and a tower-building task. Participants were then randomly assigned to a 30-minute incubation period where they were instructed to either take a nap or watch a video (control). In the nap condition, participants were fitted with a Muse EEG headband to monitor their sleep stage activity. Whenever participants fell into the hypnagogic state, they were awakened to prevent them from falling into deeper sleep. After their respective incubation period, participants

revisited their previously unsolved matchstick puzzles and repeated the AUT and tower-building tasks. Performance changes between the pre- and post-incubation attempts were analyzed to evaluate how the two incubation periods influenced creativity and problem-solving across the three tasks. Creativity, solution rates, and tower height were analyzed for the AUT, matchstick, and tower-building tasks, respectively. Participants in both incubation groups performed similarly well across the three tasks. Further analyses will investigate whether post-incubation performance was affected by the length and frequency of hypnagogic episodes in the nap condition, the rate of mind wandering in the control condition, and the type of thoughts reported during either incubation condition.

Topic Area: THINKING: Problem solving

A129 - Identifying critical conceptual moments during a lecture where neural encoding patterns distinguish successful from unsuccessful learners

Yeongji Lee¹ (yeongji.lee.gr@dartmouth.edu), David Kraemer; ¹Dartmouth College

Successful learning depends on capturing underlying relationships between concepts, not just understanding individual concepts or surface-level details. Our prior behavioral work demonstrated that the semantic structure of a lecture video predicts which information students remember. Critically, we identified specific information units in the lecture that bridge multiple concepts and capture fundamental relationships—units whose recall strongly predicts an individual's conceptual understanding. Successful learners remember this integrative information while struggling learners do not, suggesting that students could diverge onto different learning trajectories depending on whether they successfully encode these conceptual connections. In this fMRI study, participants (N = 63) watched the same 15-minute lecture covering Newtonian physics concepts, then verbally recalled what they learned and remembered while in the scanner. Using the critical information units identified in our prior behavioral study, we applied multivariate pattern analysis (MVPA) at the specific time windows when this critical information was presented. We trained SVM classifiers to distinguish neural patterns at each time point between the participants who subsequently showed high versus low conceptual understanding as rated by human raters. This work provides insight into a neural mechanism for how abstract conceptual knowledge emerges during naturalistic educational experiences, with implications for adaptive instructional design and real-time assessment of conceptual learning.

Topic Area: THINKING: Reasoning

Poster Session B

Sunday, March 8, 2026, 8:00 – 10:00 am, Fairview/Kitsilano Ballrooms

B1 - Assessment of Auditory Cognitive Resource Deployment on the Modified Paced Auditory Serial Addition Task using Pupillometry and fNIRS

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The Modified Paced Auditory Serial Addition Task (mPASAT) continuously presents spoken digits at a fixed rate requiring listeners to sum subsequent digits. Difficulty varies by increasing presentation rates from 5-4-3-2-1 seconds across blocks. Here we compare behavioral data (accuracy and reaction time), pupillometric data (Pupil Labs) and functional near infrared spectroscopy (Artinis Brite, 10-20 system) measures of BOLD activity in 28 individuals to assess how neural resource management converges across methods. Preliminary analysis reveals that accuracy decreases across ISIs (93%-92%-57%-50%-0%, from 5 to 1 second trials). For correct trials, reaction times decreased from 2.32 seconds at 5 second ISIs to 1.31 seconds at 2, giving participants more time to recover before subsequent stimuli at longer ISIs. Performance related pupil dilation changes were observed across correct trials, with smaller dilations for easier trials, and larger dilations for difficult trials. An s-shaped polynomial dilation pattern was observed over time for 5 and 4 second ISIs showing greater resource use pre-response, and a drip after, leading to better recovery before the next stimulus. The 3 and 2 second ISI trials lacked this recovery phase, explaining the drop in performance. fNIRS data showed increasing hemodynamic response (OHb-hHb) with difficulty. At F8, F7 and Fz optodes, higher accuracy trials (5 second ISI) had the lowest hemodynamic values, which increased as accuracy decreases (4-3-2 second ISIs). Overall, these preliminary findings provide further validation of the mPASAT and demonstrate convergence across the pupillometric and fNIRS measurements of neural resource management.

Topic Area: ATTENTION: Auditory

B2 - The role of attention in shaping neural entrainment across development

Elena Greatti^{1,2} (egreatti@sissa.it), Levi Antle³, Elaine Guan³, Maria Romero Ochoa³, Davide Crepaldi^{1,4}, Amy Finn³; ¹International School for Advanced Studies (SISSA), ²University of Camerino, ³University of Toronto, ⁴University of Pavia

While adults excel at filtering sensory input to prioritize task-relevant goals, children are characterized by more distributed attentional deployment. This broader attentional focus, often framed as a cognitive limitation, may facilitate learning by allowing incidental processing of background information. Here, we hypothesized that children's visual statistical learning, the extraction of regularities from the environment, would be relatively resilient to attentional diversion compared to adults. We recorded EEG from 116 participants (56 children and 60 adults) as they viewed a continuous 8-minute stream of animal images presented in triplets. Across conditions, the visual

input was identical; attention was manipulated by requiring participants either to attend to the animal stream (full-attention condition) or to perform a demanding 1-back task on overlaid shapes (diverted-attention condition). Neural entrainment at the triplet rate indexed online sensitivity to statistical structure, while target detection and familiarity judgment tasks assessed indirect and direct expressions of learning after exposure. Neural entrainment at the image rate, reflecting low-level sensory tracking, showed a condition × group interaction: adults exhibited no reliable modulation by attention, whereas children showed stronger sensory tracking under diversion. By contrast, neural entrainment at the triplet rate showed no condition × group interaction, although follow-up analyses indicated attenuation under attentional diversion in adults but not in children. Together, these findings indicate that attentional diversion differentially modulates low-level sensory tracking across development, but not necessarily higher-level tracking of embedded statistical regularities; within-group patterns nonetheless suggest the need for follow-up on a possible reduced effect of attentional diversion in children.

Topic Area: ATTENTION: Development & aging

B3 - Decoding Engagement in Live Lectures with EEG and Eye-Tracking

Yimeng Wang¹ (yimengw@umass.edu), Sidharth Anupkrishnan, Lisa D. Sanders; ¹University of Massachusetts Amherst

Learning from instructors' speech is a fundamental aspect of the classroom experience. Current techniques for comparing physiological measures to speech hold the promise of providing information about engagement and performance in classroom settings. However, these approaches have rarely been used with unscripted, continuous natural speech when the student/participant is free to move their heads and eyes. In the current study, a teacher delivered live lectures in engaging and boring styles about topics participants had rated as likely-to-be-interesting or not while participants were free to look at the speaker, the accompanying slides, or their own notes. We collected multimodal physiological data, including scalp EEG from a typical laboratory set-up, EEG from a mobile headband, and data from a head-mounted eye-tracker. Temporal Response Functions (TRFs) and ERPs elicited by acoustic onsets in speech were calculated, revealing similar P1–N1–P2 complexes and the strongest neural tracking for the most preferred lecture delivered in an engaging style. Ongoing analysis of the correspondence between speech and EEG, power in EEG frequency bands, and temporal and spatial features from eye-tracking measures are being used to predict students' self-reported engagement levels and quiz performance. Current results suggest that EEG responses and eye-tracking measures successfully capture markers of engagement, and that neural responses related to speech features are influential in classification models. Together, this research highlights the importance of using live speech as stimuli, and directly comparing mobile and lab-based recordings, to pave the way to move beyond laboratory settings and investigate speech processing in natural settings.

Topic Area: ATTENTION: Multisensory

B4 - The Effects of Frequency and Duration of Thinking Periods on Science Learning

Vishal Easwar¹ (easwarv@bc.edu), Ido Davidesco¹; ¹Boston College

Students often find it challenging to remain engaged during online lectures because attention, by its nature, tends to fluctuate between perceptually guided and self-generated thoughts (external and internal attention, respectively). However, little is known about how internal attention may promote or hinder student learning. The current study explored this question by manipulating the frequency and duration of internal attention (“thinking”) periods inserted into an online lecture. Undergraduate students (N = 111) watched an online biology lecture divided into six 4-minute segments. In the experimental conditions, the lecture paused every 4 or 8 minutes and students were prompted to quietly think about a lecture-related prompt for 30 or 60 seconds before typing their answer. In the control condition, students pressed a button to advance to the next lecture segment. Paired t-tests were separately conducted pooling data based on duration (30 or 60 s), regardless of frequency, and based on frequency (3 or 6 thinking prompts), regardless of duration. Our results indicated that the duration of thinking periods but not their frequency affected lecture engagement and learning: under conditions of shorter thinking periods (30 s), students reported higher lecture engagement ($p = .020$) and better learning gains (an effect that approached significance; $p = .052$). Although prior work typically linked internal attention to mind wandering and poor learning outcomes, our findings suggest that brief opportunities for internally focused reflection—when intentionally designed—could positively affect student engagement and learning outcomes.

Topic Area: ATTENTION: Other

B5 - Detecting mind wandering in real classrooms using eye-tracking and machine learning

Xiaorui Xue¹ (xuexd@bc.edu), Ido Davidesco¹, Na'ama Av-Shalom¹, Marina Vasilyeva¹, Nanyu Zhang¹, Rachael Sabelli¹, Jason Geller¹; ¹Boston College

The dynamic nature of attention means that students often shift their focus from the learning task to unrelated thoughts—a phenomenon known as mind wandering (MW). Although MW can have certain cognitive benefits, it is generally believed to hinder learning. Self-report measures suggest that students spend about 30% of class time MW. To date, most prior cognitive neuroscience research on MW has been conducted in controlled laboratory settings that differ substantially from real-world classroom environments. To address this gap, we are conducting a classroom-based eye-tracking study. We collected data from 15 undergraduates, each of whom attended two regular class sessions while wearing portable eye-tracking glasses (Neon, Pupil Labs). Each class session (N = 6) included 6–8 attention probes, asking students what they were thinking about immediately before the

probe appeared and how effortful the prior material was. A short quiz at the end of each session assessed learning outcomes. We plan to examine how self-reports of mind-wandering (probe-caught) and effort correlate with eye-movement measurements (e.g., fixation duration, gaze dispersion, and pupil size) and performance. As data collection continues, ongoing analyses aim to develop machine learning models that predict self-reported MW from continuous eye-tracking data. We will also examine how eye-tracking indicators and self-reports jointly predict learning performance. This work seeks to deepen understanding of attention fluctuations in naturalistic learning environments and improve methods for detecting them.

Topic Area: ATTENTION: Other

B6 - Alterations of Oscillatory Activity Underlying Visual Attention in Children and Adolescents with Mild-to-Severe Hearing Loss

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Recent work in individuals with severe-to-profound hearing loss suggests that hearing loss results in changes to visual processing and attention. Whether this extends to children with mild-to-severe hearing loss (CHL) is unclear, and studies of the underlying neural dynamics are lacking. This study sought to examine whether the neural dynamics serving visual attention are altered in CHL relative to children with normal hearing (CNH). A total of 41 CHL, and 59 CNH aged 7-14 years completed a visual search task during magnetoencephalography (MEG). Participants were instructed to indicate the location of the gray circle (i.e., target) in relation to the fixation cross in the presence of nine visual distractors. In the feature condition, participants identified the target using only one distinguishing attribute, while in the conjunctive condition, participants identified the target using a combination of features. Neural data were preprocessed and transformed into the time-frequency domain. Significant responses were identified and imaged using beamforming. Condition-by-age-by-group interactions and corresponding brain-behavior relationships were then probed. We found age-related improvements in performance across groups, as well as a significant age-by-condition effect such that performance improved more steeply in the conjunctive than the feature condition. CHL were significantly less accurate and responded slower than CNH. Significant task-related neural responses were found in theta, alpha, and beta frequencies. Source-level linear-mixed effect analyses revealed

frequency-specific condition-by-age-by-group interactions throughout frontoparietal and occipital regions, which were uniquely related to behavior. Taken together, these data suggest that variability in auditory experience may result in differences in high-order attention processing.

Topic Area: ATTENTION: Spatial

B7 - Functional Stability and Similarity of Whole-brain and Social Brain Connectomes across Development

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The functional connectome undergoes dynamic reorganization during childhood and adolescence; however, trajectories governing its maturation in typical and atypical development remain incompletely understood. Connectome stability (consistency across runs) and similarity (group resemblance) assessed using fMRI are associated with developmental outcomes including age and social abilities. These measures are also strongly correlated, suggesting that these organizational features are highly intertwined. Prior research has solely focused on the whole brain (WB), leaving it unclear whether these neurodevelopmental patterns are preserved or enhanced in the social brain (SB)—regions that become specialized for social cognition over development. In the present study, we examined associations between stability, similarity, and developmental measures (age, social abilities) in a large psychiatrically-enriched sample of youth from the Healthy Brain Network (N = 740; 6–18 years). Using linear mixed-effects models, we assessed relationships between stability (Rest–Movie) and similarity (Rest, Movie) across WB and SB connectomes and test how these measures relate to age and social abilities. We replicated robust positive relationships between stability and similarity in the WB and newly showed that this relationship is stronger in the SB. Social abilities were positively associated with WB/SB similarity during rest, whereas age was negatively associated with WB/SB stability and WB similarity during rest and movie. These findings suggest that group-typical convergence increase with social development, whereas divergence from group-typical patterns and greater task-reconfiguration increase with chronological age. These neurodevelopmental patterns were typically observed and sometimes enhanced in the SB, suggesting that SB maturation may drive some aspects of WB developmental organization.

Topic Area: EMOTION & SOCIAL: Development & aging

B8 - The behavioural and neural effect of hearing aids during speech emotion perception in older adults using functional near-infrared spectroscopy (fNIRS)

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Hearing aid research has improved speech intelligibility for individuals with hearing loss; however, recent research reveals that hearing aids

do not improve perception of emotion in speech in adults. Hearing loss has been associated with changes in neural activations when listening to emotional non-speech sounds, potentially contributing to the speech emotion perception deficits, even under aided listening. Prior neuroimaging studies required participants to remove their aids due to metal incompatibility with fMRI, limiting research on neural mechanisms underlying speech emotion perception in hearing aid users. Like fMRI, fNIRS non-invasively measures brain activity through changes in blood flow, but fNIRS is silent and compatible with hearing aids, making it a promising tool for auditory cognitive neuroscience. We leveraged fNIRS to examine how hearing aids affect brain function in experienced hearing aid users during speech emotion perception. Thirty-two older adults (17 normal hearing, 15 hearing aid users) judged emotional speech while fNIRS recorded hemodynamic activity in prefrontal, auditory and parietal cortices. Hearing aid users completed the task twice, once aided and once unaided. Behavioral results replicate prior research that hearing aids do not improve speech emotion perception. Neural data show greater engagement of sensorimotor regions in individuals with hearing loss, regardless of hearing aid use. Under unaided listening, there was additional recruitment of the superior medial frontal area, whereas aided listening showed reduced task-based connectivity between sensorimotor nodes. Results suggest that while hearing loss increases localized activity in sensorimotor areas, hearing aids reduce the connectivity between these areas during speech emotion perception.

Topic Area: EMOTION & SOCIAL: Development & aging

B9 - Ventromedial Prefrontal Cortex Thickness Mediates Age-Related Shifts in Valence Bias

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The tendency to interpret emotionally ambiguous information (e.g., a surprised face) as more positive or negative is a phenomenon known as valence bias, offering insight into how emotional meaning is constructed and modified across the lifespan. Although it is well-established that a shift toward more positive interpretations occur with age, the contributions of neural structural integrity to this shift are underinvestigated. The ventromedial prefrontal cortex (vmPFC) plays a key role in evaluating affective meaning, integrating emotional and motivational information, and guiding regulatory responses. Although functional imaging studies have repeatedly implicated the vmPFC in emotional appraisal, less is known about how structural variation in this region relates to affective outcomes across the lifespan. In the present study, 410 participants aged 6–80 years completed a valence bias task where they were instructed to categorize clearly and ambiguously valenced faces and scenes as positive or negative. Structural MRI data were used to quantify cortical thickness in the vmPFC. Analyses examined whether vmPFC thickness predicted valence bias and mediated age-related changes in bias. Results revealed that individuals with greater vmPFC thickness showed a more negative bias. A mediation model indicated that vmPFC

thickness partially and significantly mediated the relationship between age and valence bias: increasing age and reduced vmPFC thickness predicted a more positive valence bias. These findings appear to be specific to the vmPFC as no such mediation was evident in other cortical regions tested (i.e. insula or anterior cingulate cortex) that are also implicated in affective processing.

Topic Area: EMOTION & SOCIAL: Development & aging

B10 - Longitudinal mapping of social brain development in common marmosets

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Primate species, including humans, navigate complex social environments by interpreting relationships through cooperative (e.g., grooming) and competitive (e.g., chasing) behaviors that reveal social hierarchies. Understanding the neural mechanisms underlying such interactions is key to elucidating the basis of adaptive behavior and its disruption in neurodevelopmental disorders such as autism. The common marmoset (*Callithrix jacchus*), a highly social New World primate, provides a unique opportunity to study the development of social cognition due to its rich social repertoire, rapid maturation, and translational relevance to humans. This project investigates how social cognition emerges in marmosets through a combination of functional and structural Magnetic Resonance Imaging (fMRI, sMRI) and behavioral assessments. Four marmosets (two males) were scanned awake longitudinally from 9-month-old (mo, juvenile) to adulthood while viewing videos of conspecific social behaviors (e.g., grooming, fighting, nursing). Complementary T1- and T2-weighted MRI from 6 mo (i.e. late infancy) onward tracked cortical myelination and frontoparietal functional connectivity, while behavioral tasks using touchscreen and eyetracking assessed social categorization. Results reveal progressive cortical myelination and strengthening of frontoparietal connectivity across development. Emotional valence of observed social interactions modulated brain activity: competitive interactions engaged the amygdala, while friendship and kinship behaviors elicited weaker responses and a similar brain pattern until 15 mo. With maturation, prefrontal activation patterns became increasingly distinct across social contexts, paralleling improved behavioral discrimination. These findings advance our understanding of how the primate brain supports the development of social cognition and establish the marmoset as a powerful preclinical model for investigating social deficits in autism.

Topic Area: EMOTION & SOCIAL: Development & aging

B11 - Real-Time Neural and Autonomic Correlates of Perseverative Cognition in Intracranial EEG

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Perseverative Cognition (PC) refers to the sustained and repetitive processing of distressing thoughts, such as rumination and worry,

which can prolong neural and physiological activation long after a stressor has passed. PC has primarily been investigated using functional MRI, a powerful but temporally limited technique that captures static snapshots of brain activity. While fMRI studies have identified consistent involvement of the anterior cingulate cortex, medial prefrontal cortex, posterior cingulate cortex, and insula—regions that integrate self-referential, affective, and interoceptive processes with autonomic arousal—these paradigms rely on brief, externally cued tasks and therefore provide limited insight into how maladaptive thought patterns unfold spontaneously over time. This exploratory study integrates intracranial EEG (iEEG), physiology, and ecological momentary assessment (EMA) to capture self-identified episodes of PC in adults undergoing multi-day iEEG monitoring for epilepsy. Participants are trained to recognize and report sustained negative thinking using a button press linked to immediate EMA ratings of thought intensity, valence, and temporal focus (past versus future). iEEG and autonomic signals (heart rate and heart-rate variability) are recorded continuously. Each event is classified as rumination-dominant, worry-dominant, mixed, or low-intensity, with the latter reflecting thoughts with minimal negative affect or limited repetition. Analyses will compare high-frequency oscillatory activity and connectivity across prefrontal, cingulate, amygdalar, and insular regions during PC episodes versus neutral intervals. By directly linking neural and physiological dynamics to spontaneous perseverative thought, this study advances understanding of mechanisms underlying anxiety, depression, and related disorders, informing transdiagnostic and closed-loop intervention approaches in mental health.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

B12 - Clarifying the DMN-Depression Connectivity Paradox: Functional Connectivity Associations between Specialized DMN Subnetworks and Depression Severity

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Depression is a pervasive and debilitating mood disorder that disrupts multiple aspects of cognition, including episodic memory and perspective-taking processes. Neural evidence suggests that depression is associated with changes in functional connectivity of the Default Mode Network (DMN), a neural network that supports self-generated thought processes such as autobiographical memory, self-referential processing, and social cognition. However, findings are inconsistent, with some studies supporting DMN hyper-connectivity, and others DMN hypo-connectivity as a risk factor for depression, introducing a DMN-Depression Connectivity Paradox. Recent precision functional brain mapping findings reveal high inter-individual variability of DMN organization and suggest the DMN is composed of two distinct, functionally dissociable subnetworks, involved in episodic memory and perspective taking, respectively. In this study, Aim 1 will validate a data-efficient within-individual brain mapping pipeline to discriminate between the two DMN subnetworks using resting-state

neuroimaging data from the Human Connectome Project, and verify its mapping accuracy with fMRI localizer tasks. Aim 2 will test associations between the two DMN subnetworks' resting-state functional connectivity and depression severity, in contrast to whole-DMN associations. We predict that a model including each DMN subnetwork's connectivity separately will better predict depressive symptomatology than whole-DMN connectivity, given that these two subnetworks uniquely contribute to the cognitive deficits present in depression. This study has the potential to clarify mixed findings in prior literature and pave the way for identifying personalized neurobiological markers of depression. Clinical implications of this work include furthering neuroscientific models of depression, as well as precision psychiatry applications such as connectivity-based treatment stratification.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

B13 - Neural Signatures and Personality Predictors of Belief Updating on Controversial Issues

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Belief polarization pervades socio-scientific debates, yet the neurocognitive bases of how beliefs change remain unclear. We investigated belief updating about nuclear power using fMRI, testing how individual differences shape responses to supporting versus opposing evidence. 87 participants viewed 80 minutes of naturalistic video segments on nuclear energy (17 supportive, 18 opposing) with presentation order counterbalanced across groups. We used inter-subject representational similarity analysis (IS-RSA) to quantify neural reconfiguration. Structural equation models (SEMs) estimated contributions from six questionnaire-measured traits: Big Five Inventory (BFI-44), Intolerance of Uncertainty Scale (IUS-12), Need for Closure (NFC), Interpersonal Reactivity Index (IRI), Positive and Negative Affect Schedule (PANAS), and Short Schwartz Value Survey (SVS). Behaviorally, both perspectives shifted beliefs in the expected directions. IS-RSA revealed an updating network spanning the dorsomedial prefrontal cortex (DMPFC) and posterior cingulate cortex (PCC). Belief change for both perspectives was associated with neural similarity changes in the anterior ventrolateral prefrontal cortex (VLPFC). Notably, changes under opposing information related to the ventromedial prefrontal cortex (VMPFC) and PCC, whereas changes under supporting information related to the nucleus accumbens (NAcc). In SEMs, only NFC ($\beta = -0.357$, $p = .0089$) and PANAS Negative Affect ($\beta = 0.352$, $p = .0029$) reliably predicted belief change under opposing evidence; supportive exposure effects were non-significant. These findings reveal that belief updating about controversial issues is context-sensitive. Avoidance of ambiguity and negative affect jointly predict how individuals respond to belief-

challenging perspectives, providing a neurocognitive model for motivated reasoning.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

B14 - Fc-MVPA reveals migraine-related differences in connectivity during emotional audiovisual processing

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Migraine is a neurological disorder characterized by headaches, nausea, mood changes, and fatigue. It alters lower-level visual and auditory processing, leading to hypersensitivities that may amplify audiovisual multisensory integration. Migraine has also been associated with increased sensitivity to emotional arousal and valence, though the relative significance of these factors remains unclear. The present study investigates how migraine influences large-scale network interactions during complex audiovisual processing and how these effects vary as a function of emotional arousal and valence. Functional magnetic resonance imaging data (fMRI) data was collected from 22 migraineurs and 21 healthy controls during the passive viewing of three audiovisual films (negative valence/high arousal; positive valence/high arousal; neutral valence/low arousal). Functional connectivity multivariate pattern analysis (fc-MVPA) identified distributed connectivity patterns that differentiate the groups. During both positive and negative high-arousal conditions, fc-MVPA identified a seed within the default mode network (DMN) that exhibited differential whole-brain functional connectivity between groups. Individuals with migraine demonstrated greater within-DMN connectivity relative to controls. Under negative high-arousal conditions only, additional seeds located in the ventral and dorsal attention networks showed altered whole-brain connectivity, characterized by increased cross-network coupling with the visual network in the migraine group. A further significant seed was also identified within the visual network during this condition. These findings indicate that migraine-related network alterations emerge selectively under emotionally charged contexts in DMN, visual and attention related areas, primarily driven by negative valence rather than arousal. Taken together, these results suggest that migraine is associated with network-level differences during emotional audiovisual processing.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

B15 - PTSD Memory Deficits Bias Towards Pattern Completion Strategies of Negative Stimuli in Ambiguous Situations

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Background: PTSD is a debilitating mental health condition marked by persistent emotional and memory disturbances following trauma. Emerging literature suggests these memory disturbances reflect an overreliance on pattern completion strategies, at the expense of pattern separation. This bias may contribute to PTSD by

misinterpreting neutral cues as threatening, evidenced by attentional biases in eyetracking experiments. While prior studies have examined responses to clearly positive or negative cues, few have investigated how PTSD affects memory and perception when presented in ambiguous circumstances, mimicking common life situations. Method: A preliminary sample of PTSD ($n = 13$), subsyndromal PTSD ($n=17$) and healthy controls ($n=23$) individuals completed an eyetracking paradigm in which a series of images began in identical starting positions and resolved into either positive or negative outcomes. Participants were later presented with the positive or negative outcomes and asked to recreate the pattern of images that were studied. Growth mixture modeling was used to test success thresholds in detecting positive and negative outcomes. Results: Results indicated that PTSD participants had lower recall accuracy ($t=3.05$, $p < .01$), with greater negative recall and worse positive recall compared to subsyndromal and healthy control groups. Conclusions: Findings suggest that PTSD is characterized by heightened pattern completion and impaired pattern separation, particularly for negatively valenced material. This bias may underlie overgeneralized threat responses and difficulty distinguishing safe from dangerous cues in ambiguous contexts. This can inform future interventions to help mitigate trauma-related memory deficits.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

B16 - Dissociable emotional and social influences on facets of associative memory

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Emotional experiences in daily life are often social in nature, yet studies of emotional memory typically do not consider social context as a key dimension. Although negative emotion generally impairs associative memory, this impairment can be rescued when stimuli contain social cues. A separate line of work shows that negative emotion “bleeds over” to shape later appraisal of neutral stimuli—an effect contingent on associative memory mechanisms (hereafter, transfer of valence; TOV). Given TOV is contingent upon associative memory and that social stimuli facilitate associative binding to negative stimuli, we predicted a stronger TOV effect when negative stimuli are rich in social cues. To test this, participants encoded social or non-social negative or neutral targets paired with neutral associates. During later appraisal (to assess TOV) and cued recall (to assess associative memory) tasks, participants rated the neutral associates for pleasantness and recalled the original pairings, respectively. As expected, we observed a TOV effect: neutral associates were rated as less pleasant in the negative (versus neutral) condition. Contrary to expectation, the TOV effect was not larger in magnitude when negative pictures were rich in social cues. Moreover, associative memory recall also deviated from our expectations (and our prior work examining associative recognition): There was no effect of emotion, though participants remembered social pairs significantly better than non-

social ones. Together, these findings suggest that negative emotion and social relevance have dissociable effects on facets of associative binding. The results underscore the complexity of how people remember emotionally charged and socially rich experiences.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

B17 - Title: Emotional and Cognitive Disruption of Sexual Identity Development in Adults with Elevated ADHD Symptoms

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Attention-Deficit/Hyperactivity Disorder (ADHD) is associated with impairments in executive functioning (EF), including emotional regulation, metacognition, and self-reflection. While the neurocognitive architecture of EF has been well characterized in recent decades, less is known about how EF-related traits influence identity development across diverse populations. One critical but underexplored domain is sexual identity formation—particularly how ADHD symptomatology may alter the emotional and cognitive processes involved in recognizing and disclosing one’s sexual identity. In this study, 585 undergraduates completed the CAARS-S:S and a custom sexual identity questionnaire assessing developmental milestones (e.g., age of first crush, first sexual experience), emotional clarity, and identity-related confusion. Participants were grouped by sexual orientation and ADHD symptom severity (T-score ≥ 60). Among non-heterosexual participants ($n = 270$), those in the ADHD group ($n = 52$) reported significantly greater sexual identity confusion in adulthood ($p = .015$, $d = 0.38$), more difficulty understanding feelings in sexual relationships ($p = .038$, $d = 0.41$), and more negative emotional responses during first sexual experiences ($p = .003$, $d = 0.95$). These group differences emerged despite no significant differences in age of first crush or first sexual experience, suggesting that ADHD may disrupt emotional processing rather than delay exposure. Qualitative analyses further revealed a higher proportion of negatively valenced narratives (e.g., confusion, fear, anxiety) in early romantic experiences among the ADHD group. These findings highlight the need for identity development models that account for neurodivergent cognition and may inform future neuroimaging research on executive function and self-concept, particularly as it relates to identity formation in neurodivergent populations.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

B18 - Phenomenological and physiological differences between forgiven and not forgiven remembered wrongdoings in samples from Colombia and the United States

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Forgiveness is a valuable tool for overcoming negative emotions and healing relationships after interpersonal conflict. Recent evidence

suggests that forgiving involves a process of emotional fading, such that remembering wrongdoings is experienced with decreased affective responses, while the episodic details of the memory are not forgotten. To evaluate the role that severity plays in the recollective experience, we collected self-report ratings and psychophysiological measures with a sample of undergraduate students in the United States and a sample of victims of severe war crimes in Colombia. In a within-subject design, we evaluated emotional responses and the retrieval of episodic details of remembered wrongdoings as a function of forgiveness. Participants silently recalled two neutral-positive memories and two memories of wrongdoings while we measured electrodermal activity, as well as corrugator and zygomaticus electromyography. We also assessed participants' recollective experiences and degree of forgiveness toward the perpetrators. Consistent with the emotional fading view of forgiveness, memories with high ratings of forgiveness were associated with less negativity during recall for both the US and Colombian samples. Importantly, we found no differences in the recollection of episodic details. Interestingly, higher forgiveness for negative memories was associated with strong activation of the corrugator (marker of negative valence) during initial recall, followed by a decrease during elaboration, suggesting a possible emotion regulation process. We discuss the implications of these findings for existing psychological theories of forgiveness and suggest possible memory mechanisms that involve an underlying process of emotional reappraisal of the memories of wrongdoings.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

B19 - Feel Less, Remember Less: The Blunting-Induced Forgetting Effect

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This study explored whether people can intentionally reduce the emotional impact of unwanted memories and whether this relies on inhibitory control. Research on retrieval suppression demonstrates that stopping memory retrieval disrupts hippocampal reinstatement and leads to forgetting. However, it remains unclear whether similar control mechanisms can directly regulate negative affect. We addressed this gap by experimentally testing affect stopping. Affect stopping refers to deliberate cancellation of emotional responses when confronted with reminders that normally evoke distress because of their association with a negative memory. Affect stopping is hypothesised to draw on inhibitory control that halts the reactivation of negative affect. Our aim was to determine whether inhibiting affect also disrupts access to the underlying memory, giving rise to blunting-induced forgetting. Forty-eight participants completed a Feel/No-Feel (FNF) paradigm. They first learned associations between negative scenes and two cues: a related object cue embedded within the scene, and an independent word cue unrelated to the content. During the critical FNF phase, green-framed cues signalled participants to

experience the associated feelings ("Feel"), whereas red-framed cues instructed them to block those feelings and remain neutral ("No-Feel") with no reference made to suppressing the memory. Participants rated unpleasantness on each trial. Affect stopping reliably reduced unpleasantness ($p < .001$, $\eta_p^2 = .12$) and, critically, impaired recall of specific details of the scenes and their broader content (all p bonferroni $\leq .001$; $d_z = .63-.99$). These findings suggest that affect stopping recruits inhibitory mechanisms that blunt affect while also weakening access to unwanted memories.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

B20 - Surprise? Surprise! Learned helplessness with/without action

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Human perception of personal agency is based on statistical information (i.e. ΔP matrix, which records the frequencies of four types of events, A/B/C/D: binary states – presence vs. absence of action and outcome). Depression is characterised by reduced perceived agency, mirroring learned helplessness (LH). However, the classic LH paradigm often overlooks how the presence or absence of action modulates the learning of uncontrollability. Furthermore, while humans frequently infer control within social contexts, the mechanisms underlying controllability estimation in social settings remain poorly understood. To address this, we employed a contingency learning task where participants had no control over outcomes ($\Delta P = 0$) and recorded event-related potentials (ERPs) time-locked to outcome delivery. In Experiment 1 (active learning), participants learned through direct experience. In Experiment 2 (observational learning), yoked participants learned by observing others. Analysis revealed: (1) During active learning, C events (outcome occurrence without action) elicited a P300 component with higher amplitude and increased latency compared to A events (concurrent action and outcome), suggesting prioritised processing for detecting control failures. (2) Active learning, compared to observational learning, was associated with increased P300 amplitude and prolonged latency overall. (3) Metacognitive assessments showed lower confidence in judgments of self-uncontrollability than other-uncontrollability. These results demonstrate that the learning of uncontrollability is fundamentally shaped by both action and social context. The neural and metacognitive dissociations between active and observational learning provide a novel framework for understanding how action and biased social learning may contribute to LH in depression.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

B21 - Loneliness effects on selective attention to emotional faces

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Loneliness has been posited to bias attention toward social threat (e.g., Nezlek et al., 2015) or toward affiliative cues that may restore belonging (e.g., Cacioppo, Cacioppo, & Boomsma, 2014). We examined whether self-reported loneliness affects selective attention to emotional stimuli using a face-word interference task, in which distractor faces can capture processing through affective salience (Yantis & Jonides, 1990; Beall & Herbert, 2008). Ninety-seven university students were classified into low- and high-loneliness groups using the UCLA Loneliness Scale (Boffo, Mannarini & Munari, 2012) and the Interpersonal Acceptance-Rejection Loneliness Scale (Senese et al., 2021). A face-word interference task was employed, wherein participants categorized positive and negative words superimposed on distractor-faces displaying happy, angry, or scrambled (neutral) expressions. Task performance was assessed via reaction times (RTs) and response accuracy to examine interference and facilitation effects. Consistent with prioritized processing of threat (Öhman & Mineka, 2001), results evidence that emotional distractors reliably influenced performance: responses were faster to positive than to negative words, and angry faces elicited greater interference than happy or scrambled faces. Contrary to hypotheses, loneliness did not significantly modulate RT-based interference or facilitation. Accuracy paralleled the RT pattern; however, with IPARLS, the low-loneliness group was more accurate for positive than for negative words, whereas the high-loneliness group showed no such difference. This divergence between general loneliness (UCLA) and rejection-related loneliness (IPARLS) hints at context-specific influences of loneliness on emotional attention. Overall, loneliness did not robustly alter selective attention to emotional faces, while subtle accuracy effects suggest measurement nuance matters.

Topic Area: EMOTION & SOCIAL: Emotional responding

B22 - A study of low-frequency brain activity during narrative processing and rest.

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Narrative processing and autobiographical thought during rest both unfold across multiple timescales over extended periods. Understanding their neural mechanisms can reveal how the brain integrates moment-to-moment experiences into a coherent and unified sense of self and world. To investigate this, we conducted voxel-wise analyses of Amplitude of Low-Frequency Fluctuations (ALFF) and fractional ALFF (fALFF) on two fMRI datasets: (1) 3T data from 35 participants with one resting-state and two story-listening sessions, and (2) 7T data from 20 participants with one resting-state and one movie-watching session. The narratives differed in themes and emotional conflicts. ALFF measures BOLD signal fluctuations within 0.01–0.08 Hz, while fALFF reflects their proportion relative to the total

BOLD signal. For each participant, ALFF and fALFF maps were computed for resting-state and narrative-processing scans and compared using two-tailed paired-sample t-tests. Previous studies have reported high ALFF and fALFF values in the default-mode and sensory networks at rest. In this study, we focused on identifying brain regions that exhibited even stronger low-frequency activity during narrative processing compared to rest. In dataset 1, narrative processing elicited higher ALFF for one story and higher fALFF for both stories in the superior temporal sulcus. In dataset 2, although fALFF showed no significant effects, narrative processing produced higher ALFF in the superior temporal gyrus, Heschl's gyrus, and medial inferior temporal cortex. Together, these results suggest that sensory processing and integration areas across modalities exhibit enhanced low-frequency activity during narrative processing, indicating their role in combining brief sensory inputs into coherent meaning.

Topic Area: EMOTION & SOCIAL: Other

B23 - Modality-Specific Influences in Audio-visual Emotion Perception: Valence and Arousal Representations

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Prior research found a multimodal gain in audio-visual emotion recognition, highlighting the importance of real-world contexts in emotion studies. However, it remains unclear how visual and auditory modalities contribute to valence and arousal in emotion perception, as well as whether they constitute distinct affective representational patterns across modalities. We hypothesized that the visual modality is more dominant in emotion perception than the auditory modality, particularly for positive emotions. To test the hypothesis, we conducted an emotion perception task using audio-only (AO), video-only (VO), and audio-visual (AV) speech stimuli, in which valence and arousal were measured. Additionally, we conducted behavior-based representational similarity analysis (RSA) to investigate whether different sensory modalities exhibit distinct combined valence–arousal representational patterns. We found that the AO differed from the other modalities. In particular, RSA revealed distinct representational structures across modalities, indicating that the AO exhibited a markedly different affective similarity structure from VO and AV. For the individual emotions, “happy” and “disgusted” showed that AV patterns were more similar to VO patterns than to AO patterns, indicating greater influence of the visual modality. The “surprised” emotion had a neutral valence overall, suggesting that opposing valence cues—positive from AO and negative from VO—were integrated, resulting in neutrality. These findings indicate that sensory modalities differ not only in their impact on mean valence and arousal but also in the structure of affective representations, suggesting that individuals use adaptable perceptual strategies according to the specific features of each emotion.

Topic Area: EMOTION & SOCIAL: Person perception

B24 - The involvement of heart rate variability in the updating process of internal models during emotion recognition of others

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The accurate recognition of emotions of others constitutes a fundamental component of successful social interaction. Previous research has extensively examined the processes by which individuals infer others' emotional states from external cues such as facial expressions and vocal tone. These studies have consistently demonstrated that higher levels of parasympathetic nervous activity are associated with greater accuracy in recognizing emotions of others. However, little is known about how internal models or representations of others' emotional states are updated through experience. The present study employed trial-by-trial feedback on participants' emotion judgments to investigate the relationship between the updating of internal models and autonomic nervous activity as indexed by heart rate variability (HRV). In addition, to examine whether the influence of HRV on internal model updating is specific to social contexts, a strictly controlled non-social control condition was included. At present, data from 22 participants have been collected, preliminary findings suggest a general trend whereby, although higher parasympathetic activity indexed by RMSSD during rest did not predict greater accuracy in emotion recognition, this relationship emerged during the task. Participants showed successful learning within each block, indicating that they learned based on the feedback provided. This pattern is consistent with previous research. Further analyses will clarify the dynamic interplay between autonomic regulation and internal model updating in social emotion processing.

Topic Area: EMOTION & SOCIAL: Person perception

B25 - Neural correlates of memory generalization in young monolingual and bilingual children

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Memory generalization enables young children to apply learned information to new contexts (Eichenbaum, 1997) and engages the brain's prefrontal cortex (Ghetti & Fandokova, 2020). Bilingual 6- to 24-month-olds often outperform their monolingual peers on memory generalization (e.g., Brito & Barr, 2012). However, the underlying neural mechanisms and potential neural differences between young monolingual and bilingual children during this period of significant brain development remain unclear. This study will investigate children's frontal lobe cortical activity using functional near-infrared spectroscopy as they complete a deferred imitation task (Hayne et al., 1997). To date, we have collected data from 16 monolingual and 16 bilingual children (24-37 months). During the learning phase of the task, the child watched an experimenter perform eight actions on a puppet (e.g., shake hands). After a 10-minute delay, we assessed children's

performance by the number of actions they reproduced on a different puppet (i.e., generalization phase). Preliminary results from a subset sample (ten monolinguals and seven bilinguals) showed no behavioral differences between monolinguals and bilinguals. Children, especially monolinguals, showed greater right-hemisphere activation during learning ($p = .021$, $p = .005$). Monolinguals also showed significant left-frontal activation during generalization ($p = .009$), possibly signaling intrinsic verbal retrieval. Bilinguals did not show significant activation in either phase. These preliminary findings should be interpreted with caution given the small sample size. By the time of presentation (March 2026), we will complete the analyses of the rest. The final findings will advance our understanding of children's cognitive development for effective learning.

Topic Area: EXECUTIVE PROCESSES: Development & aging

B26 - Neural Mechanisms Underlying Cognitive Control: Frontal Midline Theta and Pre-Cue Alpha in Healthy Controls and People with Schizophrenia

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Cognitive control enables goal-directed behavior in daily life and is often disrupted in people with schizophrenia (PSZ). The present study used electroencephalography (EEG) to examine two putative neural mechanisms underlying cognitive control: frontal midline theta (fmTheta) and pre-stimulus alpha (i.e., pre-cue alpha) in a cued task-switching paradigm adapted from Cooper et al. (2019). Cue informativeness was varied to manipulate the extent to which participants could prepare for the target and engage proactive control. We hypothesized that fmTheta power functions as a neural marker of proactive control and that pre-cue alpha supports context updating by clearing residual information from the previous trial. Data collection is ongoing, with 24 healthy controls (HC) and 15 PSZ having completed the task while EEG was recorded. Preliminary analyses showed that, as expected, fmTheta power was higher on trials in which proactive control was possible (i.e., when cues are more informative about upcoming response demands) and was reduced in PSZ relative to HC. Across participants, greater fmTheta was associated with faster reaction times, suggesting more efficient proactive control. Preliminary results also provided partial support for the proposed context-updating role of pre-cue alpha: higher pre-cue alpha was marginally associated with lower switch costs in HC. Together, these preliminary findings reinforce the role of fmTheta as a neural marker of proactive control, demonstrate individual differences linking greater fmTheta to more efficient control engagement, and highlight a potential role for pre-cue alpha in clearing previous-trial information to facilitate task performance.

Topic Area: EXECUTIVE PROCESSES: Goal maintenance & switching

B27 - Locus coeruleus–norepinephrine (LC-NE) system and cognitive and behavioral flexibility in autism

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Purpose: This study examined: (1) differences in LC–NE system function and cognitive flexibility between neurotypical (NT) and autistic children, and (2) associations among LC–NE activity, flexibility, and autism symptoms. **Methods:** Participants were 12 autistic and 21 IQ- and sex-matched NT children. Three tasks conducted include 1) Resting-state eye-tracking to assess tonic LC activity (pupil diameter), 2) Passive novelty-response task to index phasic LC activity (pupil dilation response; PDR), and 3) Dimensional Change Card Sort (DCCS) task to assess cognitive flexibility via behavioral switch costs and ERPs (N2 and late frontal negativity during switch trials). Caregivers completed the Behavioral Flexibility Rating Scale–Revised (BFRS-R) and Social Responsiveness Scale–2 (SRS-2). **Results:** No significant group differences were found in tonic pupil diameter or phasic PDR ($p > .05$). During the DCCS, children were slower on switch than repetition trials ($p < .001$), but performance did not differ by group. Across participants, larger resting pupil diameter correlated with reduced PDR ($r = -.406$, $p = .019$), driven by NT children, and with higher switch cost ($r = .377$, $p = .033$). LC activity did not relate to BFRS-R or SRS-2 scores. However, reduced behavioral flexibility (higher BFRS-R) associated with smaller switch costs ($r = -.638$, $p = .035$). ERP measures showed group-specific associations with autism traits. **Conclusions:** The current preliminary findings suggest altered tonic–phasic LC coupling and reduced flexibility linked to elevated tonic LC activity in autism. Despite no direct links with autism symptoms, LC–NE function appears integral to cognitive and behavioral flexibility in childhood.

Topic Area: EXECUTIVE PROCESSES: Goal maintenance & switching

B28 - Transient frontopolar cortex stimulation induces prolonged disruption to counterfactual processing

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Frontopolar cortex (FPC) contains area 10, which is an anterior sub-region of prefrontal cortex exclusive to humans and non-human primates (NHPs), and is thought to support monitoring the value of switching between alternative goals. However, the neuronal mechanisms underlying this function are unclear. Here we used multielectrode (Utah) arrays to record the local field potentials (LFPs) in the FPC of two macaques performing a Wisconsin Card Sorting Test analogue. Using model-based analyses we found that bursts of gamma and beta in FPC tracked counterfactual not current rule value. Moreover, we show that brief high-frequency microstimulation to a single trial causally affects both LFP activity in FPC, as well as the NHPs rule-guided decision-making across ~10-15 successive trials. Following stimulation of FPC we observed reduced exploration of the counterfactual rule in the run up to a rule-change ~10 trials later, as

well as a delayed adaptation to the newly relevant rule following the rule-change. A similar, multi-trial time-course disturbance to beta and gamma activity within FPC was also induced following the aforementioned single-trial microstimulation. These findings link neuronal activity in FPC with behavioural monitoring of the value of counterfactual rules and provide neural mechanistic insights into how FPC supports rule-based decision-making.

Topic Area: EXECUTIVE PROCESSES: Goal maintenance & switching

B29 - The Demands of Beginning of Extended Tasks are Categorically Different from Control Demands During Their Subsequent Execution

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Neuroscientific accounts of cognitive control fundamentally center on the activation of frontoparietal regions in response to diverse task demands. Typically, these cognitive control processes are instantiated within the framework of overarching, extended tasks, where they are implemented as part of a larger, coordinated set of control interventions. Studies have demonstrated the presence of goal-directed, higher-level programs that are established at the initiation of such extended tasks; these programs subsume the subsequent execution of the task and bring about this coordinated set of control interventions. Difficult task episodes that require a complex set of control processes will also require a complex higher-level program to organize and bring about this complex set of control processes. Although it is well-known that the frontoparietal regions activate during the execution of such difficult episodes when more complex control processes are needed, what happens at the beginning of such episodes, when a more complex higher-level program is needed, remains unknown. Using functional magnetic resonance imaging (fMRI) and five different experiments, we show that instantiating complex higher-level programs deactivates the very same frontoparietal regions that activate during control processes. This distinction between the demands of the higher-level programs versus control processes also extended to psychophysiological signatures. Pupil diameter, well known to increase to control processes, decreased when more demanding, higher-level programs were being instantiated. Collectively, we show that the cognitive demand related to instantiating such higher-level programs is categorically different from control demands during the subsequent execution of extended tasks. This study was funded by TÜBİTAK 1001-grant:120K924.

Topic Area: EXECUTIVE PROCESSES: Goal maintenance & switching

B30 - Integrated uncertainty modulates frontoparietal hub connectivity profiles for flexible control

To flexibly guide behavior, the human brain must integrate multiple streams of information from diverse external and internal information sources. Frontoparietal hub regions have long been assumed to be involved in integrative functions due to their extensive connectivity with other regions/networks. Recent work from our lab suggests frontoparietal hubs read out and resolve integrated uncertainty in the service of flexible, goal directed behavior (Leach et al., 2025). What remains unknown is how frontoparietal hubs leverage this integrated uncertainty to influence communication between distributed brain systems. In the current study, we developed, validated, and applied a novel beta-gPPI analysis to answer this question. In short, this beta-gPPI method combines two functional connectivity measures, gPPI and beta series, with a temporal lag component to assess temporal directionality, allowing for directional inferences in the observed connectivity profiles. To validate this approach, we first conducted simulations demonstrating that this method is capable of detecting directional interactions obscured by noise (power > .80; false positive rate < .05). Next, we confirmed detection of expected motor and task region connectivity profiles in the dataset. Finally, we extended this approach to assess how frontoparietal hubs utilize integrated uncertainty to flexibly guide behavior. Findings suggests that frontoparietal hubs leverage uncertainty arising from integration (cue time-lock) to first bias task execution (probe time-lock) and then bias prediction error processes (feedback time-lock). Altogether, these results show that frontoparietal hubs utilize integrated uncertainty to dynamically configure functional interactions between brain systems for flexible, goal directed behavior.

Topic Area: EXECUTIVE PROCESSES: Goal maintenance & switching

B31 - Real-world cognitive benefits of acute classroom-based exercise in a large-scale sample of schoolchildren

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An accumulating literature has reported that acute physical activity (PA) positively benefits executive function (EF); however, such benefits have been largely limited to controlled laboratory settings and not large-scale, real-world classroom replications. This represents a salient limitation because from the current literature it is unclear whether PA elicits domain-general or domain-specific EF benefits, and whether pre-class PA provides a larger EF “boost” compared to pre-class activities focusing on cognitive training. Here, 99 children (8-10 years) from four classes participated in a real-world classroom experiment comprising four groups: (1) 10-min mentally passive sitting (i.e., video watching), (2) 10-min mentally active sitting (i.e., math training), (3) 5-min sitting and 5-min PA, and (4) 10-min of PA involving instructor-guided group physical exercise (i.e., running, knee lifts, and

deep squats). Domain-general (Flanker task) and domain-specific (negative priming task) EF were evaluated at baseline (T0), post-intervention (T1), and after a 40-min math lesson (T2). Bayesian linear mixed models were used to examine reaction time (RT) and inverse efficiency scores (IES) across domain-general and -specific tasks. Results for the domain-general assessment did not elicit RT or IES changes across T0 to T2. Notably, however, for the domain-specific assessment, the 10-min PA condition showed improved IES at T2 compared to T0, whereas no other group showed a similar benefit. Thus, in the context of a real-world classroom setting, a brief bout of PA provides a specific and durable benefit to a domain-specific component of EF.

Topic Area: EXECUTIVE PROCESSES: Monitoring & inhibitory control

B32 - Adaptive recovery under motivation: Characterizing multimodal signatures of post-error effort adjustment in an incentivized cognitive control task

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Adjusting cognitive performance after an error might be a key facet of adaptive cognitive control. While post-error response slowing has been reliably characterized during cognitive task performance, post-error changes in accuracy have been more variable, with both increases and decreases observed. Motivational context might be a key element in whether post-error, cognitive effort and task accuracy increase, or whether both are reduced. To address this question, we propose a study where healthy young adults will complete a modified Flanker task with adaptive noise calibration (to ensure comparable error rates across individuals) under incentive and non-incentive conditions. Concurrent with task performance, we will collect eye-tracking data to examine pupil dilation (indexing cognitive effort) and gaze allocation (indexing attention) on a trial-level basis. Predictive modeling will allow us to test the extent to which, at the trial-by-trial level, pre-error behavior and physiological measures predict post-error performance recovery across motivational contexts. We will test the hypothesis that, on a trial-by-trial basis, stronger multimodal “ramp-up” signatures (increased post-error slowing, enhanced pupil dilation, and increased on-target gaze) will predict higher rates of adaptive recovery (post-error correct response) versus disengagement (post-error incorrect response). We further anticipate that incentives will amplify multimodal ramp-up, thereby increasing post-error adaptive recovery. We will also examine the extent to which individual differences in reward sensitivity, motivation, and emotion moderate these relationships. This approach will advance understanding of post-error adjustment and help clarify the contexts under which more or less adaptive adjustment of performance occurs, with important implications in applied domains.

Topic Area: EXECUTIVE PROCESSES: Monitoring & inhibitory control

B33 - Deficits of response inhibition in depression arise from subphases of inhibitory control

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Inhibitory control deficits may underlie depression's most troubling symptoms. Response inhibition (RI), measured during the Stop-Signal Task (SST), is often but not always impaired in major depressive disorder (MDD). We predict paradoxical findings arise from imprecision of estimated RI metrics such as the Stop-Signal Reaction Time (SSRT). Furthermore, recent RI literature emphasizes that stopping involves a fast, nonselective Pause-phase followed by a slower, selective Cancel-phase. If and how Pause and Cancel processes are disrupted in MDD is unknown. We measured muscle and brain (EMG/EEG) correlates of Pause and Cancel in MDD patients to test if they significantly differ from Healthy Controls (HC). MDD patients (N=29) completed the SST while EEG and hand EMG were collected. Their performance and EMG/EEG signatures of Pause and Cancel were compared to a sample of healthy controls with open-source SST data (N=20). MDD patients responded more slowly than HCs. Their SSRT was also significantly longer ($t = -2.76$, $p = .008$), indicating impaired RI. Though timing of the Pause process did not differ in MDD versus HCs ($t = -1.24$, $p = .22$), residual EMG during stopping was higher during the Cancel period in MDD ($t = 2.37$, $p = .02$). MDD was also associated with significantly smaller frontal P3 peaks (348-402ms, p 's $< .05$). Result support that RI abnormalities in depression are driven by changes to the Cancel process, purportedly implemented by indirect pathway circuits that change in depression. Our work sets the stage for investigation of Cancel as a cognitive factor in MDD.

Topic Area: EXECUTIVE PROCESSES: Monitoring & inhibitory control

B34 - Widespread Network Functional Changes Including Sensory Cortices in Temporal Lobe Epilepsy

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Temporal lobe epilepsies (TLE) are amongst the commonest types of epilepsies. While the lesions are typically in the medial temporal lobe, patients present with a range of neuropsychological deficits. Existing studies have characterized poor activations of cognitive control regions and poor deactivations in the default mode regions as well as changes in functional connectivity across these regions, and have suggested that TLE is characterized by widespread neural dysfunction that is not limited to medial temporal lobe regions. We found that

changes in these patients are not limited to these networks and even include sensory cortices. While these regions do not present with perceptual problems, the behavior of their sensory cortices was markedly different from that in healthy controls. These regions did not activate in task situations that normally activate them and did not deactivate in situations that normally deactivate them, resulting in overall less differentiated responses. Visual regions in TLE patients showed poor activation of visual regions in visual working memory tasks compared to those in controls. However, these same visual regions in TLE patients showed greater activation in response to language tasks, a phenomenon not observed in controls. Auditory and right somatomotor regions, which are not involved in the ongoing visual working memory task since responses are made using the right hand, were deactivated in control subjects but not in TLE patients. Lastly, while sensory regions in the control group did not show higher activation in response to language processing demands, those in TLE patients did.

Topic Area: EXECUTIVE PROCESSES: Other

B35 - When Control Loses Control: Disordered Activation of Frontoparietal Networks in Temporal Lobe Epilepsy

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Temporal lobe epilepsy (TLE) is among the most common forms of epilepsy. Although lesions are typically confined to the medial temporal lobe, cognitive control deficits are a consistent feature. Previous studies have shown reduced activation of cognitive control regions in TLE patients, yet it remains unclear whether this reflects the disease's etiopathogenesis or the suppressive effects of antiepileptic medications that reduce neural firing. We investigated whether the diminished activation observed in TLE extends across all brain regions or is functionally selective. TLE patients and healthy controls performed two tasks: a visual working memory (WM) updating task and a language task in which participants completed sentences by generating the missing word. Analyses focused on well-characterized networks—frontoparietal regions associated with cognitive control and frontotemporal regions linked to language. These networks are functionally distinct: frontoparietal regions typically activate under control demands but not during language processing, and vice versa for language regions. As expected, controls showed strong frontoparietal activation during the difficult WM task. This activation was markedly reduced in TLE patients. In contrast, language-region responses during sentence completion were preserved. Strikingly, in TLE patients, frontoparietal regions that failed to activate during WM exhibited abnormally elevated activation during the language task—a pattern absent in controls. These results suggest that TLE is not

characterized by a general hypoactivation of cognitive control regions but by disordered activation: regions that should engage during control tasks fail to do so, yet aberrantly activate during tasks where they should remain inactive.

Topic Area: EXECUTIVE PROCESSES: Other

B36 - Daily Yoga on Working Memory and Symptomology of Attention Deficit Hyperactivity

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Attention deficit hyperactivity disorder (ADHD) impacts a person's executive functions, including self-control, selective attention, cognitive inhibition, and working memory. The symptoms associated with ADHD affect a person's daily life. As young adults transition into adulthood, ways of managing symptoms are crucial to improving quality of life. To examine yoga as a potential form of symptomatic regulation for ADHD in young adults, participants with ADHD took part in an eight-week Vinyasa yoga intervention. With a control group of ADHD participants completing a movement intervention. Pre- and post-tests included the 2-Back Task and Adult ADHD Self Report Scale (ASRS) to assess the impact of yoga on working memory. EEG measurements were taken of the P1, P3, N1, and N2 ERP components. In the post-test, the Yoga group demonstrated a significantly greater improvement in accuracy and response time of the 2-back task than the Movement group. Relative to the Movement group, where no impact on the N2 or P3 was found post-intervention, the Yoga group showed a larger N2 and P3 post-intervention, indicating that yoga, as opposed to movement, improved conflict monitoring and attentional resource control, respectively. Additionally, the Yoga group presented a lowered delay in the P1 component and higher amplitudes in the N2 component, suggesting increased attention compared to the Movement group. Participant responses post-intervention to ASRS suggest correlations with reduced ADHD symptomology. Higher ERP components in the N2 and P3 suggest a complex impact of yoga on participants' working memory.

Topic Area: EXECUTIVE PROCESSES: Working memory

B37 - Functional connectivity of alpha-oscillations varies across task conditions.

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The proposed role of alpha-range (8-12Hz) oscillations in cognition includes gating for selective attention and cognitive control. Here we measured within-subject functional connectivity (FC) during modulations of alpha power across task conditions, to test if they can be mapped to an underlying network. We recorded, concurrently, EEG

and fMRI signals while participants (n=176) performed a spatial working memory (SWM) task, a passive viewing task, and resting eyes open/closed (EO/EC) conditions. Using psychophysiological interaction modeling, we identified alpha-related FC of lateral and superior occipital regions of interest (ROIs) during encoding and probe conditions of the SWM task, and during passive and EO/EC conditions. Across ROIs, alpha-power decreases during stimulus processing were associated with FC with visual and dorsal attention networks, and control network A, as well as decreased FC with default mode network B for superior ROIs. However, the FC differed among ROIs, stronger for superior over lateral ROIs, and differed by stimulus type (encoding, probe, passive), with no significant FC associations during passive viewing despite significant alpha modulation. Furthermore, the FC patterns further differed during EO/EC conditions, involving greater FC with somatosensory networks, and contextualized by accompanying decreases in BOLD signal. In sum, the data show that alpha power modulations are associated with varying FC of visual cortex, most strongly superior, that is contextualized by task context. The data are consistent with a general role of alpha oscillations in modulating cortical activity, subject to varying driving factors.

Topic Area: EXECUTIVE PROCESSES: Working memory

B38 - Dynamics of motor code formation in working memory

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Working memory (WM) maintains information to guide adaptive behavior, preparing required action plans as motor codes based on its contents. In this EEG study, we investigated how the formation of motor codes from sensory information is influenced by affordances, selective attention, and task demands. Participants performed a delayed-match-to-sample task in which they memorized two simultaneously presented orientations and later reported them in cued order. Response preparation was made possible for either the first or second report, through blockwise instructions. Results showed that affordances alone did not trigger motor preparation until cue presentation: Even when both stimuli only allowed selection of the same response hand, we observed no lateralized centro-parietal mu/beta activity prior to the cue, suggesting the absence of motor preparation, and indicating that task demands shape how items are supported in WM. We also found evidence of motor preparation related to the probes that doesn't allow response preparation by instruction. This suggests that affordances can still be a supporting factor for WM. Furthermore, on trials where it was possible to prepare a response for the second probe, we found no posterior alpha power lateralization associated with the re-focusing of attention after the first probe. This supports the assumption that WM relies more strongly on prospective motor codes when sensory information is not prioritized and the of prospective action is sufficient. Overall, our results indicate that the

relative contribution of affordances and selective attention in forming motor codes within WM is shaped by task requirements.

Topic Area: EXECUTIVE PROCESSES: Working memory

B39 - Successive Task Steps Elicit Orthogonal Activity Patterns in Widespread Brain Regions

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Our goals require a sequence of steps for their completion. This sequential organisation is a key principle of cognition. While existing research has explored the initiation and termination of tasks, the relation between their sequential steps remains underexplored. Primate neurophysiology has suggested that neural population activity-patterns in the fronto-parietal cortices dynamically evolve across extended tasks, going through a series of states such that successive steps elicit orthogonal or uncorrelated patterns of activity (Sigala et al., 2008; Kadohisa et al., 2020). These observations come from task steps with distinct demands and have been explained as the same population of neurons doing different cognitive operations required across the successive steps. Here, we investigated whether orthogonal coding of successive steps is a general feature of cognition and occurs in other neural regions, and during any sequential task – even when successive steps do not require different cognitive operations – and if this occurs for steps that are not proximate in time but are construed by participants as being successive. Participants (N = 33) executed a 3-back task consisting of 9-trial episodes. They covertly detected ‘targets’ (i.e., matches) across fMRI runs. The maximum number of targets within episodes was three. We found that activity-patterns generated by successive steps were less correlated with each other compared to those generated by non-successive steps. Further, successive targets, although they never occurred consecutively, also showed decreased correlation in their activity-patterns. Crucially, these were seen not just in the control-related fronto-parietal regions but were seen in most brain regions.

Topic Area: EXECUTIVE PROCESSES: Working memory

B40 - The Effects of Hearing Loss on Age-related Changes in Neural Oscillatory Activity Underlying Spatial Working Memory Processing in Youth

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Neuroimaging studies have shown that working memory-related (WM) neural dynamics change as a function of age, and these changes support improvements in performance. While children who are hard-of-hearing (CHH) are at a heightened risk for difficulties in language ability relative to children with normal hearing (CNH), less is known whether these differences extend to other cognitive domains such as spatial WM. This is especially important, as studies show a link between WM and language ability in both CNH and in CHH. To this end, this study explored whether age-related oscillatory dynamics serving spatial WM differed between CHH and CNH, and the effects on behavior. A total of 66 typically-developing CNH and 54 CHH ages 7-15 completed a modified Sternberg spatial WM task during magnetoencephalography (MEG). MEG data was co-registered, pre-processed, and transformed to the time-frequency domain. Significant oscillatory responses corresponding to each phase of WM (e.g., encoding, maintenance) were imaged using beamforming and submitted to linear mixed effects modelling to determine age-related changes as a function of group. We found a significant main effect of age on accuracy and reaction time in both groups, as well as a significant age-by-group interaction on reaction time. We also found significant phase-specific changes in the age-related alterations in alpha-beta oscillatory dynamics throughout frontoparietal and temporal regions as a function of group that were uniquely related to task performance. Taken together, these data suggest that CHH show altered age-related changes in the neural dynamics serving WM function, which may underlie differences in language development.

Topic Area: EXECUTIVE PROCESSES: Working memory

B41 - The effect of ketamine on the activities of and interactions between interneurons and principal cells in the dorsal hippocampus

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Sub-anesthetic ketamine is a dissociative drug that has gained recent attention for its ability to treat psychiatric and neurodegenerative disorders such as depression and Parkinson's disease, possibly by disrupting pathological patterns of neural synchrony. Although sub-anesthetic ketamine is known to alter local-field potentials in the hippocampus, less is known about how ketamine alters interactions between individual neurons and neuron types. We examined how ketamine affects interactions between principal cells and interneurons in the dorsal hippocampus, a brain region important for memory and navigation. We predicted that ketamine would reduce between-neuron correlations. To investigate, male and female Sprague-Dawley rats (N=5) were implanted with Neuropixels probes, and recordings were

acquired from the CA1, CA2, and CA3 regions of the hippocampus (AP:3.35 ML:2.8 DV:2-3.5mm) while rats were freely traversing an open field. Rats were subsequently injected with two doses of ketamine (20 mg/kg, i.p.) administered 2 hours apart. Neurons were subdivided by firing-rate and waveform width to allow analysis of putative principal cells and interneurons. Analysis of >400 single units as well as local-field potentials in the hippocampus revealed altered firing dynamics in putative interneurons and principal cells. We found that ketamine both increased and decreased firing-rate, decreased bursting activity, and altered oscillatory activity. These findings indicate that ketamine is able to disrupt neural firing patterns in the hippocampus and that ketamine could be treating psychiatric and neurodegenerative disorders by disrupting pathological patterns of neural synchrony. Supported by: NIH R01 RF1AG081767, NIH R01 NS122805-03.

Topic Area: EXECUTIVE PROCESSES: Working memory

B42 - Dual Mechanisms of Music Effects on Working Memory: Timing-Dependent Neural and Autonomic Signatures of Arousal and Interference

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The effects of background music (BGM) on cognitive performance are still debated. We examined whether music influences working memory differently depending on when it is heard, comparing music played during task performance (BGM) with music heard before the task (Mozart condition). Neural and autonomic measures were combined. Twenty-nine healthy young adults (29.0 ± 4.5 years; 21 males) performed a Sternberg working memory task under six conditions: BGM (simultaneous listening) and Mozart (pre-task listening) $\times$ fast/slow tempo, plus a silent control. Prefrontal activity in the dorsolateral and dorsomedial prefrontal cortex (DLPFC, DMPFC) was measured using fNIRS. Heart rate (HR), heart rate variability (RMSSD), and ratings of arousal and concentration were collected. Data were analyzed using linear mixed-effects models. Accuracy showed a significant condition $\times$ tempo interaction ($p = .017$). Performance improved in the Mozart–Fast condition (+2.5%) but declined during BGM. DLPFC activity was higher during BGM than during the Mozart condition ($p = .023$), suggesting increased cognitive demands. DMPFC activity and HR were mainly influenced by tempo, with higher values for fast than slow music ($p < .001$; $p = .003$). Arousal and concentration ratings were weakly related in BGM–Fast but positively correlated in Mozart–Fast ($r = .42$, $p < .0001$), with corresponding changes in RMSSD. Music affects working memory in a timing-dependent manner. Music heard during task performance tends to interfere with processing, whereas music heard before the task enhances arousal in a way that supports concentration and performance. Fast-tempo music before a task may therefore benefit working memory.

Topic Area: EXECUTIVE PROCESSES: Working memory

B43 - Age-Dependent Shifts in Functional Correlates of the Tip-of-the-Tongue Phenomenon

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Imagine pausing mid-sentence as a familiar word lingers just out of reach—its meaning vivid, its sound inaccessible. The Tip-of-the-Tongue (ToT) phenomenon is classically attributed to weakened transmission between semantic and phonological nodes, yet the dominant source of this transmission failure may evolve with age. Here, we ask whether the principal systems underlying ToT differ across the adult lifespan, integrating behavioral and resting-state magnetoencephalography (MEG) data from the CamCAN dataset. Behaviorally, we derived motor- and memory-related indices from a battery of cognitive measures using principal component analysis and examined their relationships with individuals' ToT ratios across age. The two components exhibited dissociable trajectories: motor factors predicted ToT frequency more strongly in younger adults, whereas mnemonic factors increasingly dominated with age. At the neural level, we computed power-envelope correlation matrices across multiple frequency bands and identified nodes showing reliable correlations with ToT ratios that recurred across leave-one-out iterations. Nodes within motor and memory networks revealed frequency-specific associations with ToT ratios that differed across age groups, suggesting distinct frequency bases for their contributions to word retrieval. Together, these results indicate that the Tip-of-the-Tongue phenomenon is associated with different functional networks across adulthood: ToT variance covaries with motor–phonological network measures in younger adults and with memory-related network measures in older adults. These associations exhibit distinct frequency profiles, suggesting age-dependent shifts in the neural correlates of semantic-to-phonological transmission.

Topic Area: LANGUAGE: Development & aging

B44 - Tracing the Emergence of Classifier Use in Mandarin-Speaking Children: Insights from Longitudinal Naturalistic Data

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Mandarin Chinese provides a revealing case for studying early language development as a classifier language, where a classifier must appear between a numeral or determiner and the quantified noun. Classifiers encode rich semantic features such as animacy, shape, and material, yet the mappings between classifiers and nouns are often opaque, even for adult speakers. How young children discover these form–meaning correspondences offers a window into the development of linguistic and conceptual organization. Previous research has largely examined older children (above age four) in experimental settings, leaving the early emergence of classifier use underexplored. The present study analyzed longitudinal naturalistic data from 16 Mandarin-speaking children (ages 1;4–5;4) available on CHILDES. Results show that children first produce the general classifier *ge* and extend its use to contexts where specific classifiers

(e.g., liàng for vehicles) would be expected. Over time, they expand to classifiers denoting animate, shape-based, and collective categories (e.g., zhī, tiáo, zhāng, shuāng). Moreover, children initially employ determiner–classifier combinations (e.g., zhè gè, “this [CL]”) before numeral–classifier constructions and tend to omit the noun in the former but not in the latter. These findings support both the Semantic Feature Hypothesis and the Functional Core Hypothesis, suggesting that early classifier use reflects the interaction between perception and the bounding contexts children are exposed to.

Topic Area: LANGUAGE: Development & aging

B45 - Neural Oscillatory Dynamics Serving Lexical Decision-Making in Youth with Mild-to-Severe Hearing Loss

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Despite early clinical interventions, children with mild-to-severe hearing loss (CHH) remain at greater risk for language deficits throughout development compared to children with normal hearing (CNH). Recent research has shown that a proper characterization of the neural dynamics underlying these language processes may hold promise in uncovering the biological underpinnings of these deficits. Nonetheless, an understanding of the neural dynamics that underlie language processes in youth and how auditory experience impacts these dynamics in CHH remains unclear. To this end, the current study aimed to characterize the neural responses that serve lexical decision-making processes among CHH and CNH. A sample of 50 CNH and 40 CHH ages 7-15 years completed a lexical decision-making task during magnetoencephalography (MEG). Participants were binaurally presented with a stimulus and instructed to indicate whether they heard a word or pseudoword. MEG data was preprocessed and transformed into the time-frequency domain. Significant oscillatory responses were identified and imaged using beamforming, and the effects of group, age, and brain-behavior relationships were analyzed. While we found significant age-related improvements in task performance across groups, CHH responded significantly slower and were less accurate than CNH. Significant neural responses in the alpha and beta frequencies were identified in well-known language regions following the onset of the stimuli. Source-level linear-mixed effects modelling revealed frequency-specific effects of group and task condition on neural responses in the left language network, including the temporoparietal junction. These data suggest that altered auditory experience may impact the neural oscillatory dynamics that serve lexical processing

Topic Area: LANGUAGE: Lexicon

B46 - Earlier sensory encoding for surprising words in connected speech

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Understanding spoken language involves hierarchical processing, from early sensory analysis of sound to higher-level linguistic comprehension. Predictive neural models such as temporal response functions (TRFs) have shown that these stages are not independent. Yet, it remains unclear how different levels interact in neural timing. Recent work from our lab (Dou et al., 2025) found that TRFs to word surprisal—resembling an N400-like response—are faster for more predictable words. Here, we test whether this effect extends to earlier sensory processing. Specifically, we asked whether acoustic TRFs that track the speech envelope also show shorter latencies for predictable words, suggesting that higher-level predictions can influence the temporal dynamics of low-level auditory encoding. We reanalyzed EEG data from Broderick et al. (2018), in which 19 participants listened to ~60 minutes of an audiobook. Word surprisal and entropy were computed and grouped into four levels (very low, low, high, very high). Separate TRF models were built for each group within each linguistic complexity metric, focusing on acoustic TRFs while controlling for word-level features. Envelope TRFs showed shorter latencies for highly surprising words compared to very predictable ones—contrary to our initial hypothesis. This pattern replicated in a second dataset (N = 21). No latency shifts were found for word entropy, suggesting that the effect may relate specifically to prediction error rather than contextual uncertainty. Although additional analyses are needed to exclude attentional effects, these findings suggest that surprisal shapes the temporal dynamics of early auditory encoding, highlighting top-down interactions during naturalistic speech comprehension.

Topic Area: LANGUAGE: Lexicon

B47 - Optimizing the multivariate stimulus-response framework for identifying EEG responses to statistically-dependent stimulus representations

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An emerging approach to studying speech-related EEG processing involves fitting a multivariate forward model (mTRF) in which stimulus properties are used to predict neural electrical responses. A key question in that regard is how to represent the stimulus as input. Two attributes of speech stimuli commonly used as inputs to forward models are the spectrogram of speech sounds and binary feature

vectors representing its phonetic properties. Both of these are known to contribute to the neuroelectric response evoked by speech, individually and together. However, a significant challenge is how to best isolate their respective effects, given that they share some degree of mutual information. To address this, we propose enhancements to the mTRF framework using a new statistical method. Forward model specificity is increased through cyclic permutation. Implementation requires tackling three technical challenges: effectively managing correlations among channels in multi-sensor EEG data; reducing effects of endogenous drift and recording artifacts; and reducing the noise sensitivity of the ridge regression hyperparameter via numerical simulation. The effectiveness of this approach is tested on EEG data of natural speech listening in 24 adults with normal hearing. Our method identifies neural responses specific to phonetic and acoustic input variables, even when data were insufficient for the conventional mTRF model to achieve the same. We discuss the benefits of this approach to developing multivariate EEG models with greater sensitivity and stimulus-specificity.

Topic Area: LANGUAGE: Other

B48 - Bilingual arithmetic in the brain: an ERP study of simple multiplication in balanced bilinguals and English speakers with limited L2

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Typically, bilinguals learn multiplication facts in their native language (L1), resulting in a performance advantage for arithmetic in L1 compared to a second language (L2). This advantage is often greater for individuals with lower L2 proficiency. The bilingual encoding complex model posits that language proficiency influences the strength of associative links between multiplication problems and solutions within language-specific memory networks. Consequently, individuals with lower L2 proficiency may access L2 arithmetic representations less efficiently than higher-proficiency adults. This project examines whether adults with low L2 proficiency exhibit distinct neural responses to multiplication problems presented in each language compared to adults with balanced L1 and L2 proficiency. Event-related potentials (ERPs) were recorded as participants verified the correctness of spoken multiplication facts (e.g., $2 \times 4 = 8$?) in L1 or L2. Preliminary behavioral data ($N = 16$) suggest that low L2 proficiency adults were more accurate and faster than adults with balanced L1 and L2 proficiency ($M_{acc} = 77\%$ vs. 73% ; $MRT = 1,190$ ms vs. $1,270$ ms). Both groups showed an L1 advantage; however, low L2 proficiency adults' performance in Spanish was slightly lower than that of adults with balanced proficiency, suggesting potential convergence in L2 arithmetic processing among lower-proficiency participants. Preliminary ERP findings indicate that, for low L2 proficiency adults, incorrect L2 solutions elicit a larger N400 component than correct ones, reflecting differences in semantic memory access. In contrast, this effect appears modulated by a target-

related P300 in L1, suggesting that over-rehearsed L1 arithmetic relies on automatic retrieval, whereas L2 problems evoke deeper processing.

Topic Area: LANGUAGE: Other

B49 - Talker accent modulates neural processing of Mandarin-English code-switched speech

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Code-switching in speech typically results in behavioural (Fricke et. al, 2016; Olson, 2017) and neurophysiological costs (e.g., N400, LPC; Fernandez et. al, 2019; Yacovone et. al, 2021). That said, anticipatory phonetic cues reduce behavioral switch costs (Shen et. al, 2020). Moreover, foreign accented speech modulates neurophysiological responses to otherwise unexpected speech patterns (Hanulíková et. al, 2011). Here, we ask whether listeners process code-switched sentences differently when speaker accent varies. Mandarin-English bilingual participants ($n = 48$) listened to English sentences with and without Mandarin code-switches produced by a Canadian English or Mandarin-accented talker, while their neural activity was recorded using a 32-channel whole-head EEG. In half of all audio stimuli, the entire sentence was spoken in English, while in the other half, a sentence-medial noun was spoken in Mandarin, while the rest of the sentence was in English; for example, "He did his homework on the school bus" or "He did his zuòyè (homework) on the school bus". We observed N400s for all code-switches relative to unilingual targets, and reduced N400 effects for English-to-Mandarin code-switches in the Mandarin-accented condition relative to those in the Canadian English condition. We also observed LPC/P600 effects exclusively for code-switches in Canadian English speech. We infer that speaker accent does influence code-switch processing costs, and that processing demands are eased in contexts where the code-switch is perceived as more typical. This research provides insight into neurophysiological mechanisms underlying code-switching, deepening our understanding of phonetic variation and cross-linguistic interactions in the multilingual brain.

Topic Area: LANGUAGE: Other

B50 - Combining MEG with Real-Time Measures of Articulation to Examine Motor Sequencing in Speech and Nonspeech Tasks

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We recently developed an MEG-compatible motion tracking system (MASK) capable of acquiring precise 3-dimensional kinematic data during speech and oromotor movements simultaneously with neuromagnetic brain activity [1,2]. To examine differences in brain

activation during speech versus nonspeech movements ten healthy adults performed overt speech movements (disyllabic nonwords, /ipa/, /pataka/) and non-speech movements (smile, pucker lips, tongue protrusion) of increasing sequencing complexity. These tasks required participants to organize simple and complex motor movement sequences, allowing us to examine how sequencing demands influence brain function and activation across speech and nonspeech actions. Speech and mouth kinematics were tracked simultaneously with 275-channel MEG recordings (CTF Systems, Canada) from the upper and lower lip and the tongue body, tip and dorsum to measure formation of vowels (/a/, /i/) and consonants (/t/, /k/), respectively, in addition to the acoustic speech signal. Source analysis showed left lateralized suppression of beta band (15-30Hz) activity during speech tasks in a region of the mid-precentral gyrus associated with speech motor sequencing [3]. In contrast, non-speech movements were associated with bilateral suppression of motor cortex. These preliminary results demonstrate the ability to measure time-locked brain responses and speech kinematics during overt speech tasks demonstrating the role of specific regions of the motor cortex in speech motor control.

Topic Area: LANGUAGE: Other

B51 - Processing of Diphthongs by Turkish English Bilinguals: An ERP Study

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This study examines how native phonological experience influences the brain's response to speech sounds in Turkish-English (TE) late bilinguals and American-English (AE) monolinguals. We asked whether neural responses reflecting encoding of auditory information would be sensitive to language-specific experience. Using the event-related potentials (ERP) Acoustic Change Complex (ACC), we measured neural responses to six stimuli, /u/, /ua/, /iu/, /ia/, /ea/, /eu/ where the vowel quality changes for all of these, except /u/ at 200 ms after onset. Participants were expected to show sensitivity to a change in vowel quality, but phonological differences between the two languages might lead to difference in the ACC, particularly for vowels changing the rounding and backness features (e.g., /i/ to /u/). In Turkish vowel harmony rules result in a second vowel taking on the features of the first vowel for many words. Twenty participants (10 AE, 10 TE) were tested using a 17-channel system. Results showed a significant ACC effect 200 ms after the vowel change at frontal-central sites, consisting of a P2 and N2 to the vowel change. No group differences were observed. This study suggests that general auditory mechanisms are reflected by the ACC. This finding, however, will need replication with a larger sample and other languages before concluding that language specific experience does not modulate the response. The future goal is to develop this measure as an index of auditory-phonetic deficits in bilingual populations.

Topic Area: LANGUAGE: Other

B52 - Right hemisphere capacity for language: A scoping review of lesion studies

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Background. The work of Jackson (1874, 1915) on the duality of human brain did not generate serious responses, but a few decades later, numerous studies addressed the issue of right hemisphere's language capacity (RHLC). The objectives of the current study include: What are the emerging trends in research? Are there distinctive sites of lesions and unique set of language characteristics associated with (RHD) syndrome and 'Crossed aphasia' (CA)? Were there any methodological innovations in the study of syntactic processing capacity of RH? What does language recovery reveal about the role of RH? Does RH contribute to reading and writing? **Method.** Scoping review of research published during 2000-2025. Several sources of data were used (PubMed, PsycINFO). Search terms used: RH damage and language, & language laterality. **Results.** A total of 250 articles were selected. Several emerging trends/topics of research were identified: Discourse production and comprehension (Blake, 2006), Prosodic production and comprehension (de Beer et al, 2023), Pragmatic deficits (Minga et al, 2020), Lexical semantics (Thompson et al, 2016), and Crossed aphasia (Takahashi et al, 2024). More importantly, our study found the use of morpho-syntactic processing as a tool to identify the status of syntax in RHD (Martoukou et al, 2025). The contribution of RHLC to reading was recognized (Taylor et al, 2003). Individual differences in learning and relearning of language were accounted by RHLC. (Pratt et al, 2023). The conceptual issues related to RHD syndrome and CA will be discussed in terms of a comparison of lesion localization and language characteristics.

Topic Area: LANGUAGE: Other

B53 - Differences in electrocortical activity during preparation for inner vs. spoken speech

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Understanding how inner speech is manifested electro-cortically is important for the development of brain-computer interfaces for communication, as well as gaining insight into disorders where inner speech is disrupted/misattributed. This study examined similarities and differences between event-related potentials (ERPs) during preparation for inner or spoken speech. Sixteen undergraduate students first viewed a response preparation cue (inner vs. spoken), followed by a word that they either spoke inwardly or aloud depending on the cue. Current analyses focused on ERP amplitudes obtained after the preparation cue: ERPs were quantified in 50 ms windows from 150-350 ms over frontal, central, and posterior sites as a function

of laterality (left, middle, right). Analyses indicated that changes in response preparation began after approximately 200 ms and were manifested as differences in topographic distribution of amplitudes over time. More specifically, ERP differences to cues were first manifested during the 200-250 ms window, with larger amplitudes to “spoken” vs. “inner” speech cues at central sites. This difference was maintained during the 250-300 ms window, spreading to bilateral frontal regions and continuing into the 300-350 ms window, possibly reflecting early articulatory mechanisms. At posterior sites, increased amplitudes were noted for inner speech cues during the 250-300 ms window, especially on the right. Although tentative, results provide evidence of dissociable electrocortical signatures of brain activity in preparation for inner and spoken speech. Increasing statistical power and examining individual differences in this activity are underway to enrich these preliminary findings.

Topic Area: LANGUAGE: Other

B54 - Modality-Specific Effects of Bilingualism and Musical Experience on Executive Control

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Bilingualism and musical experience have both been shown to moderate aspects of executive functioning but little is known about the similarities and differences between these effects. The present study examined the ability of participants to classify visual and auditory stimuli both individually and in combination in a task that placed high demands on executive control. One hundred fifteen young adults completed single-modality (visual or auditory) and dual modality (combined visual and auditory) versions of the task. Bilingualism was measured using the Language and Social Background Questionnaire score and musical experience was quantified using a score derived from detailed self-report questionnaire. Data were analyzed categorically by groups and continuously using linear regression. For categorical analyses, bilinguals performed more poorly than monolinguals in the auditory modality for which rapid lexical retrieval was required, whereas musicians performed better than nonmusicians overall. In the continuous analyses, more bilingual experience was associated with poorer performance in the dual auditory conditions, whereas greater musical experience contributed to accuracy across both dual modality conditions. These results demonstrate that these experiences contribute to specific aspects of executive functioning rather than overall modifications.

Topic Area: LANGUAGE: Other

B55 - Do Monolingual Norms Reflect Bilingual Expectations? Cloze and Association Consistency in English, Spanish–English and Mandarin–English Speakers

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Research on bilingual language comprehension has revealed differences in how bilinguals represent and predict words in their second language (L2). Such studies often rely on normative measures of word predictability—sentence cloze probability, which reflects the consistency of sentence completions, and forward association strength, which reflects the consistency of word-to-word associations. However, because norming studies typically come from monolingual speakers, it remains unclear whether these norms accurately reflect bilinguals’ predictive expectations in their L2. To test this, we collected sentence cloze probability and forward association norms from 170 Spanish–English bilinguals, 135 Mandarin–English bilinguals, and 37 English monolinguals. Proficiency was assessed with the Language History Questionnaire 3.0 and the LexTALE in English, Spanish or Chinese. English monolinguals showed the greatest consistency of cloze and association responses indicating stronger convergence on shared contextual expectations. Within bilingual subgroups, English proficiency predicted response consistency, though its effects varied by group and task. For Mandarin–English bilinguals, higher English proficiency was associated with greater consistency in sentence completions ($p < .001$) but not in word associations. For Spanish–English bilinguals, English proficiency showed a trend toward greater consistency in cloze completions ($p = .091$) and significantly predicted greater convergence in forward association responses ($p = .0045$). Overall, bilinguals showed greater variability reflecting differences in language experience. These findings show that predictive norms vary with bilingual experience. Establishing bilingual-specific normative datasets will enable more precise modeling of how prediction is implemented in the bilingual brain, linking language experience, expectation, and neural computation.

Topic Area: LANGUAGE: Semantic

B56 - Altered age-related changes in theta and beta oscillatory dynamics serving semantic processing in children who are hard-of-hearing

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Despite early detection and intervention, children who are hard-of-hearing (CHH) are at persistent risk for language delays compared to children with normal hearing (CNH). There is also substantial variability in language outcomes for CHH, but the root of this variability is unclear. An investigation of the neural dynamics underlying language processing may hold promise to determine the root of this variability. The present study aimed to characterize the neural

dynamics serving semantic processing in CHH and CNH. A sample of 50 CHH and 66 CNH ages 7-15 years completed a semantic judgment task during magnetoencephalography (MEG). In the task, participants were asked to determine whether a pair of words were semantically related. MEG data was preprocessed and transformed into the time-frequency domain. Significant oscillatory responses were imaged using beamforming, and the effects of group, age, and brain-behavior relationships were evaluated. We found CHH were less accurate on the task than CNH and showed a steeper age-related improvement. Significant task-related theta and beta responses were found throughout a distributed language network. Whole-brain linear mixed effects modelling revealed that CHH showed steeper age-related beta power decreases throughout anterior prefrontal cortex, ventral occipitotemporal cortex, and cuneus, as well as steeper age-related theta reductions in the inferior frontal gyrus and right superior temporal gyrus compared to CNH. These data suggest that hearing loss is associated with altered retrieval and control sub-processes of semantic processing during language development in youth, which could be used to inform the root of variability in outcomes in CHH.

Topic Area: LANGUAGE: Semantic

B57 - Memory for Category Exemplars and Hippocampal Connectivity in Aging

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Aging is often associated with changes in cognition and changes in brain connectivity. Here we asked how anterior and posterior hippocampus connectivity with large-scale brain networks changes with age, and how it relates to different memory functions. Young and older participants completed category learning, recognition and categorization test with novel stimuli, providing behavioral measures of category learning and exemplar memorization. Background functional connectivity was recorded during categorization in fMRI scanner. We found that age-related differences in hippocampal connectivity were regionally and network-specific. In anterior hippocampus, young adults showed greater connectivity to default mode and limbic networks, while older adults showed greater connectivity with control, ventral attention, and dorsal attention networks. Posterior hippocampus showed fewer age-related connectivity differences, with younger adults demonstrating greater connectivity with limbic and visual networks. Greater anterior hippocampal connectivity to default network was associated with better exemplar memorization in both age groups. In older adults, exemplar memorization was also positively correlated with anterior hippocampal connectivity to dorsal attention network, and less strongly the control network, both of which showed increased rather than decreased hippocampal interactions in aging. This pattern of results suggests that anterior hippocampal connectivity to control and dorsal attention networks in older adult might be compensatory for the

decreased connectivity to other networks and highlights the nuanced age-related changes in hippocampal connectivity and cognition.

Topic Area: LONG-TERM MEMORY: Development & aging

B58 - High-Level Visual Representations Drive Memory Errors in Older Adults

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Aging tends to be associated with the decline of different cognitive domains, with episodic memory being the prime example. In contrast, domains such as semantic knowledge tend to be preserved. This latter pattern has inspired several functional magnetic resonance imaging (fMRI) studies that have shown that older adults exhibit stronger representations of the high-level/semantic features of stimuli. Moreover, the neural representations of these features are predictive of better memory performance. However, whether the same features that aid encoding might drive memory errors remains an open question for fMRI research. In the present fMRI study, we aimed to test whether visual memory errors in older adults are driven by high-level/semantic representations. In the current experiment, young and older adults encoded several images of daily objects (e.g., a dog). During retrieval, each object was paired with a lure (i.e., a different dog), and subjects had to choose which image was seen during encoding. Employing a recurrent convolutional neural network, we modeled the similarity of each target and its lure, from their low-level to high-level visual features. Our behavioural results indicate that visual recognition errors in older adults were predicted only by high-level visual similarity. Convergent results were obtained by employing representational similarity analysis during retrieval. Stronger representations of high-level visual features, in the ventral visual stream, predicted memory errors. None of these effects were observed in younger adults. Taken together, our results indicate that visual memory errors in older adults are strongly driven by semantic/high-level visual representations.

Topic Area: LONG-TERM MEMORY: Development & aging

B59 - Effects of Motherhood Experience and Menopause Type on Estrogen-Related Cognitive Function in Female Rats

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This experiment aims to investigate whether estrogen replacement following natural versus surgically induced menopause produces differential effects on females depending on their previous motherhood experience. Some research suggests that giving birth tends to enhance learning and memory in both humans and non-human animals (Li et al., 2013). These findings are more inconsistent in human than in animal studies, likely due to confounding variables such as the uncontrolled use of hormonal birth control, which makes it difficult to draw clear conclusions about the role of pregnancy-related hormones in cognitive outcomes. Physiological effects in non-human animals, however, appear more consistent. For example, reproductive

experience induces long-lasting changes in the brain and behavior of rats, including increased neural plasticity in brain regions involved in learning and memory (Kinsley et al., 1999). Furthermore, studies have found that previous pregnancies increase both the number and sensitivity of estrogen receptors in the brain (Byrnes et al., 2009). If previous motherhood enhances sensitivity to estrogen, these females should benefit more from estrogen treatment during menopause. Using rat models to induce both natural menopause (via 4-vinylcyclohexene diepoxide) and surgical menopause (via ovariectomy; OVX) (see Koebele & Bimonte-Nelson, 2016, for review), followed by estrogen replacement, will allow for a controlled examination of menopause-related cognitive decline and the restorative effects of estrogen. Learning, memory, and cognition will be evaluated using the open field tower maze (OFTM) in 24-hour and 30-day retention tests. This design will thus explore whether prior reproductive experience mediates the cognitive benefits of estrogen treatment.

Topic Area: LONG-TERM MEMORY: Development & aging

B60 - Default mode and salience network connectivity interactions underlying the positivity effect across the adult lifespan

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Some individuals, particularly older adults, have stronger memory for positive information compared to negative information. This positivity effect is linked to the medial prefrontal cortex, a key area of the default mode network (DMN). The salience network (SN) also includes critical areas for emotional memory. However, it remains unclear how connectivity patterns between the DMN and SN may underlie the positivity effect. To address this knowledge gap, the current study investigated DMN and SN interactions as they relate to emotional memory across the adult lifespan. We used data from the Cambridge Centre for Ageing and Neuroscience (Cam-CAN) dataset that included 294 participants (18- 87 years old). Participants completed an emotional memory task and underwent structural and functional MRI. The emotional memory task consisted of 120 encoding trials where participants saw a neutral object superimposed on a positive, negative, or neutral background. To assess item and associative memory, participants were tested on 160 objects. The positivity effect was calculated as the difference between positive and negative memory in both item and associative conditions, yielding item positivity effect and associative positivity effect scores. Functional MRI data were pre-processed using functional connectivity toolbox (CONN) pipelines. Although the results did not reach statistical significance, participants with stronger DMN connectivity tended to have a stronger positivity effect, whereas those with stronger SN and SN-DMN connectivity tended to have a weaker positivity effect. These results suggest that

variability in DMN and SN connectivity patterns across the adult lifespan may differentially underlie the positivity effect.

Topic Area: LONG-TERM MEMORY: Development & aging

B61 - Hypertension Modifies Age-Related Change of Hippocampal Subfield Volumes: A Four-Year Longitudinal Study

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The hippocampus, a key neural structure supporting episodic memory, comprises distinct subfields including the dentate gyrus (DG), Cornu Ammonis (CA1–3), and subiculum. Hippocampal subfields typically show age-related volumetric decline across adulthood, but subfield aging may be differentially vulnerable to hypertension. Here, we examined age-related changes in hippocampal subfield and entorhinal cortex (EC) volumes among normotensive and hypertensive adults (baseline age: 18–83 years; baseline n = 265) across 2 ($\Delta T_2 - T_1$) and 4 years ($\Delta T_3 - T_2$) follow-up intervals, while accounting for individual differences in body roundness index. Latent change score modeling revealed no significant mean volume change in either group across intervals, though substantial individual differences in change were observed in all regions. Baseline age partially explained this variability in the change of subfield volumes, but not of the EC. Among normotensive adults, age trajectories remained largely stable over time ($p > .025$). Hypertensive adults showed a pattern of accelerated shrinkage of the DG-CA3 and subiculum ($p < .006$) in older age by the 4-year follow-up. The 4-year age trajectory differed significantly from that of the normotensive group for DG-CA3 ($p = .01$) and was greater in magnitude across all subfields compared to the 2-year interval ($p < .014$). Body roundness index was not significantly associated with change patterns in regional volumes ($p > .05$). These findings reveal a dynamic, age-dependent, and region-specific pattern of hippocampal aging linked to cardiovascular risk, underscoring the importance of identifying sensitive periods for intervention to mitigate late-life memory decline.

Topic Area: LONG-TERM MEMORY: Development & aging

B62 - Distinct Domains of Psychosocial Stress Impact Brain and Behavior Function Across Working Memory and Episodic Memory Tasks

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Psychosocial stressors are prevalent sources of stress across the lifetime. Experiencing chronic stress can deteriorate physical and mental health. Most research has focused either on current evaluations of perceived stress or childhood stress (e.g., adverse

childhood experiences), but few studies have examined the impact of specific stress domains during various life stages, from childhood to adulthood. The present study collected data from African Americans aged 50-74 from Birmingham and Tuscaloosa, Alabama. A survey was administered to assess self-reported stress across various domains (discrimination, global, loneliness, personal/work, & financial) based on previous validated surveys. The questions were assessed across different life periods: childhood, 20's/30's, and current. Participants also underwent MRI scanning during two functional tasks: a 2-back working memory (WM) and a Remember/Know/New episodic memory (EM) task. Multivariate partial least squares regression (PLSR) assessed the associations between stress domains and brain activity. Greater discrimination and financial stress (young adulthood) and perceived and loneliness (current life) were significantly associated with reduced hit rates and increased reaction times under higher stress. For WM, most of the stress domains were associated with reduced brain activity in prefrontal cortex and precuneus (2-back>1-back) and greater activity in prefrontal and parietal regions (1-back>0-back). The opposite occurred for loneliness. For EM, greater stress (global, discrimination, loneliness) was associated with greater activity in posterior hippocampus and reduced activity in lateral parietal cortex (R>K) and improved accuracy. Understanding the stressor domains gives insight into how different exposures across life stages affect an individual's cognitive and brain health.

Topic Area: LONG-TERM MEMORY: Development & aging

B63 - Neural correlates of implicit associative memory in younger and older adults

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Associative memory declines with age; however, it appears that this effect is specific to explicit memory because age-effects are attenuated when associative memory is tested implicitly. This dissociation suggests that implicit associative memory may rely on neural mechanisms that are less vulnerable to age-related decline. During fMRI, 27 young and 26 old adults completed a speeded object categorization task in which they viewed objects with superimposed text. Implicit memory was tested by presenting intact (original pairs) and rearranged pairs (items previously presented, but not together) from encoding while participants did the same categorization task. The measure of neural (activation) and behavioural (reaction time) associative priming was indicated by a rearranged > intact contrast. A whole-brain analysis yielded significant clusters in regions previously related to associative priming of objects and words (left lateralized: middle and inferior occipital, fusiform, middle and inferior frontal, middle and inferior temporal) with no interaction with age. An ROI analysis showed that, on average, the hippocampus and parahippocampal gyrus were not sensitive to associative priming, but this effect was modulated by behavioural priming in older adults. Older adults who showed greater behavioural priming exhibited greater

neural priming in the right hippocampus ($p = 0.058$) and parahippocampal gyrus ($p = .008$). There was no brain-behaviour relationship in young adults. Together, this supports that implicit associative priming is largely intact in older adults, but those who exhibit larger behavioural effects may recruit MTL structures more strongly.

Topic Area: LONG-TERM MEMORY: Development & aging

B64 - Predictions and declarative memory encoding: two fMRI paradigms provide slim pickings for SLIMM

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Memory is often better for both highly unexpected and highly expected information. To explain this U-shape relationship between memory and expectancy, the SLIMM framework appeals to two memory systems: one involving the hippocampus and another involving the medial prefrontal cortex (MPFC). Specifically, SLIMM predicts that these two brain regions support opposite ends of the U-shape, with the hippocampus supporting memory for unexpected events, and MPFC underpinning memory for expected events. We tested these predictions in two fMRI paradigms: one examined memory for the location of objects within scenes (e.g., a toothbrush in a bathroom, either on a sink, as expected, or on top of a bin, as not expected); the second tested memory for words that completed well-known idioms either in an expected or unexpected fashion (e.g., "Don't count your chickens before they... hatch/cook"). Both paradigms replicated the predicted behavioural U-shaped relationship between expectancy and memory performance. However, neither study found the predicted interaction between expectancy and subsequent memory (remembered vs forgotten trials) in terms of fMRI activation in the a priori defined hippocampal and MPFC regions-of-interest. We discuss the implications of these findings for SLIMM, and how our results fit within the broader literature on expectancy and memory.

Topic Area: LONG-TERM MEMORY: Episodic

B65 - Prior knowledge modulates curiosity-driven learning: An ERP analysis

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An extensive body of research has demonstrated that curiosity drives hippocampus-based learning and that information we are curious about is perceived as reward. However, it is still not well understood whether curiosity is also beneficial for learning when a learner's prior knowledge supports learning and learning is less reliant on the hippocampus. Here we use event-related potentials (ERPs) to unravel the mechanisms underlying curiosity-driven learning. We presented words pairs in semantically congruent contexts in which learning is less reliant on the hippocampus or in neutral contexts in which memory

formation more strongly depends on the hippocampus. Behaviorally, we found enhanced cued recall performance for word pairs that elicited high curiosity as well as high satisfaction of curiosity and for word pairs being learnt in congruent contexts. Moreover, the influence of satisfaction of curiosity on recall performance was stronger in congruent contexts. The ERP analysis revealed a reward positivity in the neutral condition that was larger for subsequently remembered than forgotten word pairs, especially when participants were highly curious. For congruent contexts, successful memory encoding is characterized by memory-related variations of the N400 whereby the direction of this effect is modulated by the learner's satisfaction. Our results support the view that two different mechanisms underly curiosity-driven memory formation: Curiosity-driven learning without support by prior knowledge is associated with reward signals. Whereas satisfaction of curiosity and semantic integration processes are important catalysts for learning when learning is driven by prior knowledge and less dependent on the hippocampus.

Topic Area: LONG-TERM MEMORY: Episodic

B66 - Age-related differences in the relationship between creative thinking and false memory

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Constructive retrieval processes can lead to increased rates of false memory (e.g., incorrectly claiming a new event has been previously experienced). Prior research in young adults has shown that the same constructive memory processes that lead to false memory have an adaptive benefit, in that they are positively correlated with divergent creative thinking ability (i.e., creatively combining diverse bits of information). In the present study, we investigate whether the positive link between false memory (recall and recognition) and divergent creative thinking changes with age. Older and younger adults completed the Deese-Roediger-McDermott paradigm to measure false recall and recognition, and the Alternative Uses Task (AUT), a standard assessment of divergent creative thinking. Replicating prior findings, false recognition was positively correlated with performance on the AUT for younger adults. Importantly, there was no corresponding relationship observed in older adults. Interestingly, this interaction was not observed during false recall, which was positively correlated with performance on the AUT for both younger and older adults. Our findings indicate that healthy aging may be associated with the recruitment of differential retrieval processes during false recognition and divergent creative thinking. More broadly, our findings identify an age-related disconnect in the relationship between the positive benefits and negative consequences of constructive retrieval processes.

Topic Area: LONG-TERM MEMORY: Episodic

B67 - When space divides, time expands: the role of boundaries in retrospective duration

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Psychological time is a rich and multifaceted phenomenon. Prior research suggests that retrospective duration estimates are shaped by the contents of memory for events. Event segmentation theory proposes that our continuous experiences are parsed into discrete events, a process that has been shown to hold implications for memory. However, the effect of such segmentation on retrospective duration for naturalistic events remains unclear. In the present study, we examined the interplay of event segmentation and duration memory using a naturalistic virtual reality paradigm. We conducted a within-subjects study (N = 54) in which participants navigated a series of events with or without a boundary (doorway). Subsequently, we asked participants to provide retrospective duration estimates for these events. We hypothesized that events containing boundaries would be recalled as being longer in duration compared to those without boundaries due to increased segmentation. We tested this using a linear mixed effects model that controlled for actual time. Consistent with our hypothesis, events with boundaries were recalled as being longer than those without. Additionally, we observed a general compression effect wherein events were recalled as being shorter than their true duration. A second experiment introduced a one-week delay between encoding and retrieval to investigate the persistence of the effect. Future work will explore the effects of perceptual versus cognitive boundaries on remembered duration. Together, our findings underscore the significant role of event boundaries in shaping retrospective duration estimates, suggesting that the organizational structure of events in memory can influence subjectively experienced time.

Topic Area: LONG-TERM MEMORY: Episodic

B68 - Scene Construction under Constraint: Neural Reorganization of Imagination in Limbic Encephalitis

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Imagining scenes is a core cognitive function, supporting our ability to recall autobiographical memories and simulate possible futures. Its disruption in temporal lobe epilepsy secondary to limbic encephalitis (LE) offers a rare insight into the mechanisms of constructive imagination and their reorganization. This study combined a behavioral assessment, neuropsychological profiling, and ultra-high-field 7 T fMRI to investigate how people with LE construct atemporal scenes. We hypothesized reduced scene construction, mediated by figural and verbal memory performance relative to controls, accompanied by compensatory recruitment of the ventromedial prefrontal cortex (vmPFC). Participants completed an imagined experiences task validated in other neurological populations, requiring

them to visualize and verbally describe richly detailed atemporal scenes. During fMRI, they engaged in a visual imagery paradigm, in which they imagined objects, scenes, or scenarios cued by brief words validated in a pilot study to evoke consistent imagery across individuals, while the category identity was kept covert. The control condition was a nonword-counting task. Ten patients (age= 50 years; disease duration= 9 years) and twelve age-matched controls were included. Patients showed reduced SC ($p=.04$), correlating with figural ($p=.04$) and verbal memory ($p=.04$). During fMRI, patients generated fewer images within the intended scene category, accompanied by overlapping scene and scenario representations, in contrast to the discrete, task-specific networks observed in controls. This blurring of representational boundaries corresponded to increased recruitment of anterior hippocampal and vmPFC regions during scenario construction, suggesting a convergence of constructive processes that may underlie difficulties in recalling past experiences and imagining future events.

Topic Area: LONG-TERM MEMORY: Episodic

B69 - Associations between encoding-related neural selectivity and retrieval-related reinstatement are robust and age-independent.

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We employed multivoxel pattern similarity analysis to examine category-selective neural pattern similarity at encoding, and categorical retrieval-related reinstatement, in healthy younger (18 – 29 years, $n = 40$) and middle-aged (44 – 56 years, $n = 40$) adults. Participants underwent fMRI while encoding word-image pairs (faces or scenes), followed by a memory test requiring old/new and source memory decisions (face, scene, “Don’t Know”). Univariate analyses identified two scene- (Parahippocampal Place Area, Medial Place Area) and one face-selective (Medial Face Area) regions-of-interest (ROI). Encoding-related selectivity for each ROI was operationalized as the difference between within- and between-category trial-wise correlations. Reinstatement was operationalized by the difference in similarity between a study trial and test trials of the same versus the alternate image category, restricted to Source Correct trials. Younger adults outperformed the middle-aged adults for both item and source memory. Selectivity at encoding was robust and age-invariant in all ROIs. Reinstatement effects differed by age: younger adults demonstrated reinstatement in scene-selective regions, whereas middle-aged adults exhibited reinstatement in both scene and face-selective regions. Encoding-related selectivity and reinstatement metrics were robustly correlated in all ROIs, both within-category and across-category. Across groups, reinstatement indices were positively associated with source memory accuracy. The robust age-invariant associations between metrics of encoding selectivity and reinstatement replicate prior findings. They underscore the importance of the quality of neural representations at encoding for high-fidelity

retrieval, consistent with the ‘Garbage-In, Garbage-out’ principle. These findings highlight both the shared and age-specific neural mechanisms supporting episodic memory.

Topic Area: LONG-TERM MEMORY: Episodic

B70 - Relationships between neural selectivity at encoding and retrieval in face- and scene-selective neural regions in young and middle-aged adults

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Results from a recent fMRI study employing multi-voxel pattern analysis indicated an age-invariant association between neural selectivity for face and scene images at encoding and retrieval-related reinstatement of face and scene information. Here, we investigated whether this relationship generalized to young (18 to 27 years) and middle-aged (44 to 56 years) adults and to univariate rather than multi-voxel measures of selectivity. While undergoing fMRI scanning, participants encoded words paired with images of faces or scenes. In a subsequent scanned memory test, participants made sequential item (old/new) and source memory (face/scene) judgements. Item and source memory accuracy were both lower in middle-aged relative to young adults. Selectivity at encoding and retrieval was quantified as the difference between the mean BOLD response of a given ROI's preferred and non-preferred image class, scaled by the pooled standard deviation of the single-trial beta estimates. Robust age-invariant selectivity for face and scene information was identified in face- and scene-selective ROIs at both encoding and retrieval. Echoing prior findings, scene-selectivity was positively correlated between encoding and retrieval. Selectivity metrics correlated positively between face- and scene-selective ROIs at encoding, but correlated negatively between the same ROIs at retrieval. This latter finding is suggestive of a trade-off between the resources allocated to face and scene retrieval. Across age groups there was a positive association between encoding-related selectivity and memory performance. At retrieval, however, this association was positive for young adults but negative for middle-aged adults, suggestive of differential retrieval strategies in the two age groups.

Topic Area: LONG-TERM MEMORY: Episodic

B71 - Mnemonic effect of category exception learning as a function of prediction error type

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We extract patterns from our experiences to form category knowledge, a process sometimes violated by new conflicting information known as exceptions. Current literature suggests that prediction error induced by exceptions can shift our memory into a flexible state that promotes the encoding of exception information. However, can such encoding enhancement generalize to category-irrelevant information in the

learning context? We tested the impact of exception learning on memory by presenting participants (n=71) with random animal facts during a category learning task in which two exceptions were introduced late in learning. One exception was confusable with the competing category and thus violated the conceptual prediction of category membership, whereas the other exception was a visual oddball that violated the perceptual prediction of stimulus features presented in the learning task. We found that, over exception learning, participants exhibited unique memory enhancement for facts presented on learning trials related to the conceptual prediction error, but not for learning trials related to the perceptual prediction error. These findings indicate that memory for irrelevant information in the learning context can become strengthened with category exceptions, but the specific type of prediction error induced by the exception matters. Particularly, the confusable exception, by violating the conceptual prediction based on prior knowledge, can elicit more extensive memory updating and encoding compared to the oddball exception. This account was supported by measuring representation updates in category learning model simulations. In conclusion, we demonstrate the broad mnemonic consequences of exception learning and highlight the nuances of prediction error-driven memory enhancements.

Topic Area: LONG-TERM MEMORY: Episodic

B72 - Exploring the Neural Mechanisms underlying the Impact of Emotion on Temporal Distance Memory

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Our temporal memory is often influenced and distorted by emotional states, such that our subjective temporal memory is compressed or lengthened in comparison to objective time. Prior work suggests that this phenomenon can occur in the context of sequences of events, yet the relative contributions of valence and/or arousal, and their underlying neural mechanisms, remain unclear. In the present fMRI study, we investigated how emotional valence and arousal influence temporal memory, with a specific focus on temporal distance within a sequence of events and its neural correlates. In each block, participants viewed emotional images of varying levels of valence and arousal. They then completed a temporal distance rating task in which they reported how close or far apart pairs of previously seen images had been presented during the encoding phase. The behavioural results showed that subjective temporal distance memory was driven more by arousal than valence, indicating that the high arousal condition led to longer subjective temporal distances compared to the low arousal condition. The fMRI analyses further revealed differential patterns of neural activity associated with varying levels of valence and arousal during the encoding and temporal distance retrieval phases in memory-related regions. Together, these findings provide further insights into how emotion can influence our temporal memory, advancing our understanding of the underlying mechanisms.

Topic Area: LONG-TERM MEMORY: Episodic

B73 - Optimal encoding time windows for memory precision

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Are there optimal times for encoding information? Animal research suggests the hippocampus naturally oscillates at a theta rhythm (~4-10 Hz), fluctuating between encoding and retrieval phases. Here, we tested whether theta rhythmicity of memory can be demonstrated using non-invasive behavioral methods in humans. To do so, we combined the mnemonic similarity task with a manipulation of stimulus onset asynchrony (i.e., the duration between a cue and object image) to obtain a behavioral timeseries of memory precision at the group level. Participants encoded a series of images, and were then tested on discriminating encoded images from similar lures. Critically, by timing the image onset at specific delays after a full-screen cue flash, the images putatively appeared at varying phases of the theta cycle, making them easier or harder to encode. Spectral analysis of the accuracy timeseries tested for frequency fluctuations across a range of frequencies (3-14 Hz). Compared to permutation-based null distributions, we found that the ability to precisely encode images fluctuated reliably at frequency of 8 Hz. These findings replicate and extend previous work reporting behavioral evidence of theta rhythmic memory fluctuations in humans and help can pave the way for new lines of inquiry into hippocampal memory traditionally relying on invasive measurements.

Topic Area: LONG-TERM MEMORY: Episodic

B74 - Reinstatement of Complex Semantic Memory Representations for Visual Scenes Captured through Language Embeddings

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When we recall complex scenes, we experience them with a wealth of semantic information. Here we used representational similarity analysis (RSA) and language encoders to test the hypothesis that this information is reinstated, in its semantic richness, during cued recall. We used the multilingual Universal Sentence Encoder (USE) to obtain embeddings of normative descriptions of complex visual scenes that participants were cued to remember while undergoing functional magnetic resonance imaging (fMRI). This allowed us to investigate whether activity patterns during recall correspond to semantic embedding structure. We focused on the anterior temporal (AT) and posterior medial (PM) networks and hypothesized that the latter should reflect the rich semantic information of complex scenes. Indeed, only the PM network showed significant alignment between neural and language-derived scene similarity, consistent with the PM's established role in representing contextual-relational structure. A preliminary whole-brain searchlight RSA also revealed a bilateral region between the lateral occipital and temporal cortices. Critically, these effects were diminished or even absent when participants were

given a cue but instructed not to retrieve the associated scene. On one hand, this highlights that the scenes themselves – and not their cues – gave rise to the similarity structure observed. On the other, it also shows that such reinstatement is under voluntary control. In sum, our findings show that high-level semantic embeddings derived from language can effectively model the neural reinstatement of complex visual memories.

Topic Area: LONG-TERM MEMORY: Episodic

B75 - Reshaping Self-Identity Through Memory Replay: Integrating Schema-Congruent and -Incongruent Learning with a Smartphone-Based Intervention

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Autobiographical episodic memory links past experiences into a coherent self-schema that guides how future events are encoded and recalled. In social anxiety, self-schemas surrounding social interaction and performance are often negative, reinforced through selective recall of past social failures during post-event rumination. Over time, this biased recall strengthens maladaptive self-beliefs, perpetuating social anxiety and contributing to loneliness and social isolation. The Schema Congruent/Incongruent Learning (SCIL) model proposes that schema-incongruent memories evoke hippocampal prediction errors that drive schema updating, while congruent memories consolidate revised self-beliefs. Digital memory augmentation technology like HippoCamera, a smartphone app that enhances episodic recall by allowing users to capture and replay high-fidelity memory cues, may leverage these mechanisms to promote adaptive self-schema updating in individuals with social anxiety, who often struggle to recall memories that conflict with their negative self-schemas. Participants will engage in a two-part intervention using HippoCamera to capture and replay daily positive social experiences. The replay schedule will be structured to initially elicit hippocampal prediction errors that challenge negative/maladaptive self-beliefs, while later sessions will reinforce updated positive/adaptive ones, reflecting the schema-incongruent and schema-congruent learning phases proposed by the SCIL model. Structured replay of schema-incongruent/congruent memories using HippoCamera is expected to facilitate the transition from maladaptive to adaptive self-schemas, reduce social anxiety, and enhance positive sentiment in recalled social memories. By combining the SCIL model with HippoCamera, this study offers a novel approach toward improving self-concept, reducing social anxiety, and understanding the bidirectional relationship between self-identity and autobiographical episodic memory.

Topic Area: LONG-TERM MEMORY: Episodic

B76 - Cortical traveling wave pattern reinstatement supports successful associative memory formation and retrieval in humans

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The neural mechanisms that enable us to bind pieces of information together remain unclear. While the direction of large-scale spatiotemporal patterns of low-frequency oscillations across the cortex are known to support memory encoding and retrieval states, the functional role of microscale cortical traveling waves is less understood. Using intracranial electrocorticography data collected from 10 neurosurgical epilepsy patients during a paired associative verbal memory task, we examined the spatiotemporal patterns of low-frequency oscillations recorded on microelectrode arrays implanted in the anterior temporal lobe. We identify time periods during word pair encoding and subsequent cued recall when theta and alpha oscillations propagated in organized patterns across the cortex. We compared these patterns between encoding and retrieval and found that participants successfully retrieved previously encoded word pairs when the same directional pattern of traveling waves that occurred when they viewed the pair occurred again, or reinstated, following the retrieval cue. Conversely, unsuccessful retrieval exhibits less precise or altogether absent emergence of previously observed directional patterns. These results provide evidence that the reinstatement of specific microscale directional patterns of traveling wave patterns in the anterior temporal lobe supports the successful retrieval of previously encoded pairs of information, supporting the hypothesis that recalling the past involves a form of dynamically neural recreation of the encoding context.

Topic Area: LONG-TERM MEMORY: Episodic

B77 - Both viewing entropy and hippocampal structure are related to spatial memory success in healthy aging

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In everyday life, people learn and remember information through the coordinated activity of visual and memory systems. While important for many aspects of relational/associative memory, the hippocampus is essential for the binding/retrieval of spatial information. Recent work has demonstrated that the ways in which individuals deploy directed eye-movements when encoding spatial information is related to later memory for that information. Indeed, young adults with higher viewing entropy at study, show better spatial memory than those with less ordered viewing patterns. Additionally, patients with bilateral hippocampal damage show decreased viewing entropy suggesting that the hippocampus may contribute to organized looking. In the current study, we investigated the relationship between study-time viewing entropy, spatial memory, and hippocampal volume in a group

of 50 cognitively healthy middle-aged and older adults (range 45-74 years old; 31 females and 18 males). All participants completed an MRI scan and performed a Spatial Reconstruction Task while eye movements were tracked. On each trial, participants studied the location of five abstract stimuli and were asked to reconstruct the study display after a short delay. Misplacement error was assessed. After controlling for age and sex, misplacement errors were significantly correlated with both viewing entropy and hippocampal volume such that people with more constrained viewing at study and larger hippocampi made smaller memory errors. Furthermore, entropy and hippocampal volume each explained unique variance in memory outcomes. These data suggest that as we age, both hippocampal integrity and organized viewing behaviors during encoding contribute to spatial memory successes and failures.

Topic Area: LONG-TERM MEMORY: Episodic

B78 - How emotional appraisal during encoding impacts subsequent memory reactivation and recall.

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Past work shows that emotional stimuli are recalled differently than neutral stimuli, such that gist-based features are enhanced in memory. However, these studies used intrinsically emotional stimuli leaving open how emotional appraisal influences memory representations for neutral memoranda. To investigate how emotional goals may influence memory reactivation and recall, we employed a movie-watching paradigm that asks participants to make continuous self-paced ratings about either emotional (negative to positive) or perceptual (brightness) changes they observed during encoding. We then asked participants to passively watch all movies again, but this time every 10-seconds the screen went blank while the audio continued to play — cueing reactivation. Finally, we asked participants to free recall as many details as they could about the movies from both conditions. Connectivity and representational similarity analyses will be conducted on an fMRI version of the study currently being collected. We predict that movies that were appraised in the emotional versus perceptual condition will show more connectivity between the hippocampus and semantic memory networks reflecting gist-based processes during encoding and be reactivated cortically in this semantic network. The degree of connectivity and reactivation will be related to free recall of more semantic details. Meanwhile, movies appraised in the perceptual versus emotional condition will show connectivity between visual networks and the hippocampus and be reactivated early-on in the ventral visual stream which will be predictive of higher recall of perceptual details. Overall, we hope to better characterize how emotional appraisal may impact brain representations and subsequent memory behaviors.

Topic Area: LONG-TERM MEMORY: Episodic

B79 - EEG Correlates of Memory in a Naturalistic Spatial Environment

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Prior studies have identified specific patterns of neural activity associated with successful encoding and retrieval. However, these effects were typically observed in highly controlled, non-naturalistic laboratory environments. In this study, we investigated whether behavioral and neural correlates of successful encoding and retrieval extend to a memory task within a naturalistic spatial environment. We recorded scalp EEG in 40 young adults (aged 18-30) as they navigated to different landmarks in a desktop virtual environment. Study items would appear both visually and auditorily during navigation, with subjects later recalling the items vocally. Behavioral data demonstrated typical primacy and recency effects, as well as the temporal organization of memory, consistent with findings reported from past research. Spectral EEG analyses also replicated previously characterized biomarkers of retrieval success. However, the same patterns did not emerge during encoding, possibly because the navigation task engaged neural resources that were also involved in memory processing, thereby complicating the relationship between EEG activity and subsequent mnemonic success. Future research seeking to translate neural markers of memory into practical tools for optimizing learning or remediating memory disorders should account for the complex relationship between measured neural activity and memory performance in real-world settings.

Topic Area: LONG-TERM MEMORY: Episodic

B80 - Incidental visual attention and subsequent memory for landmarks during real-world navigation

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Every day experience in the real world is a dynamic, continuous stream of information, processed through the attention system and stored in long-term memory. However, our cognitive resources are finite. Thus, our visual attention selectively encodes information for later retrieval of memories associated with specific experiences. Traditionally, studies of memory using eye-tracking have used images presented on a computer screen to assess the effects of visual attention on later memory for images. Wearable eye-tracking glasses offer the opportunity to evaluate visual attention in complex, dynamic, and real-world environments without constraints from laboratory settings. Using a wearable eye-tracking device synchronized with direct hippocampal recordings, the present study examines how visual attention influences our ability to subsequently remember landmarks during real-world navigation. Five participants with intractable epilepsy, surgically implanted with NeuroPace

Responsive Neurostimulators recording hippocampal local field potentials (LFPs), wore mobile eye-trackers to learn a 0.75-mile indoor-outdoor route. On Day 1, participants completed a guided-navigation walk with several subsequent self-guided retrieval walks. On Day 2, more self-guided retrieval walks were completed along with a surprise recognition task for the landmarks on the route. Eye-movement results revealed that the participants demonstrated incidental encoding for the landmarks on the route without explicit memory instructions. Longer and more frequent fixations on landmarks during natural navigation were predictive of successful memory encoding and later retrieval particularly on the initial, second, and final walks before the recognition task. Post-test visual attention was modulated by landmark recognition outcomes, indicating top-down memory-driven guidance of attention. Overall, these findings replicate results found in controlled laboratory settings and open new opportunities for understanding visual attention and memory in the wild.

Topic Area: LONG-TERM MEMORY: Episodic

B81 - Computational Sentiment in Narratives: Links Between Depressive Symptoms and Film-Based Episodic Memory

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Depressive symptoms are associated with poorer episodic memory in aging, yet emotional content can enhance memory performance. Here, we used naturalistic movie stimuli to test the impact of emotional sentiment on the relationship between depressive symptoms and memory in cognitively normal, non-depressed older adults. Methods: Sixty-nine participants watched three short films and freely recalled everything they could remember from each film following a 1hr delay. Transcribed audio-recordings were scored for memory (total verifiable details) and sentiment (positive, neutral, and negative). Sentiment was quantified using natural language processing analysis (open-source transformer-based deep learning model optimized for sentiment classification; CardiffNLP's twitter-roberta-base-sentiment latest model; Loureiro et al., 2022). We measured depression symptoms using the Geriatric Depression Scale. Results: Higher levels of depressive symptoms were associated with poorer film memory recall ($r = -.24$, $p = .049$). We observed moderating effects of sentimentality for both positive and negative content relative to neutral. Specifically, the negative effect of higher depressive symptoms on memory was diminished in individuals who expressed higher levels of positive ($t(61) = 3.33$, $p = .002$) and negative sentiment ($t(61) = 2.32$, $p = .024$). Individuals with greater positive versus negative sentimentality showed better memory performance overall ($r = .31$, $p = .010$), though positive biases were not directly related to depressive symptoms. These findings suggest emotionally contextualized information may help buffer the detrimental effect of depressive symptoms on episodic

memory. This study highlights movie stimuli as a useful tool for examining links among emotion, depressive symptoms, and memory.

Topic Area: LONG-TERM MEMORY: Episodic

B82 - Does sensitivity to novelty relate to memory organization of narrative events?

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Event boundaries are associated with increased arousal and focused attention and have a strong effect on memory organization. However, not all boundaries are created equally; considerable variability exists in boundary detection and event memory across individuals. Here, we asked if differences in memory organization relate to individual differences in novelty-related arousal, a key mechanism that supports event perception. We adopted an existing event segmentation task (Ezzyat & Davachi, 2011) in which participants read narratives containing both boundary and non-boundary temporal cues. The episodic organization of narratives in memory was measured using narrative sentence cued recall. Cued recall accuracy was measured using both traditional indices as well as semantic overlap between encoded and recalled sentences. Pupil dilation during a separate auditory oddball task was used to assess trait sensitivity to novelty and arousal. We hypothesized that greater pupil responses to contextual novelty (i.e., goal-relevant auditory oddballs) would be associated with greater segmentation of adjacent events in memory. In our preliminary sample of 18 young adults, multilevel modeling revealed that goal-relevant oddballs elicited significantly larger pupil dilations compared to standard tones, providing a physiological biomarker of novelty sensitivity. Preliminary analyses showed substantial variability in cued recall in both sentence conditions (e.g., boundary vs. control). Future analyses will test if and how such variance may be predicted by individual differences in oddball-evoked pupil responses, revealing a critical link between event perception in naturalistic stimuli and novelty sensitivity.

Topic Area: LONG-TERM MEMORY: Episodic

B83 - Tracking memory for a positive collective event: A longitudinal study of the 2024 solar eclipse

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Collective memories, personal recollections of shared public events, have traditionally been examined in the context of negative, unexpected occurrences (e.g., the 9/11 attacks). Such studies show that memories of these negative events remain vivid and confidently recalled over time, despite declines in accuracy. This pattern has been attributed to social sharing of the memories to form collective narratives. Whether positive, public, and meaningful events follow a similar pattern remains unknown. To address this question, we examined how individuals remembered the rare, positive, and socially

shared 2024 solar eclipse over time. In a longitudinal online study, 175 Canadian university students recalled their experience of the solar eclipse and a personal event from the same week across four sessions (1 week, 1 month, 3 months, and 6 months post-event). At each session, participants provided free recalls to assess thematic (gist) content, answered specific detail questions ("who/where/what") to assess accuracy, and rated each memory for confidence, emotional valence, arousal, rehearsal, and meaning. Results revealed that solar eclipse memories retained their thematic structure but were recalled with reduced accuracy over time compared to the personal memories. Despite this decline in accuracy, participants reported consistently higher confidence in their eclipse memories and rated them as more positive and arousing than the personal memories. These findings suggest that positive, anticipated public events can evolve into collective memories in a similar manner to negative public events.

Topic Area: LONG-TERM MEMORY: Other

B84 - The Impact of Mental Health Symptoms on Relational Memory Performance

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Introduction: Broad memory challenges arise for people with clinically diagnosed mental health disorders, in part due to changes in hippocampal structure and/or function. However, individuals with mental health symptoms often show memory impairments, even when their symptoms do not reach the level of a formal clinical diagnosis. **Building on this,** the present study examined how mental health symptoms influence performance on two relational memory tasks that are known to be critically dependent on hippocampal function. **Methods:** Participants from across the adult lifespan completed a transverse patterning task (n=622) for which they learned directional relations among abstract objects. In a separate experiment, participants (n=295) completed a transitivity task in which they learned the relations between pairs of objects and subsequently made inferences across those pairs. All participants completed the Depression, Anxiety and Stress Scale (DASS-42). Logistic regressions examined performance on each task, including interactions between DASS subscales, with age and sex as covariates, and test accuracy as the outcome. **Results:** Individuals with greater symptoms of anxiety performed less accurately on both relational tasks. Greater symptoms of depression were associated with accuracy declines on both tasks, but only when participants also reported greater stress levels. Older participants performed less accurately on both tasks, with even greater deficits on the transitivity task for those experiencing stress and depression. **Conclusion:** These findings demonstrate that even sub-clinical levels of depression, anxiety, and stress can negatively impact hippocampal-dependent memory, underscoring the importance of early mental health support for maintaining cognitive and brain health across the lifespan.

Topic Area: LONG-TERM MEMORY: Other

B85 - Associative inference and self-derivation of knowledge involve the same underlying process of relational generalization

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Relational generalization is the ability to infer new information by connecting related information acquired at different times (A relates to B, B relates to C, thus A relates to C). This memory-based inference has been studied using several paradigms, most commonly examining the integration of arbitrary associations of objects. One more naturalistic paradigm is the self-derivation of knowledge task, where participants can integrate two real-world facts that have related information to infer new information. However, because of the rooting in the real world and language understanding, it is not clear to what degree the self-derivation of knowledge task measures the same ability as standard memory inference tasks rather than general semantic memory abilities. Utilizing an individual differences approach, here we tested the degree to which an individual's self-derivation performance can be predicted from their general verbal retrieval abilities and a standard associative inference task with visual objects. Results showed that associative inference and verbal fluency both separately positively predict self-derivation of knowledge. Furthermore, associative inference and verbal fluency predicted self-derivation of knowledge after controlling for individual's associative memory. Notably, this study is the first to empirically demonstrate that self-derivation and associative inference are underpinned by the same cognitive processes, thus reinforcing the validity of both laboratory measures to assess relational generalization.

Topic Area: LONG-TERM MEMORY: Other

B86 - Effectiveness of Memory Reactivation during Wake Depends on Brain State

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Are memories more easily reactivated during some states of wakefulness than others? We previously developed a data-driven method of identifying moments when participants enter an "offline" state, and found a particular type of offline state to be associated with improved memory consolidation. In the current study, we asked whether this state ("offline2") benefits consolidation because it facilitates the reactivation of recently encoded memory. We used Targeted Memory Reactivation (TMR) to influence memory after encoding, hypothesizing that near-threshold visual cues related to prior learning would be most effective in modifying memory when delivered at moments when participants are in this offline brain state. This hypothesis was supported. However, the effect was in the opposite direction of our prediction – Memory was selectively impaired, rather than enhanced when cues were delivered during offline 2 (one-way ANOVA for effect of state: $p=0.02$). Still, this observation suggests

that learning-related cues modify memory more easily when participants are in a particular type of offline state.

Topic Area: LONG-TERM MEMORY: Other

B87 - NOVITAS: A stimulus database with new tasks and metrics for assessing absolute and associative novelty detection in objects and scenes

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The ability to detect novelty is crucial for survival, yet it is complex. To capture this complexity, researchers distinguish between different types of novelty, as neuroscientific evidence shows that distinct brain circuits process novelty depending on its nature. Absolute novelty refers to stimuli that are entirely unfamiliar to the observer and is thought to rely on the perirhinal cortex, whereas associative novelty arises from unfamiliar combinations of familiar elements and is presumably detected by the hippocampus. Despite this distinction, methodological tools specifically designed to investigate different forms of novelty remain scarce. Moreover, given that the perirhinal cortex supports object processing and the hippocampus scene processing, it remains unclear how novelty is detected across representational levels. To address this gap, we developed the NOVITAS database, enabling systematic comparison of absolute and associative novelty for objects and scenes within the same experimental tasks. We provide a large database of stimuli that assess novelty detection without prior lab exposure, relying solely on pre-existing knowledge. To do so, stimulus novelty was validated in a normative online study with younger (N = 104) and older adults (N = 184). We then substantially adapted classic novelty-detection tasks—an Oddball-like paradigm (N = 24) and a modified Visual Paired Comparison task (N = 76)—and validated that our stimuli elicit behavioral and eye-tracking novelty markers in young adults. Results confirmed that participants looked longer at novel than familiar images, but the time course of novelty preference differed across conditions, suggesting that the stimuli can probe different underlying mechanisms.

Topic Area: LONG-TERM MEMORY: Other

B88 - Concept cells in the temporal pole and the posterior cingulate cortex: testing memory systems at the neuronal level?

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Extracellular recordings have identified neurons selective to one particular concept, concept cells, in the medial temporal lobe (MTL) structures as the building blocks of declarative memory. These concept cells demonstrate strong semantic properties. Finding such selective neurons within the MTL structures presents a paradox given that it is the temporal pole (TP) that is widely regarded as the primary hub for semantic memory. We recorded the activity from > 1000 neurons across 20 patients implanted with tetrodes from several regions including the TP (n=177) and the MTL (n=388) while they watched pictures of various famous faces, buildings, common objects or written names. Among these, neurons in the TP displayed several characteristics of concept cells: invariant, multimodal and selective responses, explicit representations of concepts and semantic coding as highlighted by comparing neuronal activity with embeddings of concepts in language models. Neurons in the TP also had shorter response latencies than the ones in the hippocampus suggesting processing in the TP before transfer to the hippocampus. Altogether, these results support the idea that neurons in the TP are the neuronal basis of semantic knowledge. We did not record concept cells in other brain areas except from the posterior cingulate cortex where response latencies occurred later than in temporal regions. Altogether these findings provide novel insights into the neuronal coding of memory in the human brain and enable to evaluate the functional organization of memory at the neuronal scale.

Topic Area: LONG-TERM MEMORY: Semantic

B89 - EEG microstates and its cortical sources during single nostril breathing

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Pranayama, a foundational yogic breathing practice, exerts modulatory effects on autonomic, affective, and cognitive processes through voluntary respiratory control. Among its variants, Single Nostril Breathing (SNB) [including left (LNB) and right nostril breathing (RNB)] is proposed to induce hemispheric asymmetries and shifts in sympathovagal tone. Yet, the fine-grained neural dynamics underlying SNB remain poorly characterized. This study investigates how SNB reorganizes large-scale brain network dynamics using high-density qEEG microstate analysis and cortical source imaging, compared to spontaneous breathing (SB). Twenty-two healthy right-handed male adults (aged 20-35 years) underwent EEG recording during SB and guided SNB paced at six breaths per minute. Preprocessing was performed in EEGLAB, followed by microstate segmentation using Cartool and source reconstruction via sLORETA. Six EEG microstates were consistently identified across conditions. Relative to SB, SNB elicited significant reductions in the mean duration and temporal coverage of Maps 1 and 3, accompanied by increased global

explained variance (GEV) in Map 6. Source localization revealed augmented current density in the anterior cingulate cortex, medial and inferior frontal gyri, and superior temporal gyrus- regions implicated in attentional control, interoceptive monitoring, and emotional regulation. No lateralized differences emerged between LNB and RNB. SNB induces dynamic reconfiguration of intrinsic brain networks, characterized by accelerated microstate transitions and enhanced engagement of fronto-cingulate and temporo-parietal circuits. These findings suggest that controlled yogic breathing fosters neural efficiency and integrative processing through modulation of transient large-scale network states, offering neurophysiological support for its role in cognitive flexibility and affective balance.

Topic Area: METHODS: Electrophysiology

B90 - PRISME: A MATLAB Toolbox for Multi-Method Statistical Power Analysis in Neuroimaging

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Low statistical power in neuroimaging often undermines research in the field, leading to missed effects, wasted resources, and reduced reproducibility. Performing power analyses during the study design phase is extremely important, but often prohibitively difficult due to a lack of analytical solutions tailored to complex fMRI statistical procedures, the challenge of defining expected effect sizes a priori, and high computational costs. We present \texttt{PRISME} (Power Reproducibility and Inference for Statistical Method Evaluation), a MATLAB toolbox for neuroimaging power calculations. \texttt{PRISME} provides a computational framework for comparing multiple statistical inference methods, enabling researchers to select the correct sample sizes for their experiments and find optimal methods for their experimental data analysis and integrate new ones for benchmarking through a flexible algorithm and architecture. Unlike previous empirical power approaches to calculate power, the toolbox supports diverse neuroimaging data types, including both voxel-based activation and functional connectivity analyses, and arbitrarily complex inferential methods due to a flexible nonparametric algorithm and unified data representations. Furthermore, \texttt{PRISME} supports multiple test types, such as association and difference tests with behavioral and clinical measures. Finally, \texttt{PRISME}'s 25x increase in speed from algorithmic optimizations compared with procedures in existing scripts enables larger-scale never before seen power calculations which were previously computationally infeasible. Overall, \texttt{PRISME} is the first method- and data-type-agnostic power calculator for neuroimaging, providing an accessible solution for power analysis across diverse study designs.

Topic Area: METHODS: Neuroimaging

B91 - Structural alterations in the brain associated with sensory processing sensitivity

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Sensory processing sensitivity (SPS) is a personality trait with both positive features (e.g., orienting sensitivity, characterized by heightened sensitivity to subtle cues) and negative features (hypersensitivity to unpleasant stimuli). Previous research has demonstrated unique patterns of brain activity associated with SPS. Here, we examined whether specific features of SPS are also associated with structural differences in the brain. Forty participants (22 women; M = 21.10 years) underwent an anatomical MRI scan after completing self-report measures capturing sensitivity to unpleasant stimulation (Low Sensory Threshold and Ease-of-Excitation subscales of the Highly Sensitive Person Scale; Aron & Aron, 1997) as well as deep processing and sensitivity to subtle cues (Orienting Sensitivity subscale of the Adult Temperament Questionnaire; Evans & Rothbart, 2007). Sensitivity to unpleasant stimulation (a negative aspect of SPS) was associated with hypergyrification in the right superior parietal gyrus and the right pars triangularis. In contrast, heightened orienting sensitivity (a positive aspect of SPS) was associated with (a) decreased gyrification in the left precentral gyrus, (b) decreased complexity in the left postcentral gyri as well as in the left superior parietal cortex; and (c) increased complexity in the left rostral middle frontal gyrus. These structural differences may underlie risk factors for common mental disorders such as anxiety (related to sensory integration, cognitive control of attention, intolerance of uncertainty) in those with SPS. However, they may also underlie factors that bolster resiliency (e.g., the use of cognitive reappraisal) that are specifically associated with the more positive features of this personality trait.

Topic Area: METHODS: Neuroimaging

B92 - Neurosynth Compose: A platform for transparent and reproducible meta-analyses

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Neuroimaging meta-analyses are a cornerstone of cognitive neuroscience, enabling synthesis across decades of neuroimaging research. However, the traditional workflow of manually curating and coding thousands of papers to extract activation coordinates is idiosyncratic and time-consuming. To address this, we developed Neurosynth Compose, an open platform that facilitates the creation of meta-analyses with transparency and reproducibility at its core. The

platform has automatically extracted reported activation coordinates and key metadata (e.g., participant characteristics, tasks, populations) from over 32,000 neuroimaging studies, supporting both hypothesis-driven and data-driven exploration through AI-assisted curation. With over 2,500 users worldwide, Neurosynth Compose offers a scalable infrastructure for systematic meta-analysis, encouraging the collaborative reuse of existing research. To demonstrate its capabilities, we are conducting an exemplar analysis comparing the neural bases of American Sign Language (ASL) and spoken language production. Using studies within Neurosynth Compose and newly added literature, we apply Activation Likelihood Estimation (ALE) and Multilevel Kernel Density Analysis (MKDA) with Monte Carlo-based familywise error correction (5,000 iterations). Comparative analyses (ALE subtraction and MKDA χ^2 tests) will illustrate cross-method consistency and the platform's ability to synthesize results reproducibly. Neurosynth Compose lowers the barrier to meta-analysis, increases methodological transparency, and enables the field to build on its vast cumulative knowledge. This open, automated framework advances the collective goal of grounding cognitive neuroscience on reproducible, integrative evidence.

Topic Area: METHODS: Neuroimaging

B93 - Cognitive underpinnings of hallucinations derived from the fMRI literature

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Background: Auditory verbal hallucinations (AVH) are beliefs about hearing voices without an external source and represent a key positive symptom of schizophrenia and related psychotic disorders. Understanding the physiological mechanisms underlying AVH remains a key challenge in cognitive neuroscience. Comparing fMRI activations collected during hallucination experiences with those collected during a range of other cognitive operations, such as responding and attention to internal representations, provides insights into the cognitive underpinnings of hallucinations, to the extent that the function of the activated brain networks is understood. Methods: This study examined voxel data from a total of 166 voxel locations associated with AVH extracted from 15 fMRI studies. For each voxel, we computed activation strength across 11 task-based functional networks, for which functions are largely known, and published in an edited volume (Percival & Woodward, 2025). Task-based functional networks better capture functionally interpretable cognitive modes than resting-state networks. Results: We found that voxel locations for the 15 studies were primarily located in peaks associated with 6 different anatomical patterns, each associated with distinct cognitive functions, including attending to auditory stimuli, perceiving auditory stimuli, responding, linguistic processing, attending to internal representations, and attending to external representations. Conclusion: An independent fMRI dataset involving AVH capture with motor responses confirmed that consistent activation in the response network reflects an artifact of experimental design rather than intrinsic

AVH-related activity. The dominance of confounding activations over theorized auditory perception regions is discussed. In conclusion, capturing reliable BOLD responses to AVH remains challenging.

Topic Area: METHODS: Neuroimaging

B94 - Automated network labeling with contrastive neuroimage-language models

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Assigning functional network labels (e.g., default mode, frontoparietal control, salience) to fMRI activation maps is common yet fragile: network topographies and names vary across atlases, and labeling often relies on visual heuristics and individual expertise, limiting reproducibility. To automate this process, we train a contrastive model with 30,000 neuroimaging publications, aligning latent text and neuroimage representations. Contrastive learning aligns matched text-map pairs in a shared embedding space while separating mismatches, enabling zero-shot network labeling using cosine similarity between a query map embedding and candidate label embeddings. This is compatible with any set of text, including terms or descriptions of cognitive processes, network names, or anatomical regions. The contrastive model may also be used to rank a set of publication text most similar to a query map. For external validation, we use group-level activation maps from NeuroVault to ensure titles and abstracts are well aligned with corresponding statistical maps and achieve area under the recall@k curve = 0.85 for ranking and retrieval. For network labeling, we evaluate against a collection of network atlases and obtain 80% accuracy. Finally, we demonstrate applicability to labeling ICA components from the Human Connectome Project and UK Biobank. These results demonstrate that contrastive neuroimage-language alignment offers a scalable, flexible, and literature-grounded method for automated network labeling tasks.

Topic Area: METHODS: Neuroimaging

B95 - Individual Differences in Functional Brain Network Integration in Tourette Syndrome: An Exploratory Precision Mapping Study in a Sibling Pair

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Tourette syndrome (TS) is a neurodevelopmental disorder characterized by motor and vocal tics, with substantial heterogeneity in symptom expression and associated neural mechanisms. Prior neuroimaging work implicates disruptions in cortico-subcortical and motor control systems. However, traditional group-average approaches may obscure meaningful individual differences. Precision

functional mapping (PFM) leverages dense, within-individual fMRI sampling to generate highly reliable functional network measurement, offering a powerful tool for studying individualized network architecture in TS. We present an exploratory analysis of PFM data from a sibling pair: one child with primarily eye-blink tics (M, 10 yrs), and his typically developing sibling (F, 13 yrs). Participants underwent 4 resting-state fMRI visits, yielding >45 minutes of low-motion, post-processed data. Functional connectivity (FC) analyses focused on network topology and connectivity, emphasizing somatomotor and cognitive control networks implicated in motor control. Preliminary findings reveal FC variants (regions differing from group averages) in bilateral frontal cortex, temporo-occipito-parietal junction, and the cingulate gyrus in both siblings. Differences between siblings were found in motor regions with patterns potentially relevant to tic expression. We highlight network integration and topology not readily captured by group-average approaches. While exploratory, these results highlight the sensitivity of PFM to individual-level differences in brain network organization relevant to tic expression. This work demonstrates the feasibility and potential value of applying PFM to the study of TS and other neurodevelopmental disorders, emphasizing individualized network architecture. PFM may provide insights into phenotypic heterogeneity and inform future personalized intervention strategies.

Topic Area: METHODS: Neuroimaging

B96 - Individual Differences in Visual Perspective: Validation of the Visual Perspective Questionnaire (VPQ)

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Visual perspective, the ability to remember or imagine events through one's own-eyes or from an observer-like vantage point, is a defining feature of autobiographical memory. The viewpoint people adopt shapes what is remembered, how vividly and emotionally it is experienced, and how the self is represented within the event. Yet people vary widely in their habitual use of these perspectives, and until now there has been no validated tool for systematically assessing individual differences in visual perspective. This study validated the Visual Perspective Questionnaire (VPQ), a brief self-report instrument designed to assess tendencies toward own-eyes and observer-like perspectives. Because theoretical accounts vary in how visual perspective is conceptualized, we tested three possibilities: that own-eyes and observer-like perspectives are mutually exclusive, graded along a shared continuum, or distinct yet coexisting cognitive tendencies. Using data from 16,594 participants, we evaluated these three accounts through reliability, factor, and validation analyses. Results supported an independent framework, revealing a two-factor structure in which own-eyes and observer-like perspectives formed separable yet correlated dimensions. External validation further revealed that the own-eyes perspective was positively correlated with imagery vividness (Vividness of Visual Imagery Questionnaire), whereas the observer-like perspective was positively correlated with spatial navigation ability (Wayfinding Questionnaire). Overall, the

findings establish the VPQ as a concise, psychometrically robust instrument capturing two separable yet complementary dimensions of visual perspective-taking. This behavioural dissociation provides a foundation for future work linking individual differences in visual perspective preferences to the neural architecture of autobiographical memory and mental imagery.

Topic Area: METHODS: Other

B97 - bWell-D: Novel virtual reality cognitive remediation for depression; preliminary feasibility trial findings and improved construct validity

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Major depressive disorder (MDD) is a leading global cause of disability and is associated with cognitive deficits that often persist beyond mood symptom remission. Conventional cognitive assessments may not fully capture these impairments, and current cognitive remediation approaches show mixed results in translating gains to real-world functioning. To address these challenges, the bWell Cognitive Care Platform for Depression (bWell-D) was collaboratively developed by the University of British Columbia and the National Research Council of Canada. bWell-D is an immersive, Virtual Reality (VR) based cognitive care program designed to target cognitive domains most affected in MDD, integrating both cognitive assessment and training within a single platform. bWell-D was developed through an agile, iterative process informed by expert feedback, followed by a co-design phase involving patients and clinicians to ensure clinical relevance, feasibility, and user engagement. Pilot trials with healthy volunteers demonstrated high tolerability, engagement, and enjoyment. Preliminary results from our actively ongoing single-blind randomized feasibility trial in individuals with MDD indicate promising feasibility and adherence in cognitive remediation delivered through VR. Additionally, early analyses suggest improved construct validity in the VR-based cognitive assessment compared to traditional measures of cognitive functioning. These findings support the feasibility and potential utility of immersive VR platforms such as bWell-D in advancing precision cognitive care for depression.

Topic Area: METHODS: Other

B98 - VisDeep: Distribution-Matched Stimulus Selection Using Earth Mover's Distance

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Selecting perceptual stimuli that are appropriately matched across experimental conditions remains a persistent challenge in cognitive research. Traditional approaches rely on subjective judgment or

matching on a limited set of attributes, increasing the risk of hidden confounds and reduced reproducibility. This work introduces VisDeep, a Python-based framework designed to support objective, distribution-matched stimulus selection using high-dimensional perceptual representations. VisDeep integrates multimodal stimulus features, including physical measurements, subjective perceptual ratings, demographic attributes, and deep neural network embeddings, into a unified feature space. The core methodological contribution is an Earth Mover's Distance (EMD)-based optimization procedure that searches across candidate stimulus subsets to identify groups with closely matched feature distributions while preserving within-group heterogeneity. The pipeline includes automated preprocessing, configurable feature weighting, and statistical evaluation tools to support transparent validation. As preliminary validation, VisDeep was applied to the Chicago Face Database, producing a complete dataset of 1,207 face stimuli represented by 4,172 features each. Using the EMD-based selection procedure, two demographically balanced face subsets (20 Asian and 20 White faces) were identified with closely matched distributions across neural, physical, and perceptual features (EMD = 0.032). These pilot results demonstrate the feasibility and stability of the proposed approach. Ongoing work uses VisDeep to compare machine-derived perceptual spaces with human psychological similarity spaces derived from behavioral judgments. Potential outcomes including partial alignment or systematic divergence will be interpreted in relation to known properties of human face perception. Although demonstrated with faces, VisDeep is designed to generalize to other perceptual domains, supporting broader methodological adoption.

Topic Area: METHODS: Other

B99 - Morphometric Correlates of Executive Functioning Dimensions in Children

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Introduction: Executive functioning (EF) encompasses cognitive, emotional, and behavioral processes that support self-regulation (Crisofori et al., 2019), yet the neuroanatomical bases of these regulation dimensions in childhood remain uncharacterized. This study examined cortical morphometry correlates of these dimensions in a heterogeneous pediatric sample, including children with ADHD, comorbid ADHD + Reading Disorder, and typically developing, to determine whether the three dimensions show dissociable neural patterns. Methods and Results: Structural MRI scans from 106 children, aged 8–12 years, were processed using CAT12. Surface-based morphometric indices—cortical thickness, gyrification, sulcal depth, and fractal dimension—were analyzed in relation to the BRIEF T-scores reflecting cognitive, emotional, and behavioral regulation (Metacognitive, Emotional Control, and Inhibition). Threshold-Free Cluster Enhancement (TFCE) with 10,000 permutations and a threshold of $p < .01$ was applied to identify regional effects. Higher

(worse) BRIEF T-scores were associated with reduced fractal dimension in the right inferior parietal for emotion regulation, decreased gyrification in left inferior parietal for inhibition, and reduced sulcal depth in frontal regions for metacognition. Toro's local gyrification analyses revealed both negative (frontal) and positive (parietal) relationships with emotion scores, as well as negative parietal associations with metacognition. No relationships emerged for cortical thickness. Conclusion: Our findings suggest that the EF dimensions are reflected primarily in measures of cortical complexity rather than thickness during late childhood, implicating frontoparietal morphology in the regulation of emotion, behavior, and cognition. Results highlight the importance of examining distinct morphometric parameters to better characterize the cortical substrates of developing executive control systems.

Topic Area: NEUROANATOMY

B100 - Lateral Prefrontal Cortex Functional Connectivity Suggests Different Retrieval Strategies for Spatial Source Memory and Color Source Memory

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Source memory refers to retrieval of contextual information (e.g., whether an object was presented on an indoor vs. outdoor scene, red vs. green background color, or left vs. right spatial location). In an fMRI study, we previously identified a left lateral prefrontal cortex (left LPFC) region that was similarly associated with spatial source memory and color source memory (using the conjunction of spatial hits vs. new-correct rejections and color hits vs. new-correct rejections). In the present fMRI study, we examined the functional connectivity of this region of interest (ROI). During spatial memory encoding, line drawings of objects or animals were presented to the left or right of fixation. During retrieval, participants classified the previous context of word labels corresponding to old images or new images as "left", "right", or "new." During color memory encoding, line drawings were presented at fixation on a red or green background. During retrieval, participants classified the previous context of old or new word labels as "red", "green", or "new". Preliminary psychophysiological interaction (PPI) analyses, corrected for multiple comparisons, showed that the LPFC ROI was functionally connected to language processing regions during spatial source memory (including Wernicke's area and its right hemisphere homolog) and was functionally connected to visual processing regions during color source memory (including intraparietal sulcus and angular gyrus, and at a reduced spatial-extent threshold, occipital gyri and V1). These findings suggest that LPFC may facilitate switching between retrieval strategies, engaging language regions for spatial context memory and visual regions for color context memory.

Topic Area: OTHER

B101 - The Brain Resilience Study: Circadian rhythm amplitude is associated with cognitive performance in older adults

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People with Alzheimer's disease (AD) often experience changes to their circadian rhythms, including altered behavioural patterns (e.g. 'sundowning'), reduced robustness of rest-activity cycles, and loss of suprachiasmatic nucleus (SCN) neurons. However, the role of circadian rhythm disruption in the etiology of AD remains understudied. Among 52 adults aged 53-84 years, we assessed cognitive function with the Montreal Cognitive Assessment (MoCA), and we collected 14 days of wrist actigraphy (ActiTrust 2, Condor Instruments, Sao Paulo, Brazil) to assess the rest-activity daily rhythm. Urine and saliva samples were also collected consecutively every three hours for 48-hours to measure markers of endogenous circadian rhythms driven by the SCN (urinary aMT6s and salivary cortisol). Participants who had a MoCA total score <26 were classified as "At Risk" for dementia, and exhibited rest-activity circadian rhythms with lower amplitude than participants performing >26 on the MoCA ($t(33.260) = 2.660$, $p = 0.012$, $\eta^2 = 0.175$). Data analysis of the biosamples is ongoing. These results suggest that lower circadian amplitude is associated with mild cognitive impairment. Pending longitudinal evaluations, reduced amplitude could serve as an early biomarker of dementia vulnerability. This research aims to deepen our understanding of circadian dynamics in understanding mechanisms of cognitive resilience in aging.

Topic Area: OTHER

B102 - Children's Enhanced Sensory Processing After Intense Music or Visual Art Training

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Long-term music training was shown to increase auditory processing in young children. However, little is known about whether short-term intense music training can increase pre-attentive processing in middle childhood. We recruited 58 children who were 8-12 years, without any previous formal music or visual art training, and no history of learning disabilities or sensory deficits. All children were screened for hearing loss and completed baseline measures of music aptitude and intelligence. Children were randomly assigned to an intense (9 day/27 hours) group piano training, visual art training, or a no-treatment control group. The piano training program consisted of scales, finger dexterity exercises, music theory, and basic piano repertoire. The visual art program consisted of painting and drawing technique, art concepts, skill practice, and construction of art pieces. We recorded the mismatch negativity (MMN), a cortical correlate of preattentive

processing, in the musical (piano tones) and language (vowels) domain. Results of an ANOVA showed no baseline group differences. MMN data showed an increased amplitude for the music and visual art groups as compared to controls. Larger amplitudes were found for the music group when compared to visual art group. These results highlight the influence of intense short-term music training on music and speech perception in middle childhood.

Topic Area: PERCEPTION & ACTION: Audition

B103 - PRoMiSS: EEG Posterior Neural Correlates of Autobiographically Salient Music

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Music plays a central role in psychedelic-assisted therapy, and the autobiographical salience (AS) of music is thought to amplify emotion, meaning-making, and imagery, processes similarly enhanced under psychedelics (Kaelen et al., 2016). We examined the neural correlates of autobiographically salient music within a psychedelic-assisted therapy setting without drug administration. Thirty-two psychedelically-naïve adults ($M = 34.4 \pm 10.8$ years; 59% female) completed hour-long, counterbalanced sessions with AS and standardized playlists with 64-channel EEG recorded. Data were band-pass filtered (0.5–60 Hz), cleaned using ICA for ocular/muscle artifacts, and downsampled to 512 Hz. Log-transformed spectral power was computed for Δ (1–4 Hz), θ (4–8 Hz), α (8–13 Hz), β_1 (13–20 Hz), β_2 (21–30 Hz), and γ (30–50 Hz). Within-subject Pearson correlations were computed between AS ratings and posterior log power (P1, Pz, P2, PO3, POz, PO4, O1, Oz, O2). Fisher Z-transformed coefficients were averaged across participants and tested against zero (one-sample t-tests; Bonferroni-corrected, $p < .0083$). Significant moderate positive correlations emerged for α ($r = 0.32$, $p = 0.007$), β_1 ($r = 0.37$, $p = 0.006$), β_2 ($r = 0.41$, $p < 0.001$), and γ ($r = 0.36$, $p = 0.001$), indicating that higher AS corresponded with increased posterior oscillatory activity. Alpha and beta increases reflect enhanced sensory integration, attention, and imagery, while elevated gamma suggests stronger binding of sensory and emotional memory representations (Imperioli et al., 2014; Knyazev et al., 2015). These findings demonstrate that personally salient music in a PAT context evokes distinct posterior alpha–gamma oscillatory dynamics linked to autobiographical memory.

Topic Area: PERCEPTION & ACTION: Audition

B104 - Blindness reorganizes the cortical network beyond the occipital cortex for lexical tone perception

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Previous research indicates that sensory loss (e.g., blindness) often alters information processing in remaining modalities, yet the neural mechanisms underlying such cross-modal plasticity remain unclear.

Using fMRI, we examined the neural bases of Mandarin lexical tone perception in sighted controls (SC, n=25) and congenitally blind (CB, n=34) adults. Participants performed a tone categorization task during scanning, identifying which of the four lexical tones a given sound represented via manual response. Behaviorally, both groups showed high and comparable accuracy. However, the CB group responded significantly faster (~200 ms) and exhibited a distinct response time pattern across tone conditions compared to the SC group. Neuroimaging results revealed that while the SC group engaged a typical network for lexical tone perception – including bilateral superior temporal cortices, left inferior frontal gyri (IFGs), and motor areas – the CB group showed altered activation patterns: they did not recruit left IFG but instead activated a set of visual areas including left V5. Time-resolved activation analyses revealed shorter neural response durations in temporal regions in the CB group, paralleling their faster behavioral responses. Multivoxel pattern analysis showed that left V5 discriminated tone categories exclusively in the CB group, and representational similarity analysis indicated its role in encoding pitch height. Functional connectivity analysis further revealed enhanced temporal–occipital coupling in the CB group, contrasting with stronger temporal–frontal connectivity in SC. These findings indicate that congenital blindness leads to a systemic functional reorganization, whereby visual areas become engaged in auditory feature representation during lexical tone processing.

Topic Area: PERCEPTION & ACTION: Audition

B105 - Modeling the Missing Fundamental: Effects of Musical Exposure in Humans and Neural Networks

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Pitch is a fundamental aspect of human sound perception. Tones are composed of a fundamental frequency (F0) and harmonics, and the pitch of a note usually corresponds to F0. Humans sometimes experience the "missing fundamental" (MF) illusion, in which the perceived pitch corresponds to an F0 that has been removed and only some harmonics remain. This illusion is more prevalent among those with musical training. We evaluated human participants and auditory artificial neural networks (ANNs) on a task designed to measure their perception of the missing fundamental. We hypothesized that musical exposure and experience would lead to improved pitch perception and increase missing fundamental responses in the ANNs, as it does in humans. The ANNs were trained on speech, music, and other audio using a variety of self-supervised and supervised learning tasks. Models trained on music and other audio were susceptible to the missing fundamental illusion, whereas self-supervised models trained solely on speech were not. In undergraduate students, we found a significant correlation with perception of the missing fundamental and musical experience. By fine-tuning models that did not initially exhibit strong missing fundamental representation, Wav2Vec 2.0 and Data2Vec, we found that this musical fine-tuning improved the models' pitch representation; however, it failed to induce a strong

representation of the missing fundamental. This work suggests that while certain types of sound exposure, like music, might be a key component to perceive the missing fundamental illusion, it is not sufficient on its own. Specific musical experiences may be critical.

Topic Area: PERCEPTION & ACTION: Audition

B106 - Electrophysiology and Modelling Highlight Diverse Strategies During Speech Perception

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Speech signals vary naturally across speakers, contexts, and productions, creating acoustic ambiguity that listeners must resolve to understand spoken language. Research in speech perception proposes that the auditory system handles this variability through probabilistic computation and abstraction, producing categorical perception. Traditionally, this phenomenon is measured by asking participants to label stimuli along a phonetic continuum in a two-alternative forced-choice (2AFC) task, which typically yields a sigmoidal identification curve. However, recent work argues that this pattern may be a product of task structure rather than a reflection of underlying perception. When listeners instead provide continuous judgments, their responses often appear graded, suggesting access to within-category acoustic detail. An alternative explanation is that listeners differ in how they perceive and respond to ambiguous speech, and that these individual strategies shape whether behavior appears categorical or continuous. To evaluate this account, we conducted a two-session experiment combining behavioral and electrophysiological measures. Participants classified 5-step continua spanning /ɪ/-/e/ vowels, /d/-/t/ stop consonants, and /ʃ/-/s/ fricatives in a 2AFC task and rated the same stimuli along a visual analog scale (VAS) in a separate session while EEG recorded neural responses. Behavioral and neural measures were strongly correlated across tasks, indicating consistent individual differences in sensitivity to phonetic ambiguity. Yet more detailed modeling revealed that listeners may flexibly shift perceptual strategies depending on task demands. These findings suggest that categorical and continuous patterns in speech perception reflect both stable individual traits and context-dependent processing strategies.

Topic Area: PERCEPTION & ACTION: Audition

B107 - Temporal Hierarchy and Contextual Facilitation in Mandarin Nasal Coda Processing: A Time-Resolved MEG-MVPA Study

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The neural dynamics of Mandarin nasal codas (/n/, /ng/) and their interaction with syllabic contexts remain underexplored. We utilized Magnetoencephalography (MEG) and time-resolved Multivariate Pattern Analysis (MVPA) to delineate these dynamics in 17 participants performing a paired-syllable discrimination task. Participants achieved high behavioral accuracy (>87%). While standard univariate analysis failed to differentiate nasal codas, MVPA revealed a distinct temporal hierarchy. Nasal coda decoding generally onset at ~200 ms, significantly later than vowels and consonants (~120 ms), reflecting sequential sub-syllabic feature extraction. Critically, neural representations were modulated by phonological context. Peak decoding accuracy for nasal codas was significantly higher in /i/ contexts compared to /a/, indicating strong co-articulatory integration. Furthermore, we observed a striking contextual facilitation effect between the first (S1) and second (S2) stimuli. While S1 nasal codas were decoded exclusively in a late window (420–760 ms), S2 processing recruited an additional early encoding window (160–280 ms) prior to the recurring late phase. This distinct temporal emergence suggests that prior context primes the system, accelerating the initial neural encoding of subsequent speech inputs. In conclusion, Mandarin nasal coda processing is hierarchical and highly sensitive to predictive task contexts, supporting models of dynamic, context-dependent speech integration.

Topic Area: PERCEPTION & ACTION: Audition

B108 - Electrophysiological Correlates of Misokinesia: ERP Evidence for Rapid Aversive Processing of Triggering Movements

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Misokinesia is a psychological phenomenon defined by a strong negative affective or emotional response to the sight of someone else's small and repetitive movements, such as seeing someone mindlessly fidgeting with a hand or foot (Schröder et al., 2013). The negative emotional response experienced by a misokinesic individual could lead to difficulties in their personal and/or professional lives. Our previous work has identified that approximately one-third of individuals in both student and non-student, non-clinical populations report misokinesia symptoms. Despite its prevalence, the neurocognitive mechanisms underlying misokinesia sensitivity remain unknown. The present study combines psychometric and electrophysiological approaches to investigate whether individuals exhibiting misokinetic tendencies show distinct event-related potential (ERP) signatures when viewing movement-based triggers. Participants will first complete the Misokinesia Assessment Questionnaire (MkAQ) to index individual differences and classify participants into low, moderate, and high misokinesia groups. During EEG recording, participants will passively view a rapid stream of images and/or split-second video clips depicting either triggering movements or neutral movements. In a subsequent rating phase, participants will evaluate each clip's aversiveness. ERP responses to each participant's most aversive

versus least aversive stimuli will then be compared. We predict that triggering movements will be associated with distinct responses in sensory and/or post-sensory ERP components, compared to non-triggering stimuli. By identifying neural signatures of misokinesia, this research aims to situate it within broader models of affective evaluation and sensory intolerance, providing electrophysiological evidence for the phenomenon.

Topic Area: PERCEPTION & ACTION: Motor control

B109 - State-dependent motor associative plasticity relies on parietal activity during action planning

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Frontal motor and parietal regions are highly interconnected and play a critical role in goal-directed motor behavior. Some suggest that parietal activity during the planning of goal-directed actions, such as object grasping, influences stimulation-induced distal motor plasticity, but it has been difficult to provide strong causal evidence for this claim in humans. Here, we examined how activity in the posterior parietal cortex (PPC) influences state-dependent associative plasticity in the parietal-motor circuit. Using a within-subject design, participants completed three stimulation conditions during right-hand object-directed grasping, a task that reliably engages PPC activity during action planning. Continuous theta-burst stimulation (cTBS) was applied to the left PPC or a left visual cortex control site to transiently disrupt neural activity, followed by a Hebbian plasticity induction protocol in the left parietal-motor circuit using cortico-cortical paired associative stimulation (cPAS). To determine whether PPC suppression alone modulates motor cortical plasticity, a third condition combined cTBS to the left PPC with a non-Hebbian plasticity cPAS protocol with altered interregional timing. Plasticity was assessed by measuring changes in motor-evoked potentials (MEPs) elicited with single-pulse transcranial magnetic stimulation before and after each protocol. cTBS to the PPC significantly reduced the task-engaged, state-dependent cPAS-induced increase in MEP amplitudes, whereas active cTBS to the visual cortex had no effect. cTBS to the PPC, followed by a non-Hebbian cPAS protocol, produced no change in MEP amplitudes from baseline. These findings provide strong causal evidence that parietal activity during action planning regulates the induction of state-dependent parietal-motor plasticity necessary for dexterous hand function.

Topic Area: PERCEPTION & ACTION: Motor control

B110 - Cognitive Stress and Environmental Recovery: Evidence from EEG and Physiological Measurements

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Urbanization increasingly challenges mental health, with chronic stress contributing to significant physiological and psychological burdens. This study explores the neural and physiological markers of cognitive stress and investigates the potential of natural environments to mitigate these effects. Twenty participants took part in a controlled experiment combining 32-channel EEG with complementary physiological recordings, including HRV, ECG, and respiration. Stress was induced via the Montreal Imaging Stress Task (MIST), followed by randomized exposure to either natural or urban video stimuli, with two sessions spaced three weeks apart. Our results confirm that the MIST reliably elevates stress levels, as evidenced by increased tonic galvanic skin response (GSR) relative to baseline. EEG analyses revealed band-specific modulations consistent with heightened cognitive load. Importantly, subsequent video exposure led to measurable stress reduction across participants, with trends suggesting that naturalistic environments may promote more pronounced recovery compared to urban settings. These findings underscore the embodied nature of stress regulation, demonstrating that both central (EEG) and peripheral (GSR, HRV, ECG) measures effectively capture dynamic stress responses and recovery trajectories. Moreover, exposure to controlled naturalistic stimuli offers a promising framework for studying restorative processes in real-world and virtual contexts, highlighting the potential for environment-based interventions to support mental well-being.

Topic Area: PERCEPTION & ACTION: Multisensory

B111 - Eye Hear You: Eye movements to mental imagery during speech comprehension in noise

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Perhaps counterintuitive, the study of eye movements can provide an index of how well we can hear. Under challenging listening conditions, such as in speech comprehension in background noise, eye movements decrease. However, eye movements tend to increase during mental imagery and memory instantiation, which may be useful in supporting listening efforts during challenging conditions. Young adults ($n = 64$, Mage = 22.28) listened to and recalled visually rich (concrete scenes) or abstract descriptions while eye-tracked on a blank screen. Listening difficulty was manipulated with two levels of background babble. Participants recalled concrete descriptions more accurately, particularly in easier listening conditions. During listening, eye movements (gaze dispersion, fixation rate, and saccade amplitudes) were reduced under difficult conditions and overall increased for abstract descriptions. Time-course analyses revealed

that gaze dispersion tracked spatial features of concrete descriptions but no other relational information. During recall, eye movements were higher for abstract descriptions and reflected listening difficulty for concrete passages. Notably, a peak in gaze dispersion preceded the recall of spatial details in concrete passages, and this pattern was seen in those with high recall performance. These results indicate that both speech content and listening environment shape the recruitment of eye movements. When listening to visualizable speech, eye movements may be co-opted to represent the spatial components of imagined content. These eye movements may be reinstated during subsequent recall to support memory accuracy. Thus, the oculomotor system may actively support speech comprehension through its role in mental imagery.

Topic Area: PERCEPTION & ACTION: Multisensory

B112 - Effects of Cathodal HD-tDCS to the rSTS on Symptoms and Audiovisual Integration in People with Psychosis Spectrum Disorders

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The right superior temporal sulcus (rSTS) is a causal node in the brain network underlying multisensory hallucination production and is associated with audiovisual integration (AVI). Psychosis-spectrum disorders feature both hallucinations and AVI deficits. We sought to reduce rSTS activity with cathodal, high-definition transcranial direct current stimulation (HD-tDCS) to reduce hallucinations and enhance audiovisual integration in people with psychotic disorders. In this double-blind, randomized, sham-controlled pilot study, HD-tDCS was applied to the rSTS using a ring montage with a cathode center and 3 anode surrounds. 12 individuals (6 active stimulation, 6 sham) received HD-tDCS for 5 days with 2 20-minute sessions per day. Symptoms and electroencephalography (EEG) were evaluated at baseline, 5-day follow-up, and 1-month follow-up. EEG tasks included a resting state and an AVI task pairing auditory and visual steady state stimuli. Changes were tested with nonparametric statistics ($\alpha=.10$). Clinical measures demonstrated significant symptom reductions at the 5-day timepoint (clinician-measured: $p=.06$, self-reported: $p=.06$), which indexed overall illness severity. EEG measures indicated attenuated AVI-associated activity at 5-days and 1-month, reduced resting alpha power over the rSTS at 1-month, and enhanced auditory response at 1-month (all $p<.10$), suggesting longer-term neuroplastic changes. HD-tDCS of the rSTS may have a short-term effect on overall psychosis severity and longer-term effects on AVI and neurophysiology. We will further investigate rSTS engagement in this sample by examining source-space EEG measures. Given the small size of this pilot study, results provide preliminary proof-of-concept

evidence supporting the initiation of a larger trial in people with hallucinations.

Topic Area: PERCEPTION & ACTION: Multisensory

B113 - Neural encoding of visually and acoustically derived speech features during multimodal narrative listening

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The presence of visual cues (e.g. lip movements) can enhance speech perception and the neural tracking of acoustic features, such as the amplitude envelope. It is unclear, however, how this neural enhancement relates to behavioural measures of audiovisual benefit. Here, we investigated the neural encoding of acoustically- and visually derived speech features, capturing amplitude, temporal, and spectral modulations in the speech signal during narrative listening. We collected concurrent MEG and eye-tracking data (n=35) alongside objective (3AFC comprehension) and subjective (intelligibility ratings) measures of story comprehension while participants listened to a speaker narrating a story (Varano et al., 2023) in auditory-only (AO), visual-only (VO) and audiovisual (AV) conditions. To assess changes in speech tracking due to changes in modality independent of changes in intelligibility, AO and AV conditions were matched in relative intelligibility using noise-vocoding. We also collected offline behavioural measures of lipreading ability and audiovisual benefit, speech reception thresholds (SRTs) and verbal IQ. Preliminary analyses found evidence for audiovisual benefit for visually-derived and spectral features, most prominently over occipital sensors, in line with a perceptual restoration of spectral dynamics via visual speech cues (Plass et al., 2020). Replicating previous work (Aller et al., 2022; Bröhl et al., 2022), we also found that tracking of speech features in temporal, but not occipital sensors during silent lipreading was associated with lipreading ability and audiovisual benefit. Ongoing work will extend these results by disentangling the relative contribution of modality-specific information through comparisons of neural encoding models including both auditory and visual speech features.

Topic Area: PERCEPTION & ACTION: Multisensory

B114 - Enhancing Music Perception Through Auditory-Vibrotactile Training

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Hearing loss limits the ability to process complex sounds, such as speech or music in noisy environments. Although hearing aids and cochlear implants improve audibility, they often fail to convey fine acoustic details, reducing speech understanding and access to music, an important source of cultural and emotional engagement. Auditory-tactile integration offers a promising way to address these challenges. Indeed, vibrotactile feedback can complement auditory input by conveying rhythm, intensity, and frequency through the

somatosensory system, potentially supporting everyday listening. Our research investigates whether vibrotactile information delivered through a novel Multichannel Vibrotactile Glove can enhance auditory perception of short musical excerpts in noise. The glove converts complex acoustic signals into high-fidelity vibrotactile stimulation, tonotopically mapped across the fingers to mirror the frequency organization of the auditory system. In a pilot study, six healthy adults completed a five-session protocol over two weeks, including baseline testing, three days of training, and post-training assessment. Auditory perception was measured using the Music-in-Noise Task (MINT), which assesses discrimination of repeated musical excerpts embedded in noise. Neural correlates of sound processing were examined with EEG, focusing on reconstruction of the music envelope as an index of neural encoding. As a result, participants showed improved MINT performance in the auditory-tactile condition compared to audio-only listening, with additional gains following training. EEG results suggested enhanced neural encoding for auditory-tactile stimulation relative to unimodal input. Together, these findings indicate that vibrotactile feedback can enhance auditory perception, support learning, and engage multisensory plasticity, highlighting its potential for auditory rehabilitation

Topic Area: PERCEPTION & ACTION: Multisensory

B115 - Event Segmentation Patterns of Real-World Navigation from a First-Person Perspective

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Event segmentation theory proposes that people divide continuous experience into discrete events using mental event models in working memory. These models integrate perceptual, semantic, and episodic information to predict what will happen next. Event boundaries—where one meaningful event ends and another begins—are key points in working and long-term memory, marked by increased processing and recall. Prior research shows high agreement among individuals on when boundaries occur, but often uses edited, third-person footage, which may not reflect real-world experience. Using first-person perspective videos, we hypothesized that segmentation agreement and alignment would be strongest and most immediate for highly salient physical context shifts and highly unpredictable events. We analyzed segmentation patterns using 38 unedited, first-person videos recorded by five epilepsy patients with intracranial EEG devices as they navigated UCLA's medical campus, offering a more naturalistic view of everyday experience. A total of 430 undergraduates completed an event segmentation task by pressing a button when they believed one meaningful event had ended and another had begun. Results

showed that physical boundaries—such as spatial thresholds and context changes—had the highest agreement and temporal alignment, partially supporting our hypothesis. Event segmentation theory suggests that information experienced around these physical boundaries should demonstrate increased recollection. In a secondary analysis, segmentation patterns from the patients who completed event segmentation tasks on their videos significantly overlapped with those of the undergraduate viewers but showed minor differences suggesting that similar but not identical event segmentation processes are used when viewing novel experiences and familiar, past lived experiences.

Topic Area: PERCEPTION & ACTION: Other

B116 - Modulation of visual recognition is manifested through sleep in lower and higher-level visual processing

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Whether obtaining semantic information about unfamiliar objects alters higher-level visual processing and whether it occurs instantly has been controversial. Accumulating evidence indicates that sleep plays a role in visual perception following extensive training (Tamaki et al., 2020, Nat. Neurosci.; Tamaki et al., 2020, PNAS). In the present study, we tested whether sleep facilitates visual recognition without extensive training and whether the process involves lower and higher-level changes. Before and after a 90-minute interval with (nap group, N=19) or without (break group, N=17) sleep with polysomnography, participants performed a newly-developed Mooney-image identification task where they were presented with various types of binarized images only once or twice and asked to respond whether they recognized the image via 2AFC and to report the content of each image. Our results showed that visual recognition accuracy improved significantly only after the nap; i.e., subjective recognition became significantly more consistent with detection accuracy. To identify the neural underpinnings driving the change in visual recognition after sleep, we applied a data-driven functional connectivity analysis to sleep EEG. We found that stronger visual-nonvisual network connectivity predicted sleep-dependent recognition change. Next, to investigate the effects of sleep on visual processing during the task, we fit linear regression models to task EEG data. We found that early event-related potentials in occipital (N1p) and fronto-central (N1a) regions, evoked 120–150 ms post-stimulus, were modulated by sleep. Thus, sleep spontaneously calibrates visual recognition without extensive training through network-level changes, resulting in changes to both lower- and higher-level visual processing.

Topic Area: PERCEPTION & ACTION: Vision

B117 - Neural object representations predict visual discrimination success in adolescents and adults

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Object perception involves processing both broad conceptual features as well as unique, item-specific ones. However, the ability to discriminate between conceptually related objects matures slowly through development. Despite this extended developmental trajectory, previous work has often focused on the neural underpinnings of object perception in infancy and childhood leaving adolescence relatively underexplored. Here, adolescents (N=36; 12-13 year olds) and adults (N=36) viewed exemplars from four object concepts during functional magnetic resonance imaging (fMRI) scanning. We used a pattern similarity searchlight to identify brain regions within each age group which represented objects at the concept or exemplar level. After scanning, participants completed a match/mismatch task assessing their ability to visually discriminate between exemplars of the same concept. We identified substantial overlap across age groups in the brain regions coding for concept and exemplar, primarily within the visual cortex. In addition, adults showed enhanced concept-coding in midline structures and exemplar-coding in parietal, insular, and anterior cingulate cortices compared to adolescents. Behaviourally, adolescents performed worse on the discrimination task, in keeping with previous findings. Yet we found consistency across age groups in the relationships between behaviour and neural representation: superior performance discriminating between exemplars of a concept was linked to stronger neural coding at the exemplar, but not concept, level. Together, our results suggest that object representations in the brain continue to mature and expand even beyond early adolescence, but these representations may inform object perception in a similar manner in adolescence and adulthood.

Topic Area: PERCEPTION & ACTION: Vision

B118 - Causal chains as a distinct type of event in visual perception

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The task of perception is to construct a description of experience. Accordingly, visual processing seems to traffic in properties beyond color or motion, such as *causality*. But what caused you to be here? Perhaps a flight to Vancouver, a September submission, or choices made along the way—but ultimately, any causal chain could, in theory, be traced back to the Big Bang. Do causal chains belong solely in the domain of reasoning, or might they also play a role in visual processing, stringing together events in time? Here, observers enumerated up to 30 discs in fast, irregular sequences. In the “causal chain” condition, each disc launched the next, while in the non-causal control, motions were identical, except for spatial gaps between discs. Observers estimated *more* discs in the causal chain, suggesting it may help retain motions in working memory. To further isolate the “causal chain” from mere causality and mere spatial continuity, we ran two additional experiments. In the “paired” condition, collisions

occurred between alternating disc pairs, preserving causality without chain structure. Estimates fell between causal chain and non-causal estimates, suggesting that causality alone does not allow the same degree of retention. In the overlap condition, each disc took over the next disc's position, providing continuity without causality. Estimates were reliably different from the causal chain—even higher—isolating an effect of spatial continuity independent of causality. Causal chains—as sequences of temporally-linked causal interactions—may be a distinct type of event in vision, allowing us to *hold on* to more of what we see.

Topic Area: PERCEPTION & ACTION: Vision

B119 - Large lump-sum vs. small sequential monetary loss: A comparison of relevant neural substrates

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It is crucial for people to avoid situations in which they experience sequential losses for the sake of their wellbeing. This study examined the neural substrates involved in large monetary loss and small sequential loss. Participants were asked to participate in a game of purchasing stocks while using an MRI scanner. In the experiment, participants made financial losses in two ways: over four successive times, and the equivalent amount of these losses in just one instance. The brain regions were compared when the participants incurred the losses for the fourth of four sequential losses (5-day condition) with the equivalent total amount of losses in one instance (2-day condition). The results showed that significant brain activation, in the 5-day condition as opposed to the 2-day condition, was observed in the bilateral lingual and fusiform gyri, and left cerebellum exterior, extending to the right angular and supramarginal gyri. The right superior frontal and middle frontal gyri and right caudate were also activated. In contrast, no significant activation was found in the 2-day compared to the 5-day condition. The right caudate in the dorsal striatum is involved in sequential financial loss. However, it cannot be confidently concluded that the activation of the dorsal striatum reflected dissatisfaction because findings concerning the activation of the striatum were inconsistent in previous studies (Balodis et al., 2012; Oldham et al., 2018). Future studies are needed to thoroughly explore the role of the striatum in a variety of losses.

Topic Area: THINKING: Decision making

B120 - Decisions at your fingertips: Characterizing object-oriented decision making with hand movements in older adults

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As life expectancy increases, age-related diseases such as Alzheimer's disease (AD) are becoming more prevalent. This

progressive brain disorder develops decades before behavioral or clinical symptoms appear, making early diagnosis and treatment challenging. Effective, theoretically informed cognitive screening should be guided by our understanding of AD neuropathology, with emphasis on the cortical regions first affected by the accumulation of tauopathy. According to Braak staging, AD pathology begins in the transentorhinal cortex of the medial temporal lobe, which includes perirhinal cortex (PRC), an area critically involved in object processing. Evidence from multiple methodologies links the integrity of PRC representations to performance on object-based categorization, recognition memory, and perceptual decisions. This is particularly true of experiments that involve discrimination among objects with a high degree of overlapping features. Building on this, this study investigates whether kinematic data, recorded as swipe trajectories on a tablet, can reveal the integrity of PRC-based object representations in older adults. To this end, older adults, ranging from cognitively healthy to mild cognitively impaired, will complete tasks involving object categorization, perceptual matching, and recognition memory. Swipe trajectories will be recorded as dependent measures to capture subtle differences in finger movements that may reflect underlying cognitive processes, beyond what reaction time and accuracy alone can reveal. We will use functional magnetic resonance imaging to examine how individual differences in swipe trajectories relate to object representations in PRC. This work will test influential theories of object representation in a manner that has potential clinical relevance for AD screening and staging.

Topic Area: THINKING: Decision making

B121 - Tracking sampling strategies during value construction to guide novel choice

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Humans often need to assign value to novel options by drawing on memory. We sometimes do this by generalizing the value of learned categories and at other times by making relational comparisons between familiar component features of novel options. It remains unclear whether people recruit categorical, relational, or both strategies when making novel choices. To investigate how value is constructed during novel choice, we present a novel task where choice options are composed of three attributes that vary along continuous dimensions (shape, angle, color), each of which are linked to underlying reward categories. After learning this initial attribute-to-value structure, participants can infer value categorically or rely on relational comparisons between the choice options on a particular dimension. To allow us to track how participants acquire and use information in their estimation of value we enforce explicit sampling of attributes using a mouse-contingent bi-resolution display paradigm, blurring attributes until participants hover over them. We predict that categorical vs relational strategies will be reflected in how participants sample attributes. Performing categorical inference should lead to sparser sampling where individuals visit each attribute of a choice

option, retrieve the category value, and calculate a sum. In contrast, relational comparison should elicit denser sampling as participants alternate between the options on an attribute-by-attribute basis. Preliminary analyses indicate that participants sample more relationally when attribute distances between options are small in perceptual space, consistent with the idea that participants rely on relational judgments when categories are harder to discern.

Topic Area: THINKING: Decision making

B122 - Temporal Decoding of Reward Processing using MEG

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The Reward Positivity (RewP) is a sensitive, specific marker of reward. The RewP is likely generated by a distributed network of brain regions that do not contribute homogenous information. Given the broad set of contributors to this signal, using a univariate approach such as ERP analysis may not capture the full scope of this signal. MVPA has shown increased sensitivity to neural signals and allowed for successful classification of perceptual stimuli based on evoked neural activity. MEG data suggest that we can use MVPA to temporally decode rewarding and non-rewarding feedback in individual participants. Participants completed a reinforcement learning task in which they received a blue or yellow screen that indicated monetary reward. Feedback-color mapping changed between runs. MVPA was first used to classify color at each timepoint, irrespective of feedback. This model accurately predicted color from 70-400ms. Feedback was accurately predicted from 200-700ms in a model including both blue- and yellow-reward trials. A cross-decoding model, in which the training set included rewards of one color and the testing set included rewards of the other color, made logical systematic errors at early timepoints (70-250ms) in line with color processing, but successfully predicted feedback at later timepoints (350-700ms). This suggests that we are successfully decoding the response to the cognitive content of the feedback, not just the perceptual attributes. This method could allow for differential decoding of both perceptual and cognitive attributes of reward. Additionally, the sensitivity of the method could allow for better understanding of individual differences in reward processing.

Topic Area: THINKING: Decision making

B123 - Neural mechanisms of decision making when sensory evidence and priors conflict

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Humans form statistical priors through experience that bias perception, but accurate decisions require overriding these biases when evidence contradicts them. We examined brain mechanisms that reflect bias override in an fMRI study (N=38) using a perceptual decision-making task with implicitly learned priors. On each trial,

participants judged the orientation of Glass pattern dot stimuli presented in red or green color with varying levels of coherence (0%, 13%, 35%, or 100%). Unbeknownst to participants, for stimuli in one color, one orientation occurred on 75% of the trials (positive prior) while stimuli in the other color occurred equally often in the two orientations (neutral prior). Most participants became sensitive to this base-rate prior across learning, reflected in a bias to choose the more frequently occurring direction on 0% coherence trials in which no diagnostic information was present. In the final block, we isolated moderately ambiguous trials (13/35% coherence) where the prior and sensory evidence conflicted. Participants either relied on the prior and erred or overrode it by using the weak sensory evidence to respond correctly. We found an interaction between prior condition (positive or neutral) and decision type (prior-based or sensory-based) in activation in the bilateral fusiform cortex and left ventral putamen. These results showed increased activity in these regions when participants overcame the acquired bias and based their decisions on the sensory evidence. These findings suggest that the putamen may help gate or suppress a biased response, while fusiform cortex enhances ambiguous sensory encoding, thereby supporting flexible perceptual decision-making.

Topic Area: THINKING: Decision making

B124 - The Influence of Episodic Memory on Creativity and its Prefrontal Correlates in Children and Adults

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Past work suggests that people rely on memories for their experiences when generating novel ideas. In early life, this “divergent thinking” capacity emerges gradually alongside both the accumulation of experiences and age-related refinements to memory and cognitive control processes supported by the prefrontal cortex (PFC). However, little is known about how episodic memory and control interface to support creative cognition across development. Here, children (6-10 years, N=17) and adults (18-25 years, N=16) generated solutions to everyday problems (divergent thinking) while near-infrared spectroscopy was recorded from PFC. In one session, participants received an episodic memory induction previously shown to enhance creativity in adults (Madore et al., 2015), in which they recalled details about a previously presented video. In a separate session, participants received a control induction soliciting more general impressions. Behaviourally, adults but not children generated more ideas following the episodic induction, suggesting an orientation to memory enhances creativity in adults alone. Conversely, only children showed neural sensitivity to the manipulation: greater functional coordination within lateral PFC predicted improved idea generation in children following the episodic induction, suggesting that children may depend more than adults on control processes to effectively use episodic content when generating new ideas. Importantly, behavioural and neural effects of the episodic induction were specific to the divergent thinking task, not being observed in a matched “convergent thinking” task where

participants selected the best solution from four options. Our findings suggest important developmental differences in the relationships among memory, control, and creativity in both brain and behaviour.

Topic Area: THINKING: Development & aging

B125 - Examining Posterior Parietal Cortex Contributions to Cognitive Flexibility With Noninvasive Electric Brain Stimulation

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Creativity, the ability to produce novel and useful ideas, has emerged as an area of research focus for cognitive neuroscience. In this project, we examine the effect of transcranial direct current stimulation (tDCS)—a noninvasive method using weak electrical currents to modulate brain activity—on cognitive flexibility. Although most creativity tasks emphasize bottom-up processes (building ideas from spontaneous associations), real-world problem solving also relies on top-down processing (applying prior knowledge) to achieve goals. To engage both types of processing, we pioneered a new task, the Alternative Objects Task (AOT), wherein participants are asked to satisfy goals with a common or an uncommon object. In prior research, we have shown that cathodal tDCS over the left prefrontal cortex enhanced response fluency on this task, whereas anodal tDCS elicited the opposite effect. Guided by these prior results and functional neuroimaging findings, here, we employed tDCS over the left parietal cortex to investigate causally the impact of transient changes in activity in this region for problem solving performance on the AOT. Participants were presented with a series of goals and generated either a common or an uncommon object that could satisfy each, while undergoing either excitatory (anodal), inhibitory (cathodal), or sham 4×1 high-definition tDCS over left posterior parietal cortex. Analyses of variance on the effect of tDCS on response fluency, reaction times, and semantic distance revealed interactions between task and stimulation type across measures and highlight how goal-orientation during cognitive flexibility may differentially rely on posterior parietal cortex.

Topic Area: THINKING: Problem solving

B126 - Exploring the effects of self-generated and induced insight on incidental memory and pupil dilation

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Previous research has established that the ‘Aha!’ experience associated with insights bestows a memory advantage (IMA). One proposal is that these benefits stem from hippocampally mediated prediction error, which accompanies the spontaneous generation of insight. This may be supported by psychophysiological evidence, as insight has been associated with pupillary dilation, which also correlates with prediction error. Yet, in contrast with the prediction error proposal, a recent study indicates that incidental memory enhancements from spontaneous insights are equal to that of low-

prediction error ‘induced insights’ (whereby solutions are presented at an expected time). This raises the question: how important is prediction error for the IMA? To address this, we investigate the effect of the IMA with varying degrees of expectation (expected induced insights, unexpected induced insights, spontaneous insights) on incidental memory and pupil dilation. With compound remote associates as insight problems, undergraduate students will spontaneously generate insight on some trials (higher prediction error), and on other trials will be shown solutions at expected (lower prediction error) or unexpected times (higher prediction error). Following induced or spontaneous insights, participants will incidentally encode images of household objects. Pupil size will be measured prior to solution generation and after solution presentation as a potential indicator of prediction error. After encoding, the Mnemonic Similarity Task, an object recognition task investigating the presence of detailed memory, will be administered for the previously encoded images. Using behavioral and pupillometric methods, this study re-examines the role of prediction error on the IMA with sensitive memory measures.

Topic Area: THINKING: Problem solving

B127 - Decoding Abstract Relations: Investigating the Neural Representation of Relational Categories in the Human Brain

Anthony Dunn¹ (anthony.t.dunn.gr@dartmouth.edu), Katherine Alfred¹, Nicholas Ichien³, Brianna Aubrey¹, Sophia Baia², Silvia Bunge², David Kraemer¹; ¹Dartmouth College, ²University of California, Berkeley, ³University of California, Los Angeles

Analogical reasoning supports the human ability to derive generalizable knowledge about the world and, in turn, hinges on our ability to understand abstract relations between concepts. Revealing how these abstract relations are organized in patterns of neural activity is key to explaining how the brain implements analogical reasoning. For example, the meanings of the words “fruit” and “apple” are distinct from those of “car” and “sedan”—however, “fruit:apple” and “car:sedan” both instantiate the same abstract relation (category:exemplar). Evidence suggests that abstract relations are activated even when they are irrelevant to task goals. However, it is unclear whether such ‘implicit’ representations differ from those activated during explicit analogy judgments. Across two tasks, we modeled abstract relations using representational similarity analysis (RSA). Both tasks included word pairs that instantiate the same set of abstract relational categories (e.g., category:exemplar). Importantly, relational categories were incidental to the first task (judging semantic relatedness between individual words), allowing us to test whether abstract relations were activated implicitly. The second task required participants to judge analogies directly. Representational Similarity Analyses revealed a common set of parietal, ventral temporal, and anterior temporal regions that reflect abstract relational categories across both tasks. Additional regions reached significance in only one of the two tasks, suggesting task-dependent recruitment of regions that reflect abstract relational categories. Variability in representational

strength was consistent with individual differences in analogical reasoning. These findings support the presence of a network that reflects abstract relations independent of explicit demands on analogical reasoning.

Topic Area: THINKING: Reasoning

B128 - Age-related changes in attentional control during speech-in-competition comprehension: neurophysiological evidence

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Understanding speech in the presence of competing sounds in real-world settings is a daily challenge that engages attentional control to manage perceptual and cognitive demands and becomes increasingly difficult with aging. However, the neurophysiological correlates of speech-in-competition comprehension (SiC) and how they change across the aging process remain to be described. We examined the effects of perceptual and cognitive demands on SiC performance and neural activity in young (18–30 years; N = 25) and older adults (60–70 years; N = 25) with normal hearing and cognition. EEG was recorded during verbal comprehension tasks in which target speech was masked by competing voices that differed in gender, language, and spatial localization. Perceptual load was manipulated via the target-to-masker ratio, and cognitive load was increased through a concurrent working memory task performed during listening. SiC tasks led to decreased accuracy and longer RTs, with perceptual load exerting the strongest effect on performance and no differential impact of masker types. An interaction between perceptual and cognitive load in RTs indicated that the effect of cognitive load was moderated by perceptual demands, such that cognitive load increased RTs only under low perceptual load. SiC induced a selectively increase in alpha-band power, with the strongest effects observed over frontal and posterior regions. This increase was evident only when both perceptual and cognitive loads were simultaneously high. Our findings demonstrate that perceptual load constrains the expression of cognitive control during SiC, and that alpha oscillations support adaptive attentional regulation when auditory processing demands exceed available resources.

Topic Area: ATTENTION: Auditory

Poster Session C

Sunday, March 8, 2026, 5:00 – 7:00 pm, Fairview/Kitsilano Ballrooms

C1 - Individual differences in sensory processing patterns and attention influence speech motor control in children

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Auditory feedback is essential for developing and maintaining fluent speech. While children are thought to rely heavily on their auditory feedback, previous experimental studies are inconsistent, suggesting the need to explore additional contributing factors. Cognitive factors such as attention and sensory processing abilities have been shown to influence speech motor control in adults; however, this has yet to be examined during childhood, where cognitive and speech motor systems are still developing. This study investigates how individual differences in attention and sensory processing patterns influence auditory feedback control of speech in children. Fifty-three children ages 4-11 completed a frequency-altered feedback (FAF) task where the pitch of their auditory feedback was shifted up or down 100 cents, and compensatory vocal responses were measured to index the child's reliance on their auditory feedback. Attention and sensory processing abilities were measured using the Sustained Attention to Response Task (SART) and the parent-report Short Sensory Profile (SSP), respectively. Overall SSP scores, as well as scores in auditory, tactile, and sensory seeking domains, were associated with larger compensatory responses to FAF, while poorer SART performance was associated with slower vocal responses to downward shifts. These results suggest that for children, greater sensory processing differences may promote increased reliance on auditory feedback for speech motor control, while attentional differences may be more important in the temporal processing of FAF.

Topic Area: ATTENTION: Auditory

C2 - Neural Signatures of Event Segmentation During Narrative Listening in Background Noise

Ryan Panella^{1,2} (ryan.panella@utoronto.ca), Aysha Motala³, Ingrid Johnsrude^{4,5}, Björn Herrmann^{1,2}; ¹Rotman Research Institute, Baycrest Academy for Research and Education, ²Department of Psychology, University of Toronto, ³Department of Psychology, University of Stirling, ⁴Department of Psychology, University of Western Ontario, ⁵School of Communication Sciences & Disorders, University of Western Ontario

Investigations into speech-comprehension difficulties often involve intelligibility of short, disconnected sentences, limiting generalization to real-life listening. Novel approaches to understanding naturalistic speech listening are critical for insight into impaired processing. Recent memory research has demonstrated that humans naturally perceive, encode, and recall continuous experiences as temporally extended discrete events, a process known as event segmentation. This phenomenon, driven by attention, helps predict upcoming information and recall experiences; however, few studies have leveraged this framework to understand challenges in speech comprehension. In the current study, participants (N=40, 17–24 years) listened to three spoken stories from The Moth podcast during fMRI scanning. Stories were overlaid with a twelve-talker babble in five conditions, ranging from easy to difficult intelligibility (clear, +14, +9, +4, –1 dB SNR). Event boundaries were identified in story transcripts using large language models and temporally aligned to the audio.

BOLD responses were time-locked to event boundaries and compared to event centres. Event boundaries elicited widespread transient increases in activity across frontoparietal, attention, default-mode, somatomotor, and visual networks, peaking approximately five seconds post-boundary. Activation at boundaries exceeded event centres, confirming that listeners parsed narratives into meaningful events. Although high-clarity speech engaged a broader set of regions than low-clarity speech, overall response magnitude did not differ. Subtle right-temporal deactivations may suggest anticipatory processing preceding boundaries. These findings indicate neural signatures of event segmentation persist despite moderate background noise. Even when intelligibility declines, listeners maintain coherent mental models, organized around events, highlighting event segmentation as a stable cognitive mechanism supporting real-world comprehension.

Topic Area: ATTENTION: Auditory

C3 - Do inattention traits relate to N2 and P3b ERP responses to novel versus target stimuli? A comparative analysis of youth and young adults

Erin J. Panda¹ (epanda@brocku.ca), Holly A. Lockhart¹, Lauren Stepien¹, Zihang Bu¹, Tyler K. Collins¹, Tinashe Buckenham Dziva¹, Sidney J. Segalowitz¹, Ayda Tekok-Kilic¹, Brock University-Pathstone Mental Health Collaborative Research Program¹; ¹Brock University

Background: Inattention, characteristic of ADHD, is a dimensional trait that affects many to some extent. This study examined how attentional allocation to response-relevant target and response-irrelevant novelty differs as a function of everyday attention difficulties. Methods: Children and youth (ages 8–17; 51% male; 60% community-recruited, 40% clinically referred) completed a fast-paced 4-stimulus visual oddball task while 128-channel EEG was recorded. Based on Conners 3-Parent (short form) T-scores, participants were classified as “high inattention” (T>65; n=22, 59 % male; M age=11.73) or “low inattention” (T<48; n=27, 56 % male; M age=11.15). A preliminary adult comparison sample was recruited and classified using the CAARS-Self Report (n=79; ages 19–30, 37% male). Results: High-inattentive youth demonstrated poorer behavioral performance, yet showed enhanced P3b amplitudes to targets and enhanced frontal N2 responses to novels relative to non-targets compared to low-inattentive peers. Adults showed canonical P3b and N2 effects, but attenuated group differences relative to youth. Conclusion: Findings suggest that higher everyday inattention in youth is linked to greater neural responses to both response-required targets and unexpected novel stimuli. Rather than indicating a deficit in attention, these patterns may reflect different attentional priorities, where salient or novel events capture processing resources more strongly. This interpretation emphasizes attentional differences – not deficits – and highlights the importance of considering diverse cognitive pathways underlying inattention. Developmental differences further suggest that neural mechanisms supporting attentional control may evolve with

age, potentially shaping how attentional differences manifest behaviorally.

Topic Area: ATTENTION: Development & aging

C4 - Does coherence facilitate memory encoding?

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The ability to selectively attend to “targets” and ignore “distracters” develops slowly into early adulthood and has powerful consequences for memory. While adults exhibit memory selectivity for targets over distracters, this effect is smaller or non-existent in children. Importantly, we do not yet know the fundamental neural mechanism by which targets are prioritized in memory, let alone how this process differs across development. Does coherence facilitate memory encoding of target information in the human brain? We used magnetoencephalography to measure brain activity in 6- to 30-year-old participants (n = 26) while they selectively attended to either objects or faces in an n-back task. After the scan, participants completed a surprise recognition memory test for both target and distracter objects. Across ages, we expected the object-selective lateral occipital complex (LOC) to show greater coherence with other regions in the ventral stream when target objects were subsequently recognized versus not. We did not expect this pattern for the face-selective fusiform face area (FFA). In contrast to our prediction, the bilateral FFA and LOC showed greater high and low gamma coherence with other ventral stream regions for target objects that were not subsequently recognized as compared to those that were. Importantly, the LOC is selective for both face and non-face objects; thus, this finding may reflect greater attention to and coherence for distracter faces on trials where the target object was not subsequently recognized. Ultimately, our findings suggest that coherence may constrain memory for targets in the face of competing sources of information.

Topic Area: ATTENTION: Development & aging

C5 - The exposome predicts youth sustained attention and attention-related brain network strength.

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While environmental factors—including perinatal exposures, socioeconomic status, and toxin exposure—are known to influence cognitive and neural development, their specific impacts on sustained attention and associated functional brain networks have not been

clearly delineated. A measure of multidimensional environmental factors, experiences and exposures, or “the exposome”, was previously derived using multilevel data from 354 variables in the Adolescent Brain Cognitive Development (ABCD) Study (Moore et al., 2022; Keller et al., 2023). Here, we establish associations between a general and specific exposome factors (School, Family Values, Family Turmoil, Dense Urban Poverty, Extracurriculars, and Screen Time), attention-related brain networks, and attention problems in youth aged 9-10. Mixed effects models revealed that the general exposome factor is associated with attention problems across caregiver-, teacher-, and youth self-report, such that youth with higher general exposome scores have higher attention problems. Negative school environments and screen time are associated with more attention problems. To capture brain networks supporting attention, we utilized an existing fMRI network model, the sustained attention connectome-based predictive model (saCPM). saCPM network strength during rest ($N = 6691$) predicted all three attention ratings as well as exposome scores, accounting for head motion and other covariates. Indirect effects models revealed that saCPM network strength statistically mediated the association between exposome score and multi-informant attention-problem ratings. Thus, the association between multidimensional environmental exposures and attention function in childhood is in part explained by the strength of large-scale attention-related brain networks.

Topic Area: ATTENTION: Development & aging

C6 - Audiovisual Simultaneity Judgment Training Improves Cortical Efficiency

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As speech comprehension is multisensory, we hypothesized that improvements in audiovisual integration would increase word recognition and functional connectivity between auditory, visual, and audiovisual brain regions. To improve audiovisual integration, we utilized simultaneity judgment training, which presents audio and visual stimuli at different temporal offsets and asks participants for their perceived synchrony/asynchrony. Participants are provided trial-by-trial feedback on the correctness of their judgments. Three groups were tested: normal hearing participants without feedback, normal hearing participants with feedback, and cochlear implant users with feedback. To evaluate training effects, we investigated word recognition scores across auditory-only, visual-only, and audiovisual conditions and utilized functional near-infrared spectroscopy (fNIRS) to evaluate changes in cortical activity and functional connectivity. Results indicated significant group level decreases in reaction times and temporal binding window (TBW) width for the experimental groups. While word recognition scores did not show group level changes, at the individual subject level, relative decreases in temporal

binding window width were associated with increases in auditory word recognition scores. Changes in auditory word recognition scores were found to be significantly correlated with brain regions including the left angular and left superior temporal gyrus. Contrary to our hypothesis, functional connectivity between auditory and multisensory regions, such as the superior temporal gyrus, showed significant decreases in connectivity in normal hearing trained participants. Overall, multisensory training exhibits promise to improve word recognition for cochlear implant users due to changes in functional connectivity, improved word recognition scores, and decreased reaction times and TBW, perhaps suggesting an increase in cortical efficiency.

Topic Area: ATTENTION: Multisensory

C7 - Unfolding the Wandering Mind: Deconvolving Fixation-Related Potentials Reveals Early and Late Attentional Decoupling During Natural Reading

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Mind wandering (MW) during reading illustrates the tension between internal thought and active sensory processing. However, investigating the EEG correlates of MW during naturalistic behavior is hindered by ocular artifacts and the temporal overlap of neural responses as participants make rapid eye movements. This study employed linear deconvolution to isolate fixation-related potentials (FRPs) from 39 participants performing a self-paced reading task called ReMind, which uses retrospective MW-onset reporting to isolate MW onset and offset times with higher temporal precision than previous studies. Using the Unfold toolbox, we modeled the EEG data as a combination of "On-Task" and "Mind-Wandering" FRPs while correcting for temporal overlap from adjacent fixations. We estimated FRPs separately for each participant and performed a Region of Interest (ROI) analysis (Occipital, Central, Parietal) across five time windows. FDR-corrected comparisons revealed significant effects of MW in the Posterior ROI. We observed an attenuation of the N1 component (120–200 ms; $p = 0.0246$), which could suggest sensory gating. Contrary to previous studies, there were no significant effects observed over the intermediate P2 or P3 components. Notably, a robust attenuation emerged in the late window (500–800 ms; $p < 0.001$), indicating sustained alterations in processing well after visual encoding. These findings suggest that the cognitive effects of perceptual decoupling in a naturalistic reading are slightly different from those described in ERP studies. By combining retrospective onset reporting with deconvolution, we offer novel insight into mind wandering's effects on both early sensory components and late potentials suggestive of deeper semantic processing.

Topic Area: ATTENTION: Multisensory

C8 - Guiding attention to fixed-feature singletons: Top-down control settings for features and singletonness.

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Researchers have sought to determine why and when attention is involuntarily captured by salient-but-irrelevant visual objects. According to contingent capture theory, such items will capture attention when they possess a target feature stored in an observer's attentional control settings. Consistent with this theory, Folk and Remington (1998) found that a green singleton object did not capture attention when participants searched for a red singleton and vice versa. However, Bacon and Egeth (1994) hypothesized that participants search for singletons using a default singleton-detection strategy. According to this view, a green singleton should capture attention when participants search for a red singleton because the attentional control settings are configured for "singletonness." Here, we hypothesize that (1) the control settings can be configured for both a target's defining feature and its singletonness, and (2) Folk and Remington's singletons were not sufficiently salient for participants to incorporate the target's singletonness into their attentional control settings. We conducted two cueing experiments in which cue and target colours either matched or mismatched (randomly intermixed or blocked). Mismatch cues produced statistically significant validity effects (i.e., faster responses on valid trials than on invalid trials), which indicates that the target's singletonness was stored in the attentional control settings. Match cues produced significantly larger validity effects, which indicates that the target's colour was also stored in the control settings. These findings are interpreted in terms of a flexible attention control system that can use multiple first-order and higher-order features to guide attention to potential objects of interest.

Topic Area: ATTENTION: Other

C9 - Context Matters: Accuracy Shapes the Link Between Neural Variability and Behavior in ADHD

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Response time variability (RTV), one of the most consistent symptoms in attention deficit hyperactivity disorder (ADHD), has been associated with an increase in neural variability during baseline resting state to RTV in children with ADHD. However, variability is not always functionally irrelevant or detrimental and, therefore, is not necessarily "noise," creating an inconsistency in how variability should be interpreted. For this reason, we investigated the effect of accuracy and symptom severity on the relationship between RTV and neural variability and structure during a Go/NoGo task in children with and without ADHD (N=176). Specifically, we calculated long-range temporal correlations (LRTCs) and the spectral slope preceding correct (fast, average, and slow responses) and incorrect (false alarms and misses) responses. We find that missed GO signals are preceded by a flattening of the spectral slope and decrease in LRTCs, and that this effect is increases with symptom severity and lower accuracy. But we also find that LRTCs increase with increasing RTV with this effect becoming more pronounced as accuracy improves. So, while we find

evidence that supports the connection between attention slips and unstructured neural variability, our results suggest that RTV is associated with increased structure which is inconsistent with the traditional conceptualization of "noise." Our results show that the dynamics behind behavioral variability do not always necessarily overlap with those behind errors or attention slips, suggestive of a context specificity to the predictions of the association between brain dynamics and RTV.

Topic Area: ATTENTION: Other

C10 - Spatiotemporal Profile of the Temporoparietal Junction in Theory of Mind: Insights from Intracranial EEG

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Theory of Mind (TOM), the ability to attribute thoughts, beliefs and intentions to oneself and others, is central to human social cognition. While functional neuroimaging has consistently implicated the temporoparietal junction (TPJ) in TOM, its fine-grained neurophysiological profile, particularly regarding the differing orders of TOM, remains underexplored. Here, we leveraged high-resolution intracranial EEG in 14 drug-resistant epileptic patients to investigate the spatial and temporal characteristics of high-frequency broadband activity (HFB, 70–180 Hz) during a story-based TOM task involving first- and second-order mental state attributions. The TPJ exhibited significantly greater HFB responses to TOM than control questions, closely aligned with task performance—a pattern not observed in a non-TPJ region (posterior insula)—confirming its functional and spatial selectivity for TOM. Within the TPJ, the temporal part contained a higher proportion of TOM-selective channels than its parietal counterpart, providing direct electrophysiological evidence for functional heterogeneity within the TPJ. Furthermore, the temporal dynamics of TPJ activity was modulated by first- versus second-order TOM, highlighting its dynamic engagement in response to additional demands of mental state attribution. Collectively, these novel findings reveal the TPJ's fine-grained functional architecture and temporal sensitivity to higher-order TOM and hold clinical relevance for disorders marked by TOM deficits.

Topic Area: ATTENTION: Other

C11 - Effect of working memory load on smooth pursuit eye movements

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Tracking a moving object involves both smooth pursuit eye movement (slow rotation of the eye) and saccades (quick jerky movements). When a distractor is presented during tracking, pursuit velocity and saccade rate decrease briefly (inhibition) before increasing (rebound) to normal, potentially indicating the brain's ability to process and recover from the distractor. Given behavioural studies showing distractor processing can be affected by cognitive load, we ask here

whether pursuit inhibition is sensitive to working memory (WM) load. We hypothesized that inhibition would be stronger with high-WM-load due to greater distractor interference. To examine this effect, we asked participants to visually track a dot moving across a screen while ignoring an unexpected flash distractor. Participants also remembered features of six numbers presented before each tracking trial. For the high-load task, participants needed to remember the order of six numbers; for the low-load task, they only needed to remember the colour. After tracking, a probe was presented, and participants indicated whether it matched or differed from what was remembered. Response accuracy was higher, and reaction times were faster in the low-load task, confirming our WM manipulation. The distractor reliably induced a drop in eye velocity, followed by a rebound, during the low-load task, replicating pursuit inhibition despite adding a secondary task. Finally, distractor effects on pursuit velocity were robust across high- and low-load conditions, suggesting that pursuit inhibition is immune to WM manipulation. Our findings support the idea that these rapid modulations of eye movements in response to distractors might be automatic.

Topic Area: ATTENTION: Other

C12 - Theta-rhythmic dynamics in human thalamus and cortex during cued visuospatial attention

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Rhythmic oscillations in visuospatial detection have been linked to theta-rhythmic (3-7 Hz) oscillatory activity in macaque pulvinar and human anterior thalamic nuclei, contributing to theories that input from the thalamus might coordinate attentional networks responsible for rhythmic sampling of the environment. Here we extend these observations to include the human pulvinar, describing the relation between thalamic and cortical oscillatory phase and visuomotor reaction time (RT) using intracranial thalamic sEEG in patients with epilepsy (N = 6). Each patient performed one or more sessions of a cued visuospatial task that involved searching for a small visual target in a constantly updating array of nontarget stimuli. The principal hypothesis was that the phase of pulvinar theta-rhythmic activity should be linked to periods of relatively impaired/enhanced performance, consistent with alternation between attentional engagement/disengagement at a given spatial location. Although performance on the task was strong (accuracy: 96 +/- 3.3%), evidence for theta-rhythmic phase-RT coupling within the thalamus was mixed. Statistically robust, theta-specific phase-RT coupling was observed only among the most medial contacts within both pulvinar and anterior thalamus. In cortical contacts, theta-rhythmic oscillatory peaks and theta-band phase-RT coupling were most prominent in frontoparietal sites, as in previous reports. Overall, these data provide preliminary evidence for theta-rhythmic phase-RT coupling in the mediodorsal pulvinar, consistent with evidence for rhythmic sampling from the pulvinar of the macaque. However, the presence of similar effects in

pulvinar and anterior thalamus, together with the reduced SNR in thalamus relative to cortex, highlight the need for further investigation.

Topic Area: ATTENTION: Spatial

C13 - Sex Differences in Childhood Trauma and Medical Comorbidities in Individuals with Psychosis: A Bipolar-Schizophrenia Network Study

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Childhood trauma (CHT) is a risk factor for psychosis and individuals with psychosis (IWP) have shortened lifespans due to medical comorbidities. Previous research indicates women with psychosis show higher rates of trauma and medical comorbidities than men, yet few studies have investigated the relationship of sex differences between chronic psychosis, CHT, and medical comorbidities. Additionally, understanding if these relationships are explained by aging, illness duration, and medication side effects is important for future investigations. Here, we investigated these factors. Participants (healthy controls: n=384, IWP: n=729) were recruited to a multi-site consortium study. CHT was assessed using the Childhood Trauma Questionnaire (CTQ); medical comorbidities were measured using a medical history assessment. Female IWP reported greater sexual abuse (p<0.001) and medical comorbidities rates than male IWP (p<0.001). CTQ total scores and comorbidities correlated positively in both female (p<0.01) and male IWP (p=0.03). Age and comorbidities correlated stronger in IWP (p<0.0001, r=0.26) than in healthy controls (p<0.0001, r=0.24), possibly due to accelerated aging in psychosis. Additionally, illness duration correlated with the total number of comorbidities while covarying for age (p<0.0001, r=0.20), suggesting that the effect of illness duration is stronger than age. In IWP, chlorpromazine equivalents correlated with comorbidities in females only (p<0.01, r=0.24). This study provides insights into sex-specific relationships between trauma and medical comorbidities in psychosis and supports targeted prevention and tailored treatment plans focusing on women.

Topic Area: EMOTION & SOCIAL: Development & aging

C14 - Molecular and Psychosocial Markers of Cognitive Resilience in a Super-Ager Cohort: Insights from Santiago, Chile

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As global aging accelerates, understanding the biological and psychosocial mechanisms that sustain cognitive and physical resilience in later life has become a pressing scientific priority. This ongoing comparative study includes 40 Super-Agers and 40 age-comparable typical older adults in Santiago, Chile, defined by younger-norm MMSE performance, and preliminary data suggest meaningful cognitive variation, with controls exhibiting patterns consistent with accelerated aging. By integrating neuroscience, geroscience, public health, and clinical medicine, the study aims to explore patterns of biological aging and their interaction with psychosocial factors. Theoretical models suggest that social determinants, such as low socioeconomic status, minority status, and adverse life events, may interact with molecular hallmarks of aging. The first analytic phase evaluates associations between telomere length and DNA methylation (DNAm) age, estimated using multiple epigenetic clocks (Horvath 1, Horvath 2, Hannum, PhenoAge, GrimAge, and DNAm telomere length) to capture varied dimensions of biological aging. Remarkably, one participant's estimated epigenetic age is 57 despite a chronological age of 86, illustrating individual differences in molecular aging trajectories. Designed analyses will compare participants at the extremes of DNAm age to identify distinguishing biological and functional features. By integrating biological and psychosocial perspectives, this study aims to refine hypotheses about potential causal pathways, inform interventions to promote healthy aging and longevity, and contribute to the broader field of aging research. We welcome feedback on study design, analytic strategies, and potential interpretations to refine ongoing work.

Topic Area: EMOTION & SOCIAL: Development & aging

C15 - Rhythm of Connection: Music-Based Intervention to Slow Cognitive Decline in Nigerian Older Adults

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Rhythms of Connection: Music-Based Intervention to Slow Cognitive Decline in Older Adults in Nigeria Mild Cognitive Impairment (MCI) represents a crucial pre-dementia stage where early psycho-social interventions can delay decline and enhance emotional resilience. In Nigeria, culturally grounded and scalable non-pharmacological strategies are limited. Music-based interventions rooted in Afrocentric rhythms offer a low-stigma and emotionally engaging approach to support older adults at risk of dementia. A pilot randomized controlled trial was conducted across four locations: Chief Tony Anenih Geriatrics Centre, University College Hospital, Ibadan, and Beere, Oje, and Yemetu communities in Oyo State. Sixty older adults with MCI were randomly assigned to an immediate intervention or wait-list control

group. The nine-week intervention involved weekly 60-minute sessions combining rhythmic movement, sing-alongs of familiar songs, and structured social engagement. Feasibility, acceptability, and preliminary efficacy were evaluated using standardized tools (GDS, HADS-A, DRS, ZBI-12). Recruitment and retention were high ($\geq 85\%$), confirming feasibility. Participants described sessions as "healing," "bonding," and "joyful." Quantitative analysis showed significant improvements in emotional well-being ($r = 0.602$, $p < 0.05$), reduced depressive symptoms ($r = 0.528$, $p < 0.05$), and enhanced relationship quality ($r = 0.541$, $p < 0.05$). Paired t-tests revealed reductions in GDS and HADS-A scores ($p < .01$), and caregivers reported lower burden and improved harmony ($p < .05$). An Afrocentric music-based intervention is feasible, culturally acceptable, and demonstrates promising benefits for cognitive, emotional, and relational well-being. Findings support further large-scale RCTs and policy integration of music therapy in dementia prevention across Africa.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

C16 - Cross-Modal Auditory Habituation in Visual Affective Contexts

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Habituation is the process through which individuals filter out irrelevant stimuli in their environment. Although previous literature has established that the sensory and affective components of our environment can independently influence rates of habituation to irrelevant stimuli, it is less clear how affective contextual information influences habituation across sensory modalities. The goal of these experiments was to understand how affective visual features (i.e., valence [positive, negative, neutral] and arousal [low, high, neutral]) influence habituation to auditory information. Three experiments were conducted, each leveraging variations of an auditory oddball task. All auditory sequences consisted of standard tones (80%) interspersed with either higher or lower pitched deviant tones (each 10%). Experiment 1 manipulated valence (positive, negative, neutral) while matching arousal of visual features. Experiments 2 & 3 varied the arousal level (high, low) of positive and negative images respectively, with neutral and low arousal control conditions present in each. All images were chosen from the International Affective Picture System (IAPS). In each condition, baseline auditory sensitivity while being presented with scrambled images was measured before and after each emotional image block. For each experiment, sensitivity measures (d' , c') were computed per participant, followed by a 2 (pre/post auditory sensitivity) x 3 (visual affect) repeated-measures ANOVA. Results suggest that the valence and arousal of visual information differentially influence auditory habituation. This work highlights the boundaries of cross modal interaction by demonstrating how visual affective contextual information can modulate basic auditory processes.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

C17 - Affective Framing of Information Influences Engagement, Donations, and Memory

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Negativity captures attention and motivates information seeking and sharing. However, negative messaging can harm mental health and potentially discourage action to address long-term challenges. The neural context model of motivation proposes that threat or urgency (imperative motivation, noradrenergic modulation) drives immediate goal-directed behavior, but narrows attention and memory. In contrast, rewards or future-oriented goals (interrogative motivation, dopaminergic modulation) motivate exploratory information seeking and enrich memory formation. To test these predictions, we adapted news article excerpts to emphasize Crisis (urgent threats; imperative) or Opportunity (future rewards; interrogative). Across two experiments, we found that positive and negative affect were both associated with greater reading and sharing intentions, and real charitable donations. Crisis and Opportunity framing both motivated reading and sharing relative to Control framing (unaltered headlines); framing effects were mediated by affect. However, we observed a trade-off whereby Crisis framing had the strongest effects on immediate engagement (reading, sharing, and donating), but Opportunity framing enhanced next-day memory for news content. In an ongoing fMRI study, we are investigating how news framing modulates activation in noradrenergic and dopaminergic systems, and using representational similarity analyses to examine neural representations of naturalistic news stimuli across dimensions (e.g., valence, arousal, self-relevance, semantic similarity). Neural results will be presented in addition to existing behavioral evidence. Overall, we show that Crisis and Opportunity framing both motivate information seeking and sharing, but have opposing effects on affect and memory. Our findings advance theories of motivated cognition and apply insights to real-world information consumption related to climate change and health.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

C18 - The effects of Heartfulness meditation on emotional and neural processes: Preliminary behavioral and fMRI findings

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While mindfulness-based meditation has been widely studied, little research has systematically examined Heartfulness meditation, a contemplative practice that cultivates inner peace, emotional balance, and regulation of mind through a deeper connection to the heart. This study investigates how six weeks of Heartfulness meditation training and practice influence emotional processing, psychological well-being, and neural activity compared with a non-meditating control condition.

Data collection was completed in July 2025 with 39 participants (20 Heartfulness practitioners, 19 controls). Before and after the six-week intervention, participants completed self-report questionnaires assessing mindfulness, depression, stress, anxiety, and happiness. They also performed cognitive tasks, including an emotion-recognition task and an N-back working-memory task. During fMRI scanning, participants completed an emotion-response task to examine how meditation training modulates brain responses to emotional stimuli, as well as an N-back task to assess working memory and attention-related responses. Preliminary behavioral analyses indicate that the Heartfulness group showed significantly higher mindfulness scores and reduced depressive symptoms after the six-week training period, while the control group showed minimal change. Early task results suggest slightly faster responses to negative facial expressions in the meditation group post-training, consistent with improved emotional awareness. This pattern may reflect enhanced attentional flexibility and reduced emotional interference following Heartfulness practice. Ongoing fMRI analyses will examine hypothesized changes in amygdala–prefrontal connectivity during emotion processing and sustained attention challenges, further clarifying how Heartfulness meditation shapes the neural dynamics of emotional regulation.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

C19 - Persistent deficits in attention errors and emotion regulation in young adults with a history of mTBI

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Long after experiencing a mild traumatic brain injury (mTBI), individuals report lingering attention and memory difficulties. They are more at risk for depression, and report changes in mood. Reliably documenting deficits, however, may be hampered by small sample sizes in past studies. This large-scale, multi-year study examined consequences of a remote mTBI in a large sample (N = 7,256). We compared performance in individuals with and without a self-reported mild head injury in their past, in separate groups of male and female undergraduates. They completed the (1) Attention-Related Cognitive Errors Scale (ARCES) tabulating cognitive failures in daily life due to inattention, (2) Difficulties in Emotional Regulation Scale (DERS) assessing affect and its control, and (3) Depression Anxiety Stress Scale (DASS) measuring endorsement of negative emotional symptoms. Replicated over multiple terms, individuals with a remote mTBI reported significantly higher scores on the ARCES, DERS and DASS than controls. Overall, females compared to males reported more everyday cognitive failures and difficulties in emotional regulation. Notably, however, in males with a remote mTBI, cognitive failures (ARCES) were uniquely predicted by endorsement of difficulties in emotional regulation (DERS). On-going difficulties with emotional control may underlie the cognitive deficits experienced by males with remote mTBI. Overall, results demonstrate more attention-related errors in daily life (enhanced mind-wandering and attention slips) and persistent difficulties with emotional control (reduced focus

and negative affect) continue to plague those with mTBI long after injury.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

C20 - A Topological Principle of Parent-Child Brain Morphological Similarity

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The brain is the biological bridge between generations, yet the parent-child structural basis of this linkage remains unclear. We mapped dyadic morphological similarity in 60 parent-child dyads (N=120, children aged 8-17 years) using a multi-metric structural fingerprint (cortical thickness, surface area, gray-matter volume, curvature). To minimize cohort/template bias, we applied leave-one-family-out standardization with covariate residualization (TBV). Dyads showed higher structural similarity significantly compared to non-dyadic random pairs ($r=0.115$ vs. -0.025 ; Cohen's $d=1.18$). Critically, low level sensory systems such as limbic, subcortical and visual networks showed highest similarity (a heritable core) and higher-order association networks such as default-mode, fronto-parietal and salience networks exhibited the lowest (forming a plastic scaffold reserved for individualized adaptation), indicating that structural similarity has two distinctive organizational principles: one reflecting genetically constrained, and the other reflecting experience-dependent adaptation. We then linked similarity to psychopathology by deriving a p-factor (higher = worse symptoms) from nine questionnaire indices using multiple-imputation PCA. Greater subcortical similarity associated with higher p ($r=0.26$, $p<.05$; risk pathway), whereas greater salience similarity associated with lower p ($r=-0.277$, $p<.05$; protective pathway). Alignment in affective subcortical hardware appears to index familial susceptibility, while alignment within salience may support detection/switching processes that buffer broad symptom liability. The results outline a parent-child, network-specific account of brain structure: a core that is conserved and a scaffold that remains open to experience, clarifying a key trade-off in intergenerational organization and pointing to concrete targets for gene-environment research on resilience. Keywords: Parent-Child Dyads; Morphological Similarity; Brain Morphometry; Large-Scale Brain Networks; Psychopathology.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

C21 - Socioeconomic status and emotion regulation: A systematic review and meta-analysis

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Emotion regulation (ER) is crucially involved in functioning and mental health. Socioeconomic status (SES) involves individual and contextual characteristics that may fundamentally shape individual variation in

ER. However, evidence on the relationship between SES and ER is mixed, and systematic reviews are lacking. Our meta-analysis revealed consistent SES-related differences in ER across various SES indicators, including income, education, and subjective SES. In children, lower SES was associated with greater emotion regulation difficulties with a medium effect size ($r = -.23$, 95% CI $[-.17, .30]$, $n=2,562$), based on teacher- and parent-report of socioemotional competence. Among adults, lower SES was associated with less use of cognitive reappraisal ($r = .07$, 95% CI $[-.05, .10]$, $n=108,996$), and more use of expressive suppression ($r = -.07$, 95% CI $[-.12, -.03]$, $n=29,356$), with a small effect size based on self-report. Although behavioral measures showed no clear SES differences for ER success, a small number of neuroimaging studies indicated that lower SES was associated with reduced prefrontal cortex activation during lab-based reappraisal tasks. These results suggest potential inefficiency in top-down control mechanisms supporting ER among lower-SES individuals. However, lower-SES individuals might utilize compensatory neural or cognitive strategies that help maintain regulatory performance. Overall, our findings highlight the importance of integrating multi-level measures to assess SES-ER relations. Finally, if SES-related differences in ER are robust, interventions focused solely on ER strategies might have limited efficacy unless the broader structural and contextual barriers associated with socioeconomic disadvantage are addressed.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

C22 - The Effect of Emotional Valence on Directed Forgetting and Source Memory

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Emotional memories have been subject to many investigations, often showing enhanced retention and resistance to forgetting compared to neutral memories. However, there is a theoretical paucity of behavioral research addressing the contextual details surrounding these memories and distinguishing between item memory and any information associated with memory acquisition, namely source memory. This study sought to investigate whether source memory judgements would be based on how much context is available when items are recognized, which was hypothesized to be influenced by the valence of the item. In this study, 27 participants viewed 72 nouns followed by a cue indicating whether it should be remembered or forgotten. The cue type was used as a contextual detail and treated as a source. At test, participants made old/new judgements for 108 words and, for words identified as old, provided remember/know and source memory responses. Results suggest that response bias manipulations affected old/new as well as remember/know judgements and made participants more likely to respond old and remember to negative words compared to neutral words. This could be explained by a misinterpretation of the greater fluency of negative words. Source memory did not differ significantly across valences which could be related to the type of source that was tested or indicate that item and source memory depend on different processing. The outcomes have

implications in a number of real-world scenarios such as in clinical settings involving negative memories, in assessing the reliability of eyewitness testimony and in fields like education and marketing.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

C23 - Psychopathology and Dimensional Anxiety Shifts Brain State Landscapes Away From Affective-Control Attractor Dynamics

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Neuropsychiatric disorders are increasingly recognized as dynamic network dysfunctions, yet research remains focused on static connectivity frameworks (e.g. static functional connectivity) and categorical diagnostic labels (e.g. DSM). These traditional approaches are often limited in capturing the fluid, dimensional nature of psychopathology. To bridge this gap, we employ Energy Landscape Analysis (ELA) to map brain activity as attractor states. Unlike static models, ELA characterizes the stability and occupancy of these states, linking neural dynamics directly to transdiagnostic traits such as behavioral inhibition and anxiety. Here, we applied ELA to resting-state fMRI from 149 transdiagnostic patients and 96 healthy controls from the Transdiagnostic Connectome Project. Data were parcellated into Yeo seven networks, and pairwise maximum entropy modeling was used to identify stable brain state attractors. We compared the frequency of occupancy of these states between groups and correlated state frequencies with Behavioral Inhibition System (BIS) and State-Trait Anxiety Inventory (STAI-Trait) scores. Compared to controls, patients showed increased occupancy of a DMN-dominant attractor ($t=4.190$; $p<0.001$) and decreased occupancy of an affective-cognitive control attractor engaging DMN, salience, control, dorsal attention, and limbic networks ($t=-4.079$; $p<0.001$). Across participants, higher BIS and STAI-Trait scores correlated positively with DMN-dominant occupancy (BIS: $r=0.22$; $p<0.01$; STAI: $r=0.19$; $p<0.01$) and negatively with affective-cognitive control occupancy (BIS: $r=-0.19$; $p<0.01$; STAI: $r=-0.18$; $p<0.01$). Psychopathology and anxiety converge on a shared bias toward internally focused, DMN-dominant states, with reduced engagement of affective-cognitive control networks. This statistically significant but modest effect suggests that lower occupancy of affective-control states may underlie transdiagnostic vulnerability to anxiety.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

C24 - Redemptive narratives are contagious: Positivity in personal memories of hardship emerges after learning about others' redemptive life events.

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From reading fiction to seeking support, stories provide a structure to express our lived experiences – potentially, a reason we incorporate narratives in our everyday conversations. It is well known that arousal

in narratives is linked to their memorability and tends to influence people's behaviors. However, less is known about how the different emotional arcs within the narratives we consume influence our own personal memories. Here, we ask if an individual's narration of their personal memories may take on the emotional arc of someone else's narrative, making some narrative arcs more contagious. Across two sessions, an online pool of participants ($N=200$) completed three phases of the study. First, they narrated a personal memory of hardship. Next, they read one of the three personal narratives from another person. Here, NLP was employed to ensure that all three versions present the same story with a different emotional arc (redemptive, tragic, or pessimistic). The third phase was completed 24 hours later; participants recalled their original personal memory again. Analyzing the language use and sentiment structure of these narratives, we find that participants selectively adopted only the redemptive arcs, making their stories more positive 24 hours later, while the other arcs did not show significant change. Our study finds that these emotional arcs may explain how some stories are integrated into our memories. Specifically, emotional arcs can influence whether it reshapes our own personal memories of hardship, with redemptive narratives being more contagious, perhaps because they leave us feeling better about our past.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

C25 - Resting-State Functional Connectivity of Brain Areas Related to Empathy Influenced by Sensory Processing Sensitivity

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Individuals with sensory processing sensitivity (SPS) report heightened sensitivity to the environment and emotional reactivity, as well as stronger empathy. The neural correlates of this common personality trait are still not well-known. We investigated the relationships between specific facets of SPS and both empathy and functional connectivity (FC) in the resting brain. Forty participants (22 women, Mage = 21.10 years $\pm$ 4.09 years) completed self-report measures of SPS and empathy, and a resting-state functional magnetic resonance imaging scan. The analyses specifically examined correlations between both positive features of SPS (sensitivity to aesthetic qualities and subtle stimuli) and negative features of SPS (overstimulation and sensitivity to negative stimuli) and FC between neural regions involved in empathy. Positive SPS traits were associated with increased FC between medial prefrontal cortex (mPFC) and clusters in the left superior parietal lobule, lateral occipital cortex (LOC), and right intracalcarine cortex. Negative SPS traits were positively correlated with FC between left inferior frontal gyrus (IFG) and the right frontal pole; right insula and primary somatosensory cortex; mPFC and left LOC; and precuneus and left frontal pole. They were also negatively associated with FC between left IFG and LOC; left insula and brainstem; and between precuneus and the left occipital pole and the right cerebellum. We propose that

these results reflect deeper visual and emotional processing, which enhances empathic abilities. Additionally, reduced FC may be a protective mechanism against the experience of empathic distress commonly found in those expressing high levels of negative SPS traits.

Topic Area: EMOTION & SOCIAL: Emotional responding

C26 - Inhibitory Control Network Connectivity and Social Adjustment After Pediatric Brain Tumour Treatment

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Risk factors for poor social adjustment after brain tumour treatment are not well established. Prior work implicates developmental, biological, and treatment factors and inhibitory control performance. However, it's unknown whether functional and structural brain connectivity within inhibitory control networks can help explain social outcomes after brain tumour treatment. Using magnetoencephalography, the Go/No-Go task, diffusion-weighted imaging, and a quality of life questionnaire, we quantified differences in inhibitory control, its supporting brain connectivity, and social adjustment between children treated for brain tumours (n=15) and typically developing controls (TDC; n=11). Relative to TDC, children treated for brain tumours showed significantly (p<.05) (1) reduced low gamma neural communication between networks important for inhibitory control, indexed by lower weighted phase lag indices (wPLI); (2) disrupted white matter microstructure between these same networks, indexed by lower intra-axonal and higher extra-axonal diffusivity metrics; and (3) lower parent-reported social adjustment based on the Pediatric Quality of Life Social Scale. In robust regressions across participants, poorer social adjustment was associated with female sex, more treatments and complications, lower low gamma functional communication underlying inhibitory control within key networks, and more diffuse white matter damage. Groups did not significantly differ in Go/No-Go performance, and performance was not related to social outcomes. These findings suggest that both specific perturbations to functional communication within inhibitory control networks and broad damage to white matter contribute to social difficulties after brain tumour treatment. Leveraging these measures of network connectivity may improve risk identification which can direct prioritization of supports.

Topic Area: EMOTION & SOCIAL: Other

C27 - Behavioral and neural mechanisms of face identity learning and generalization: a magnetoencephalography (MEG) study

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Reliable recognition of a person's identity requires the visual system to generalize across visual variations, adapting to changes in viewpoint, lighting, and expression. This study investigated how learning from variable exemplars refines perceptual and neural representations of facial identity to support generalization. During learning, participants (N=44) viewed multiple exemplars of unfamiliar faces. Before and after learning, they completed a numerosity judgment task, estimating the number of identities across images. To test whether variability exposure promotes generalization, the post-learning task included previously seen (post-old condition) and novel (post-new condition) exemplars. Neural activity was measured using MEG during all tasks. Behavioral and neural responses were compared across pre- and post-learning sessions to examine how learning reshapes facial identity recognition. Behaviorally, participants reported perceiving fewer identities after learning, reflecting a tendency to group distinct exemplars as the same identities. MEG revealed learning-related changes in neural oscillation within the face network. Repeated exemplars (post-old) elicited reduced alpha/beta power in the posterior fusiform gyrus and posterior superior temporal sulcus during early time window, indicating more efficient encoding in perceptual regions. In contrast, novel exemplars (post-new) elicited increased power in the high-beta to low-gamma range at later time windows in the anterior fusiform gyrus and temporal pole, suggesting integration of novel perceptual inputs into existing identity representations. These findings show that learning from variable exemplars engages the face-sensitive brain regions in a temporally organized hierarchy, from perceptual to abstract identity processing regions, suggesting a neural mechanism for flexible recognition of identities across novel exemplars and contexts.

Topic Area: EMOTION & SOCIAL: Person perception

C28 - Effects of loneliness on ERP responses to supportive speech

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It has been shown that supportive speech has a distinct acoustic signature (lower loudness and pitch, higher spectral slope values) and is perceived as warmer than neutral speech when produced by female speakers. Yet little is known about how this supportive tone of voice is processed by the brain. To address this gap, the present study compares the neurocognitive processing of utterances produced with socially supportive vs. dismissive voices. In addition, given research suggesting that loneliness is associated with hypervigilance to social threat, our study tests whether loneliness moderates neurocognitive responses to (un)supportive vocal cues in speech. During our testing sessions, female participants listen to brief supportive, neutral or dismissive utterances while rating the perceived compassion of the

speaker during EEG recording. Participants also complete a series of post-EEG tasks and questionnaires (explicit ratings of speaker support, UCLA Loneliness Scale, Beck Depression Inventory–II, Social Interaction Anxiety Scale). We hypothesize that compared to dismissive voices, supportive prosody will increase the P200 amplitude from utterance onset reflecting the increased task relevance of these cues for estimating speaker compassion. Speaker voice differences should also be differentiated in the subsequent Late Positivity Complex (LPC) time window (dismissive > supportive between 400-800ms post-stimulus onset) due to increased monitoring of negative vocal cues over time. We predicted that loneliness would alter these responses, producing shorter latency in the P200 response, and possibly, qualitative shifts at the P200 and LPC voice processing stages reflecting hypervigilance to negative (dismissive) cues and reduced engagement with social reward.

Topic Area: EMOTION & SOCIAL: Person perception

C29 - The Long Shadow of Childhood Trauma: Associations with Self-Esteem in Emerging Adults

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Exposure to traumatic experiences is linked to disruptions in the normal trajectory of emotional development and processing, often contributing to lower self-esteem. Experiences such as abuse, neglect, or household dysfunction during early developmental years, can foster the internalization of negative self-beliefs persisting into adulthood. Previous research has demonstrated an inverse association between childhood trauma and adult self-esteem; however, few studies have examined whether these early traumatic exposures also influence how the brain processes future self-referential content. The present study investigates behavioral and cortical correlates of the relationship between childhood trauma and self-esteem. We hypothesized that individuals reporting greater childhood trauma, indicated by higher scores on the Childhood Trauma Questionnaire (CTQ), would demonstrate lower self-esteem, enhanced cortical responsiveness to negative self-referential words, and reduced cortical responsiveness positive self-referential words. To test these hypotheses, 41 participants completed a computerized self-esteem task while electroencephalography (EEG) was recorded. Participants viewed phrases beginning with “I am” followed by a positive or negative adjective and were asked to press a button indicating whether they agreed with the phrase. Next, participants completed the CTQ to assess exposure to distressing childhood experiences. Results revealed a significant inverse association between childhood trauma and self-esteem, but only in those who reported experiences of sexual abuse. Moreover, experiences of physical abuse were associated with faster cortical responses to self-referential adjectives. These findings suggest that distinct forms of childhood trauma may differentially shape self-referential processing, with sexual abuse influencing self-

conceptual content, and physical abuse affecting the speed and automaticity of emotional processing.

Topic Area: EMOTION & SOCIAL: Self perception

C30 - Exploring Gait Related Changes in Brain Activation in Super Movers

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Gait speed is associated with general brain health in aging. While it is common for gait speed to decline with age, about seven percent maintain a fast gait speed well into older age. The neural substrate of so-called super movers, individuals above the age of 80 who walk at speeds comparable to people 30 years younger, are unexplored. The current study uses a novel mobile brain body imaging procedure to measure brain oscillatory activity tied to the gait cycle while individuals classified as super movers (n=16) and controls (n=25) performed a complex gait task. Complexity was introduced by immersing participants in full-field optical flow stimulation designed to destabilize balance during treadmill walking. We predicted that super mover status is associated with a distinct fronto-parietal activation pattern during complex gait. Preliminary data analysis indicated that controls show increased parieto-occipital and sensorimotor activation in mu and beta bands during complex compared to simple walking. In contrast, super movers exhibit overall increased fronto-medial theta power during simple and complex walking coinciding with the pre-swing phase of the gait cycle. Our findings show that groups engage different brain regions and spectral activation patterns in response to visual perturbation designed to destabilize posture. While controls increased activation of the parietal and sensorimotor cortex in complex walking, super movers may exhibit a unique neural signature, relying more heavily on frontal activation in both simple and complex walking.

Topic Area: EXECUTIVE PROCESSES: Development &aging

C31 - EEG Decoding of Goal Representations During Multistep Actions

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Action selection is guided not only by the immediate outcomes of actions but also by their contribution toward overarching goals. Traditional one-step tasks conflate goals with expected outcomes, making it difficult to dissociate these processes. Here, we used a novel multi-step construction task in which participants sequentially selected between line segments to build target shapes. This design allowed us to examine how people maintain goal representations while tracking intermediate outcomes. Behaviorally, participants (N = 27) selected actions that advanced the construction toward the intended goal, showing sensitivity to both goal progress and the current state of the shape options. Choice behavior was also biased towards the selection

of lines that contributed towards goal shapes that were closer to completion, indicating dynamic tracking of goal status across the sequence. These findings demonstrate that participants maintain an internal model of multiple goals and dynamically update it after each action. These results provide a behavioral foundation for EEG decoding analyses that dissociate neural representations of goals and intermediate action effects during multi-step behavior. Preliminary EEG work has focused on training a line decoder in a separate oddball task, which can reliably distinguish between individual line segments at above-chance accuracy. This decoder will be used to test whether representations of specific lines—and by extension, evolving goal states—can be tracked during multi-step construction behavior.

Topic Area: EXECUTIVE PROCESSES: Goal maintenance & switching

C32 - Neighbourhood disadvantage and neural correlates of inhibitory control in early adolescence

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Neighbourhood plays a crucial role in shaping children's cognitive and emotional development. However, few studies have examined how the neighbourhood is associated with the developing brain, especially the brain substrates of self-regulation. Inhibitory control (IC), the ability to suppress a dominant response in favour of a goal-directed one, is an important aspect of self-regulation and a strong predictor of a host of developmental outcomes. IC can be measured through the Go/No-Go task, where participants must quickly respond to the "go" trials but inhibit responses to the "no-go" trials. When combined with event-related potentials (ERPs), "no-go" trials elicit a larger P3 component than "go" trials, a neural marker of IC. This study examined how neighbourhood quality, indexed by the Area Deprivation Index (ADI), relates to the neural substrates of IC in typically developing youth. We recruited 115 children aged 9 to 12 years ($M = 10.91$, $SD = 1.45$) from a midwestern U.S. city. Participants completed an EEG version of a Go/No-Go task. Neighbourhood quality was determined from census tract data based on participants' home addresses. Higher ADI (indicating greater disadvantage) was associated with a larger No-Go P3 amplitude but not with behavioural performance. In other words, while children across neighbourhoods performed similarly, those from more disadvantaged areas appeared to recruit greater neural resources to achieve comparable behavioural outcomes. These findings highlight how neighbourhood conditions shape neurocognitive development and suggest that policies and community programs reducing environmental stressors may help support self-regulation and adaptive functioning in youth.

Topic Area: EXECUTIVE PROCESSES: Monitoring & inhibitory control

C33 - Memory suppression training improves sleep qualities and mental health outcomes

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Introduction: Memory control refers to the ability to voluntarily control the retrieval of unwanted memories. Previous research has shown that three-day memory control training can improve mental health among healthy individuals. Here, we investigated whether training the voluntary control of unwanted autobiographical memories could benefit mental health among individuals with subthreshold insomnia symptoms. **Methods:** Fifty-two participants at high risk of insomnia (Insomnia Severity Index > 10) completed a two-week, six-session Think/No-Think training, targeting the control of unwanted autobiographical memories. Participants completed mental health questionnaires, an 8-minute eye-closed and eye-open EEG task one day before and after training. Participants were randomly assigned to either the suppress-negative group ($n=30$, aged 24.4(3.6)) or the suppress-neutral group ($n=22$, aged 25.6(4.1)). **Results:** Preliminary results revealed significant Group by Time interactions for subjective sleep quality, negative affect, rumination, pre-sleep cognitive arousal, and eyes-closed broad beta power (16-40 Hz) ($F_{s(1,50)} > 4.60$, $P < .037$). Post hoc comparisons showed that the suppress-negative group showed significantly improved sleep quality, reduced negative affect, rumination, pre-sleep cognitive arousal, and eyes-closed broad beta power ($t_{s(50)} > 2.51$, $P < .022$), whereas the suppress-neutral group only showed improved sleep quality ($t_{s(50)} = 2.21$, $P = .032$) but not other benefits ($t_{s(50)} < 1.94$, $P > .058$). Moreover, greater eyes-closed broad beta power reduction was associated with greater sleep quality improvement in the suppress-negative group ($\rho = 0.48$, $p = .007$). **Conclusion:** Our findings suggest that a 2-week, 6-session memory control training mitigates emotional and physiological dysfunctions, supporting its potential as an accessible intervention to improve mental health outcomes even among individuals with subthreshold insomnia.

Topic Area: EXECUTIVE PROCESSES: Monitoring & inhibitory control

C34 - Mind-Wandering Partially Mediates the Relationship Between Psychedelic Use and Enhanced Cognitive Flexibility: An Online Survey in University Students

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Objective: Mind-wandering has received growing interest due to its association with a variety of clinical and cognitive outcomes, including enhanced cognitive flexibility. Our previous study found that classic psychedelic use was associated with higher cognitive flexibility on the Wisconsin Card Sorting Task (WCST), and mind-wandering may represent a candidate mechanism underlying this relationship. This cross-sectional online study examined whether trait-level mind-wandering mediates the association between psychedelic use and

cognitive flexibility outcomes. Methods: 1442 university students completed a brief, online version of the WCST and the Mind Wandering Questionnaire (MWQ), and self-reported history of classic psychedelic (e.g., LSD, psilocybin) and other substance use as an online study. Mediation models examined the effect of MWQ scores on the relationship between lifetime and recent (6-month) history of psychedelic use and WCST cognitive flexibility outcomes (number of perseverative responses and errors), controlling for other substance use (alcohol, cannabis, other illicit drugs) and relevant demographic variables. Results: Lifetime ($n = 237$) and 6-month ($n = 118$) psychedelic use predicted higher MWQ scores, and greater MWQ scores predicted less perseverative responses and errors. Mediation models indicated that MWQ scores partially mediated the associations between both lifetime and recent psychedelic use and perseverative responses and recent, but not lifetime psychedelic use and perseverative errors. Conclusions: Findings suggest that trait-level mind-wandering may represent one mechanism through which both recent and lifetime psychedelic experiences promote adaptive cognitive flexibility. Future research is warranted to examine how mind wandering contributes to cognitive outcomes and interacts with psychedelic experiences.

Topic Area: EXECUTIVE PROCESSES: Other

C35 - Chunking in Verbal Learning is Linked to Prefrontal Cortex Development

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Adults tend to review learned material more effectively than children and adolescents, yet the cognitive and neural basis underlying this advantage remains unclear. One contributing factor may be the refinement of mnemonic strategies such as chunking, the grouping of related items into meaningful units to enhance encoding and retrieval. While prefrontal cortex (PFC) maturation is known to support the use of mnemonic strategies across development, few studies have linked age-related PFC structural differences to chunking behavior. With 105 participants (ages 5–25), we examined age differences in chunking behavior across five free recall trials in the California Verbal Learning Test–Children’s Version (CVLT-C). Structural MRI data were obtained from participants and FreeSurfer segmentation was used to estimate PFC cortical thickness. Chunking differed by age such that adults more effectively integrated components of prior chunks into larger chunks across successive free recall trials ($F(6,330)=4.10$, $p<.001$). Notably, this measure of chunking ability was negatively correlated with cortical thickness in the left caudal middle frontal cortex ($r=-.28$, $p<.05$) and the right rostral middle frontal cortex ($r=-.28$, $p<.05$). Follow up examination in narrow age groups revealed that these associations were significant in adults ($r=-.39$, $p<.05$; $r=-.41$, $p<.05$ respectively), but not in children and adolescents. Taken together, these findings suggest that adults utilize chunking as an effective mnemonic strategy

to encode information into fewer but larger chunks. This ability appears linked to PFC maturation, which supports goal-directed learning and strategic organization—cognitive processes that are less developed in children and adolescents.

Topic Area: EXECUTIVE PROCESSES: Working memory

C36 - Priority-Driven Transformation of Visual Working Memory Content

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The control of priority in visual working memory is a hallmark of the flexible control of behavior. To study this mechanism, we trained recurrent neural networks (RNNs) to perform a double-serial retrocuing (DSR) task in which two stimulus items (item A and item B) are presented serially, followed by a first cue (100% valid) indicating which will be tested at the first recall epoch, then a second cue (100% valid), indicating which will be tested at the second recall epoch. In order to visualize the priority-based transformations of the representational geometry, we applied demixed principal component analysis (dPCA) to the hidden layer during post-stimulus epochs and derived mnemonic subspaces. Hidden layer activity data were then projected to these subspaces to track the representational transformations of the stimulus identities. Following the results from previous research in our lab, which provided evidence that the unprioritized memory item (UMI) adopts an “opposite” representational format to that of the prioritized item (PMI), we expect the representational geometry of the UMI to be ‘flipped’ (i.e., reflected) relative to the PMI following the priority signal (i.e., the retrocue). Our research will provide important insights into our understanding of the encoding of prioritization in visual working memory.

Topic Area: EXECUTIVE PROCESSES: Working memory

C37 - Testing the causal role of traveling waves in short-term memory with tDCS

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Cortical traveling waves (TW) characterize synchronous neural activity across the cortex and predict successful visual short-term memory (VSTM). Prior findings show that response initiation is accompanied by feedforward posterior-anterior theta TW predicting intra- and inter-individual differences in motor response onset. Additionally, a feedback anterior-posterior beta TW emerges after a response. Here, we test whether transcranial direct current stimulation (tDCS) can significantly modulate TW dynamics and confirm causal effects on VSTM. Participants ($n=13$, planned 24) received left- or right-hemisphere tDCS in 3 sessions, counterbalancing condition: anterior-to-posterior, posterior-to-anterior, sham. Each session, unilateral tDCS (2 mA, 20 minutes) was applied before participants completed a VSTM task. Each trial, two colored, tilted bars appeared to the right and left of fixation (250 ms). A probe color cue indicated which hand

the participant should use to reproduce the orientation of the probe-colored bar. Across 432 trials, EEG was recorded bilaterally along occipito-frontal axes to measure TW. We predicted that anterior-to-posterior tDCS would enhance TW and improve VSTM, whereas posterior-to-anterior tDCS would impair performance. To date, the preliminary results show hemispheric differences in reaction time and precision, regardless of stimulation direction. EEG analyses are underway to determine how tDCS influences the strength and latency of the TW. These results will clarify the causal nature of TW in VSTM and establish how directional tDCS can alter cognition.

Topic Area: EXECUTIVE PROCESSES: Working memory

C38 - Cognitive Modes Detectable by fMRI during the Sternberg Task

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Background: Functional magnetic resonance imaging (fMRI) studies of working memory (WM) have focused on individual brain regions such as the dorsolateral prefrontal cortex. However, in past work we showed that five cognitive modes can be consistently retrieved from fMRI data for WM tasks, each with their own spatial pattern and empirically derived function. This more complete set of fMRI results for WM provides a richer set of measures for input for machine learning algorithms, valuable for classifying individuals on natural abilities, and subtyping patients with brain disease for precision medicine. In the present study, we confirm these precise anatomical configurations and WM-induced BOLD signal patterns on a novel sample. Methods: 38 adults completed the Sternberg WM task, whereby participants remembered a string of letters over a 4-second delay. Constrained principal component analysis for fMRI (fMRI-CPCA) was used to extract cognitive modes and compare to past published work. Results: The previously identified cognitive modes of Initiation (initiating WM cognitive processes, peaking early trial), Focus on Visual Features (deactivated throughout trial since visual details are not required to complete tasks), Maintaining Internal Attention (load-dependent activation during maintenance period), and Default Mode (load-dependent deactivation throughout trial) were retrieved. Conclusions: These results illustrate the stability and replicability of spatial and temporal patterns, and their empirically derived cognitive functions, captured by cognitive modes involved in WM. The advantages of using this rich set of measures for input for machine learning algorithms for classifying individuals and subtyping patients for precision medicine are discussed.

Topic Area: EXECUTIVE PROCESSES: Working memory

C39 - Neural activation mediates age-related differences in cognition across memory domains

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Age-related cognitive decline is often assumed to reflect a direct effect of chronological aging on behavior. However, behavioral performance across adulthood is highly variable, suggesting that age influences cognition primarily through changes in brain function. Here, we test a brain-first model of cognitive aging by examining whether neural activation mediates the relationship between age and performance across distinct memory domains. We first analyzed behavioral and EEG data from an adult lifespan cohort performing a visuospatial item-location recall task ($n = 31$). Chronological age showed weak and inconsistent associations with task performance, explaining limited variance in accuracy. In contrast, we found that age robustly predicted multiple neural activation metrics, including event-related potentials (ERP) and phase-locking value (PLV). Importantly, these neural measures had systematic age-related modulation and were strongly associated with behavioral performance, substantially outperforming chronological age as predictors of cognitive outcomes. To assess the generalizability of this pattern, we examined an open-access EEG dataset in which participants performed a Sternberg working memory task ($n = 21$). Despite differences in task demands, age-related neural modulation converged on the same ERP and PLV signatures observed in the visuospatial task. Overall, these results support a mediation framework in which age-related cognitive differences arise indirectly through alterations in common neural mechanisms of activation. By identifying shared neural patterns across memory domains, this study reveals a memory-domain-general pathway of functional brain aging and highlights neural activation as a proximal and potentially modifiable mechanism underlying cognitive aging.

Topic Area: EXECUTIVE PROCESSES: Working memory

C40 - Tracking Words in Noise: How Classroom Acoustics Shape Children's Statistical Learning of Speech

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The ability to predict word boundaries from continuous speech in childhood, known as statistical learning (SL), is foundational for later language development. However, little is known about how adverse listening conditions (e.g., noisy classrooms) influence SL. The purpose of this study is to examine how acoustic environments influence behavioral and neural indices of SL. Twenty children aged 7-12 years old will participate in an auditory SL EEG experiment consisting of loud and quiet acoustic conditions. During the exposure phase, children listen to continuous speech containing embedded patterns while being prompted to press a button as fast as they can when they hear a target syllable. During the test phase, they choose which of two words most resembles the previously presented speech stream. Preliminary

behavioral analyses using a linear mixed effects model indicate that participants (N=11) were significantly better at identifying words they had heard before (compared to words they had not heard) in the quiet condition compared to the loud condition ($b = -0.48$, $SE = .23$, $p = 0.03$). In this preliminary sample, accuracy in the quiet ($M = 63.07\%$, $p = 0.045$), but not the loud ($M = 52.27\%$, $p = 0.28$), condition was significantly above chance. We will use temporal response functions (TRFs) in the delta and theta frequency bands to model how different acoustic environments affect the ability to track speech during SL. This approach allows us to determine how cortical tracking relates to the ability to quickly and accurately track speech in noisy conditions.

Topic Area: LANGUAGE: Other

C41 - Divergent sentence processing strategies following mild traumatic brain injury: evidence from pupillometry

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Mild traumatic brain injury (mTBI) is often characterized by transient cognitive deficits, yet emerging evidence suggests that sentence comprehension is also affected. Understanding how listeners process sentences when cognitive resources are limited has led to two prominent models of sentence comprehension. The Resource Reduction model proposes that listeners compensate for reduced resources by exerting greater effort, whereas the Good-Enough model suggests reliance on heuristic or shallow interpretations to conserve effort. The present study examined how cognitive capacity influences the use of these processing strategies in individuals with and without a history of mTBI. Cognitive effort during accurate sentence comprehension was measured using pupillometry, where greater pupil dilation indicates increased cognitive effort. Participants also completed assessments of alerting, orienting, and executive control attention, as well as working memory. Among neurotypical controls, individuals with weaker alerting attention showed greater pupil dilation than those with stronger alerting ability, indicating increased effort to prepare for incoming information, which is consistent with the Resource Reduction model. In contrast, pupil dilation did not vary by cognitive capacity within the mTBI group. This pattern aligns with the Good-Enough hypothesis, suggesting that individuals with mTBI may rely on shallow or heuristic sentence interpretations rather than engaging in resource-intensive syntactic processing when cognitive capacity is limited. Overall, these findings indicate that mTBI may change how individuals engage language processing strategies, shedding light on the mechanisms underlying sentence comprehension impairments following brain injury.

Topic Area: LANGUAGE: Other

C42 - Language-based statistical learning is a stable individual trait

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Statistical learning (SL) is the process of becoming sensitive to patterns in the environment and occurs simply through exposure to input. An important unresolved question is whether SL within a single domain is a reliable individual trait. Some prior studies have shown reliable domain-specific individual differences, though evidence is primarily limited to explicit measures of learning. Given that explicit memory abilities are generally stable at the individual level, results from these prior studies may reflect differences in explicit memory performance, rather than sensitivity to patterns in input. To further understand whether SL is a stable trait that reliably differs among individuals, we tested 94 participants' ability to learn syllable patterns in two distinct artificial language streams separated by a two-week delay, using multiple measures of learning. Both testing sessions included exposure to a unique artificial language composed of repeating trisyllabic words. Subsequently, learning was assessed with the following measures, ordered from most explicit to most implicit: (1) the sequence continuation task, (2) the familiarity rating task, (3) the 2-alternative forced choice test, and (4) the reaction-time based target detection task. We found statistical learning to be a stable individual trait, with all 4 measures significantly correlated across sessions. We also found that performance on the implicit target detection task correlated across sessions independently of explicit knowledge of the words. This evidence of stable individual differences encourages further investigations targeted at understanding whether implicit statistical learning performance predicts individual differences in real-world language learning.

Topic Area: LANGUAGE: Other

C43 - Presurgical right-hemisphere language network connectivity predicts spared language function after left-hemisphere tumor surgery.

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Although the networks supporting language are typically left-lateralized, the right hemisphere may play a compensatory role in patients with left-hemisphere tumors. We tested whether presurgical right-hemisphere language network functional connectivity predicts post-operative language outcomes in left-hemisphere glioma patients. Resting-state fMRI data were acquired from 55 left-hemisphere glioma patients before neurosurgery. Right-hemisphere ROI-to-ROI connectivity (RH-RRC) was computed for all ROI pairs from the Fedorenko language network atlas. Post-operative language outcomes were extracted from clinical documentation during inpatient recovery. A random forest classifier with nested cross-validation was trained to distinguish language-impaired ($n = 27$) from language-spared ($n = 28$) patients using the pattern of RH language RRC. Model

performance was evaluated using accuracy, sensitivity for preserved language, and AUC. Permutation testing assessed the statistical significance of model performance and identified features critical to accurate classification. A clinical model using tumor grade, a tumor marker, tumor volume, sex, and age was constructed for comparison. Right-hemisphere language network connectivity accurately predicted post-operative language outcomes (mean accuracy = 73%, sensitivity = 75%, and AUC = 0.75; all $p = 0.001$), whereas the control model performed at chance levels. Functional connectivity between the right middle frontal gyrus and pars orbitalis emerged as the most influential classifier feature and was significantly elevated in patients with preserved language function after surgery ($t = 2.68$, $p = 0.005$). Enhanced coupling between these executive control and semantic language regions may support the reallocation of cognitive resources to compensate for increased language processing demands following surgical disruption of the left-hemisphere.

Topic Area: LANGUAGE: Other

C44 - Identifying Distinct Activation Patterns of Visual and Auditory Language Processing Across Reading Abilities

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Introduction. The Simple View of Reading posits that successful reading comprehension depends on both visual word decoding and oral language comprehension. Functional magnetic resonance imaging (fMRI) studies consistently identify a left-lateralized reading network, which often shows disrupted activation and connectivity in individuals with reading disabilities (RD). In addition to decoding difficulties, people with RD often exhibit deficits in oral language comprehension. Understanding how the brain distinguishes visual reading from auditory listening tasks in children with varying reading ability may reveal neural markers of these deficits. While many studies have examined differences in brain activation during visual and auditory tasks, few have used multivariate pattern analysis (MVPA) to test whether distributed activity patterns, rather than overall activation strength, can differentiate these modalities in children with varying reading abilities. We used MVPA to identify voxel-wise patterns distinguishing visual and auditory language processing. **Methods.** Nine children (mean age=9.6 years, 33% female) with varying reading ability completed two visual reading and two auditory listening tasks during an fMRI. Trial-wise beta estimates were used to train classifiers to distinguish modalities using a whole-brain searchlight approach. Group-level significance was assessed using permutation-based cluster correction ($t > 2.3, p < 0.05$, family-wise-error). **Results.** Classification accuracy was significantly above chance in the left inferior parietal cortex (MNI: -60, -23, 21) and occipital cortex (MNI: -6, -88, -3), indicating modality-specific patterns across visual and higher-level semantic regions. **Conclusions.** These findings highlight distinct neural representations for visual and auditory language processing across developing readers and identify candidate regions of interest

for future analyses linking modality-specific brain patterns to reading ability.

Topic Area: LANGUAGE: Other

C45 - Predictive Control and Self-Monitoring in Covert and Overt Speech Explored with Intracranial Directed Connectivity

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Predictive control theories propose that speech motor planning generates auditory predictions via efference copies, which are internally monitored to support fluent production and, in inner speech, the phenomenology of the inner voice. High-gamma peaks (80–150Hz) during covert and overt picture naming suggest a consistent temporal sequence in which motor planning (~400ms) precedes auditory prediction-related activity (~500ms), followed by motor execution and feedback monitoring (>1000ms). To characterize directed information flow during internal monitoring of auditory predictions, we conducted spectral Granger causality (GC) analyses using a sliding-window approach. Alpha (8-12Hz), beta (13–30Hz), and low-gamma (30–70Hz) bands were evaluated for auditory–motor interactions between the premotor cortex (PMC), superior temporal gyrus (STG), and, given its role in salience detection and conscious attention, the anterior insula. Analyses focused on one patient with electrodes in all regions of interest who performed covert and overt picture naming during stereo-EEG recording as part of a presurgical evaluation for focal drug-resistant epilepsy. The insula appeared to function as a monitoring or integrative hub, as following peaks in local high-gamma activity (e.g., in PMC and STG), low-frequency directed influence flowed predominantly from the insula toward these regions. Reduced low-gamma GC originating from the PMC was observed for covert relative to overt speech during speech planning windows, which may reflect movement inhibition. Together, these findings support efference-copy–based auditory prediction during speech planning and suggest a role for the anterior insula in cascaded internal monitoring processes preceding speech production.

Topic Area: LANGUAGE: Other

C46 - How Representational Geometry Aligns Between Brains and Anchors to Semantics During Live Verbal Communication

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While previous hyperscanning studies have demonstrated inter-brain temporal synchrony, it remains unclear whether neural representational geometry aligns during live communication and whether such alignment relates to the linguistic information being exchanged. This fMRI hyperscanning study with 29 sender-receiver dyads directly addresses this question. In each trial, senders viewed an image and generated five sentences based on five given keywords to enable receivers—who had no access to the image—to mentally reconstruct it. We examined inter-brain alignment during the 15-second real-time interaction by computing cross-trial RDMs within sliding time windows. First, we assessed neural-to-neural representational geometry alignment by measuring time-resolved correspondence and the receiver's progressive convergence toward the sender's geometry, comparing real dyads with pseudo-partner controls. Real dyads exhibited significantly stronger, interaction-specific, time-dependent increases in neural-to-neural alignment across bilateral language areas (L-IFG, bi-STG/MTG, R-AG), left executive control regions (SFG, SMG), and right visuo-attentional cortex (IPL, LOC). Second, we tested whether this progressive inter-brain alignment is directly grounded in the linguistic content using language embeddings (BERT) derived from senders' descriptions. Senders progressively anchored their neural geometry to their own semantic models, engaging bilateral visual-memory networks (L-LG, L-PhG, L-PCu; R-FG, R-AG). Receivers showed increasing semantic anchoring to the sender's linguistic embeddings over time, engaging left attention-control (SFG, SMG) and right temporo-occipital regions (IOG, FG, TP), but this effect was not interaction-specific. These findings demonstrate that authentic communication progressively aligns inter-brain representational geometry through linguistic grounding. The divergent semantic anchoring patterns between senders and receivers reveal distinct neural mechanisms underlying this representational coupling.

Topic Area: LANGUAGE: Semantic

C47 - N400 Splitting Reveals Unexpectedly Early Effects of Semantics on ERPs

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For many researchers, the N400 ERP appears too late to index initial semantic processing. Nevertheless, no purely semantic effects have been consistently reported on ERPs prior to the N400. However, this absence may result from averaging across participants who have effects in opposite directions on earlier ERPs. The present study aimed to separate participants based on amplitude differences between their N400 to ambiguous words and their N400 to unambiguous words. This was done first in the data of an experiment run in Paris (N = 94). There, participants read short stories that ended either with semantically univocal and coherent endings, equivocal, or incoherent words. These endings were identical across the three conditions, while the short story context they ended was changed across participants. Participants were median-split into two groups

based on the results of the subtraction of the ERPs to coherent from the ERPs to equivocal in the 300-500 ms time-window. Very early effects of condition were observed. Additionally, a significant interaction of group x condition was found in a very early time window (i.e., 40-120 ms). To verify whether this interaction was replicable, we analyzed the data of the same experiment run in Montreal on different participants (N = 91). A group x condition interaction was found again. We are thus reporting these results to open a discussion as to the nature of the semantic processes that could be at stake at such an early latency.

Topic Area: LANGUAGE: Semantic

C48 - Poor sleep habits in adolescents are associated with disrupted memory encoding and sleep-dependent offline consolidation

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Sleep before learning restores hippocampal encoding capacity, while sleep after learning stabilises and integrates new memories into neocortical stores. Although these processes are well documented in adults and young children, they remain poorly understood in adolescence, despite circadian shifts and behavioural changes that disrupt sleep during this period. We hypothesised that the transition to adolescence would be associated with poorer sleep and reduced encoding and consolidation efficiency. Participants (225 11-12-year-olds and 263 13-15-year-olds) completed a word learning task across two sessions spaced 24 hours apart, testing immediate encoding and overnight consolidation. Sleep was assessed via questionnaires, diaries, and actigraphy in a subsample. Bayesian mixed effects models revealed substantial sleep differences between age groups. Older adolescents exhibited stronger evening chronotypes, later sleep onsets (41 mins later), shorter durations (44 mins shorter), and poorer sleep hygiene (an individual's habits and environmental factors that promote good sleep). In the word learning task, older adolescents outperformed younger peers at encoding, but underperformed at delayed recall, suggesting age-related improvements in encoding were offset by weaker consolidation. Across groups, better sleep hygiene predicted better encoding and consolidation (β s = 0.10 - 0.56). Closer analysis of sleep hygiene suggested physical activity before bedtime and lack of bedtime routine were particularly strongly associated with poorer memory. These findings suggest that behavioural choices around bedtime contribute to the trade-off between improved encoding capacity and reduced consolidation efficiency in adolescence. Interventions targeting modifiable sleep behaviours may strengthen memory formation during this developmental period.

Topic Area: LONG-TERM MEMORY: Development & aging

C50 - Connectome-based modelling of inter-individual variability in perceptual and mnemonic fidelity in healthy ageing

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Ageing reduces the fidelity of perceptual and mnemonic representations, but individuals vary widely in terms of cognitive maintenance. We used connectome-based modelling on resting-state fMRI data to identify which functional interactions between brain regions best explain inter-individual variability in 149 older adults at baseline and 44 at follow-up seven years later. Participants performed perceptual discrimination (PD) tasks with similar stimuli and mnemonic discrimination (MD) tasks, one which requires distinction between an encoded target and a simultaneously presented similar lure (Forced Choice: FC) and one in which either target or lure were shown at retrieval (Yes/No: YN). These tasks were chosen to manipulate the degree to which strategic recollection is needed to avoid false recognition. We focused on medial temporal lobe, default-mode and frontoparietal network regions. Over seven years, Montreal Cognitive Assessment scores were stable. Older adults declined in YN, but not FC performance highlighting the influence of retrieval support as determinant of age-related memory dysfunction. PD performance also declined, possibly due to working memory demands. The functional connectome predicted baseline YN, but not FC performance, with hippocampal-temporal and temporal-parietal connections contributing most. Change in YN was best predicted by entorhinal and prefrontal cortical connections. Entorhinal-perirhinal connectivity also explained variability in PD. These findings suggest that complex perceptual discrimination and recollection-, but not familiarity-based memory fidelity or standard neuropsychological tests are sensitive to age-related changes in cognition. Both tasks index the integrity of networks vulnerable to Alzheimer's pathology, providing further evidence for potential use of these tasks in early detection.

Topic Area: LONG-TERM MEMORY: Development & aging

C51 - Category learning in adults but not children benefits from delayed introduction of exceptions

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Grouping information into meaningful categories allows us to generalize past knowledge to new experiences. But not everything conforms to existing category rules (e.g. penguins are birds but cannot fly). The hippocampus is thought to play a key role in category learning by both extracting category regularities and rapidly storing details of

such rule-violating "exceptions". Prior research shows that category learning in adults benefits from delayed introduction of exceptions, potentially because rule violations are easier to detect after category rules are well-established. However, during development, the hippocampal pathways thought to support exception learning mature more slowly than those that extract regularities, suggesting that children may not benefit from delayed exception introduction to boost learning in the same way as adults. In this study, children (7-9 years) and adults completed a rule-plus-exception category learning task in which exceptions were introduced either at the start of learning (early) or only after many repetitions of category-consistent items (late). We found a reliable age group difference between children and adults on exception performance, with adults but not children benefitting from late exception introduction. Interestingly, within the child age range, only older children showed an adult-like advantage from delayed exceptions, highlighting 7-9 as a potentially important developmental window for the maturation of exception learning. These results align with neural network model simulations of the hippocampus, which show that learning to categorize exceptions relies on later-maturing pattern differentiation processes. More broadly, our findings underscore the importance of aligning a learning curriculum to the learner's neurodevelopmental state.

Topic Area: LONG-TERM MEMORY: Development & aging

C52 - Sex and menopause differences in how hippocampal subfield volumes predict spatial source memory at midlife

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Midlife is a critical stage in adulthood when age-related episodic memory decline is first detectable. Midlife is also the age that most females experience spontaneous menopause. Age-related episodic memory decline is associated with hippocampal volume reduction. Yet, it remains unclear how age, sex, and menopause jointly shape hippocampal subfield trajectories and their relation to episodic memory at midlife. The present study addressed this gap in a middle-age sample. Using high-resolution T2-weighted MRI, 118 cognitively unimpaired middle-aged adults (35 males, 42 premenopausal females, 41 postmenopausal females; aged 39.55–65.46 years) completed a face-location episodic memory task with correct spatial source accuracy (CS) as the outcome measure. Hippocampal subfields were segmented using a customized-automated pipeline and volumes were adjusted for intracranial volume (ICV). Analysis of variance and regression analyses were used to examine sex and menopause group differences, and age-related differences in CS and subfield volumes, respectively. Preliminary results revealed no significant sex difference in CS or hippocampal subfield volumes, but there were sex and menopause effects on age-related differences in memory and subfield volumes. Compared to other groups,

postmenopausal females showed the steepest age-related decline in CA1 and subiculum volumes, CS accuracy, and negative associations between all subfields and memory performance. In contrast, subfield volumes did not predict memory in males or premenopausal females. Thus, menopause is an inflection point in females, when age-related declines in memory and hippocampal volume arise. These results highlight the importance of examining sex and menopause effects in cognitive neuroscience studies of aging and memory.

Topic Area: LONG-TERM MEMORY: Development & aging

C53 - Effects of amnesic mild cognitive impairment on cardiac manipulations of familiarity and interoception

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Familiarity can be both mentally experienced and physically embodied and is impaired in amnesic mild cognitive impairment (aMCI). Research has linked familiarity to cardiovascular baroreceptor signaling during systole. The present study uses a frequency judgment task, which includes a cardiac phase manipulation that synchronizes the presentation of stimuli to either systole or diastole, to determine whether familiarity is higher during systole than diastole. Older adults with aMCI show impaired familiarity overall compared to healthy controls, and do not show the predicted higher familiarity during systole than diastole. Interoceptive measures and structural magnetic resonance imaging of the perirhinal cortex are also collected to examine their relationship with autonomic nervous system (ANS) activity in supporting familiarity. Overall, these findings suggest that ANS coupling with familiarity is distinctly different in older adults with aMCI.

Topic Area: LONG-TERM MEMORY: Development & aging

C54 - Delaying exception introduction enhances children's hippocampal engagement during category learning

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Grouping items based on regularities ("categorization") also entails reconciling items that do not fit these regularities ("exceptions"), an ability that improves over development. Computational models have linked hippocampal subfields to different roles during categorization in the mature brain: Cornu ammonis 1 (CA1) may be sensitive to regularities, whereas CA2,3/dentate gyrus (DG) may be sensitive to exceptions, especially when encountered after learning category regularities. Although category learning improves throughout childhood, little is known about how brain function supports this learning over development. Children (7–9 years) performed two learning phases that trained them to group items into categories with feedback, the only difference between phases being when exceptions were introduced—either at the start ("early") or after exposure to category regularities ("late"). Each phase ended with a test on the

category membership of the items. Behaviourally, children's exception learning did not vary by exception timing. We next characterized whether subfield engagement during each task varied by when exceptions were introduced. There were no differences in CA1 versus CA2,3/DG engagement, potentially reflecting a lack of subfield specialization in children during categorization. Instead, engagement of both subfields varied by task and exception timing, with greater activation during learning when exceptions were introduced late versus early, and the reverse at test. These results suggest that, despite no behavioural differences in exception learning, delaying exception introduction preferentially engages children's hippocampal mechanisms. More broadly, particular instructional sequences may enhance children's engagement of hippocampal learning mechanisms, with future work needed to characterize the behavioural significance of this difference.

Topic Area: LONG-TERM MEMORY: Development & aging

C55 - How Does Race Influence the Hypertension–Cognition Link? Evidence From Two Community-Level Cohort Studies

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The 2025 American College of Cardiology/American Heart Association Joint Committee on Clinical Practice Guidelines highlight systolic blood pressure's (SBP) role in preventing cognitive impairment. Research supports a direct link between hypertension and cognitive decline; however, this relationship may not function similarly across race. Hypertension is more common in minority racial groups, with 2–3 times greater prevalence than in White individuals. Often attributed to race, these differences may be more complex than previously thought. This work intends to answer two questions highlighting how race is related to hypertension and cognitive decline: 1) does race increase risk for hypertension then lead to cognitive impairment, implying a downstream/cascading effect of race? and 2) does race intensify the existing relationship between hypertension and cognitive impairment, implying a compounding effect of race? To address these questions, we utilized community-level data from 2 publicly-available datasets across varying age groups (i.e., middle-aged adults – Offspring: N=269 and older adults – Rush: N=4,828). Results revealed higher SBP was associated with worse cognition regardless of race. Across both cohorts, SBP mediated the relationship between race and domain-specific cognitive abilities; however, no race differences existed between domain-specific or global cognitive abilities and SBP. Findings suggest elevated SBP is a risk factor for cognitive decline functioning independent of race, although race-related experiences may contribute to hypertension, causing a downstream effect on cognition. Race is a social construct that may serve as a proxy for other direct moderators on cognition, but race alone does not affect the relationship between hypertension and cognition.

Topic Area: LONG-TERM MEMORY: Development & aging

C56 - Effects of an acute exercise intervention on levels of hippocampal GABA and Glx in young and older adults

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An intervention that has shown promise to enhance cognitive functioning in young and older adults is aerobic exercise. A candidate mechanism for these enhancements is the modulation of cortical excitability/inhibition. Whereas previous research has largely used non-invasive brain stimulation applied to the superficial cortex to assess excitability/inhibition, here we leverage advances in magnetic resonance spectroscopy (MRS) to examine the effects of exercise on inhibitory GABA and excitatory glutamate/glutamine (Glx) in the deep hippocampus, a region vital for cognitive functioning and particularly susceptible to age-related degradations. Healthy young (n=15) and older adults (n=12) completed a randomized crossover design in which MRS and blood biomarkers of plasticity (i.e., brain-derived neurotrophic factor (BDNF), and anandamide (AEA)) were assessed before and after a high-intensity interval training (HIIT) intervention and a control condition. We examined i) differences in baseline levels of BDNF, AEA, as well as hippocampal GABA and Glx; and ii) the effects of HIIT on hippocampal metabolites and BDNF/AEA. We hypothesized that exercise increases BDNF, AEA, and hippocampal metabolite levels, with greater effects in older adults, potentially serving to mitigate age-associated declines. Preliminary results suggest differences between age groups in baseline (i.e., pre-exercise) Glx, BDNF, and AEA, but not GABA. We found no evidence that exercise modulated hippocampal Glx or GABA. Both BDNF and AEA increased post-exercise in older adults, suggesting that exercise may minimize age-related reductions in these blood biomarkers. Further investigations into the effects of exercise on cognitive functioning are necessary and will have applications in healthy and pathological aging contexts.

Topic Area: LONG-TERM MEMORY: Development & aging

C57 - Effects of chronic trazodone administration on cognitive performance in the APPNL-F mouse model of Alzheimer's disease

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Sleep disturbances are prevalent among individuals diagnosed with Alzheimer's disease (AD) and sleep is being explored as a therapeutic target for AD. The current study aims to assess the effects of trazodone, an antidepressant with sleep-promoting properties, on

cognition in a mouse model of AD. We previously developed a voluntary oral administration paradigm to administer trazodone hydrochloride (60mg/kg) to mice. Using our protocol, we demonstrated that trazodone increased slow wave sleep in the APPNL-F mice and reduced amyloid plaque neuropathology. Here, we administered trazodone to 14-month-old APPNL-F mice (N = 16, treatment = 8, female = 8) for 120 days. Cognitive performance was assessed using touchscreen cognitive testing (Bussey-Saksida, Lafayette Instruments; Paired Associates Learning (dPAL) and Location Discrimination (LD) tasks) and novel object recognition. Trazodone treated mice demonstrated a higher accuracy on LD Punish Incorrect (p = 0.011) and exhibited a higher preference for novel objects after a 1h delay (p = 0.006). Further cognitive testing and neuropathology assessment is ongoing. Our results suggest that trazodone should be explored as a potential disease-modifying therapeutic for AD, with potential beneficial effects on cognition and neuropathology.

Topic Area: LONG-TERM MEMORY: Development & aging

C58 - Interaction between Residential Segregation and Genetic Susceptibility to Alzheimer's Disease Among Racially and Ethnically Diverse Older Adults

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Introduction: Residential segregation is an important environmental determinant of health that shapes exposure to harmful risk factors (e.g., stress, pollution). Segregation has been associated with poor late-life cognitive health, and biopsychosocial models suggest its adverse effects may be amplified among individuals with genetic susceptibility to Alzheimer's disease (AD). This study examined whether apolipoprotein (APOE) $\epsilon 4$ moderated the association between segregation and AD risk in a large, racially/ethnically diverse sample. Methods: 113 community-dwelling older adults (Mean age = 65; 61% Black/Latino) completed MRI scans, blood draws, and cognitive testing. Baseline residential addresses were geocoded and linked with 2020 U.S. census data to estimate current segregation levels using the interaction index. APOE- $\epsilon 4$ status was determined by the presence of at least one $\epsilon 4$ allele. AD risk-related outcomes included plasma amyloid-beta 42:40 (A β 42:40), quantified via immunoassays, and hippocampal volumes estimated using HippoDeep. Analyses utilized generalized estimation equations (GEE), accounting for age, sex, race/ethnicity, geographic clustering, and intracranial volume (hippocampal volume only). Results: GEE models revealed a significant segregation x APOE- $\epsilon 4$ status moderation effect on plasma A β 42:40 (B=-0.70, p=.001). Higher segregation was associated with worse AD pathology (B=-0.44, p=.011) among APOE- $\epsilon 4$ carriers, but there was no association in non-carriers. There was a significant segregation x APOE- $\epsilon 4$ effect for left (B=-0.41, p=.035), but not right hippocampal volume (B=-0.24, p=.252). Higher segregation was linked to lower hippocampal volume among APOE- $\epsilon 4$ carriers (B = -0.26, p = .076). Conclusion: Findings suggest that gene x environment interactions play an important role in shaping biological risk for AD.

Topic Area: LONG-TERM MEMORY: Development & aging

C59 - Network Activation During Sleep Slow Oscillations Differs Based on Their Coupling with Spindles.

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Sleep slow oscillations (SOs, 0.5-1.5 Hz) support functions such as synaptic homeostasis, glymphatic clearance and memory consolidation. Complexes of one SO followed by a spindle within a short delay are causally linked to overnight episodic memory consolidation, yet little is known about region-specific activation during SO-spindle complexes versus uncoupled SOs. As these complexes may support neuronal engram reactivation required for consolidation, understanding their selective network involvement is crucial. We compared the current source density (CSD) of cortical and subcortical regions during spindle-coupled and uncoupled SOs in the nighttime sleep high-density EEG of 22 participants. Each SO CSD was encoded as a region-by-time matrix, with entries serving as features. Functional connectivity (FC) between features was measured using mutual information. We compared FC under three conditions: within each SO, between subsequent SOs, and in subnetworks of interest (thalamo-hippocampal-cortex (HTC), basal ganglia, and mesolimbic-with-brainstem). Analyses were conducted separately for N2 and N3 sleep. Within-SO analyses revealed that coupled SOs exhibited higher overall FC and significantly more high-FC feature pairs than uncoupled events. FC between subsequent SOs was not sensitive to inter-event delay. Subnetwork analyses showed strong FC differences in HTC for coupled versus uncoupled SOs in both N2 and N3, with additional basal ganglia differentiation in N2. Our study introduces a strategy for exploring CSD-based FC in sleep EEG events and demonstrates its utility in identifying coupling-related network engagement. Findings suggest enhanced HTC and basal ganglia FC during coupled SOs, with greater coupling-related differentiation in spindle-rich N2 compared to SO-rich N3 sleep.

Topic Area: LONG-TERM MEMORY: Episodic

C60 - Dream incorporation of emotional and narrative movie features during sleep

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It is still unclear to what extent dreaming activity and memory consolidation are intertwined and which aspects of an experience predominantly resurface in dreaming. As emotional memories are preferentially consolidated during sleep, emotionality might alter reprocessing dynamics and modulate dream incorporation. In this study, we biased participants' dream content by experimentally

manipulating their prior learning experience. 40 subjects underwent two experimental sessions, during which they watched and recalled movies before sleeping. They were then awakened repeatedly during the night and we collected their dream reports (N=202). Each participant was assigned to one emotional category (positive, neutral, negative), studying movies set either indoors or outdoors according to the experimental session. Three blind human raters were then asked to guess, based solely on the content of the anonymized dream reports, which emotional condition, spatial context, and specific movie-narratives each dream report was generated from. Dream reports were correctly assigned to the actual experimental condition above chance level based on the emotional as well as narrative features of collected dreams but not based on their spatial context. Moreover, dream incorporation scores based on emotional category as well as a combined measure of emotional and narrative features were significantly higher in the negative condition. Our findings show that both the emotionality and the narrative, but not the spatial context, of previously learned video material are incorporated into subsequent dreaming, particularly after an aversive encounter. Systematically manipulating pre-sleep learning experiences proves to be a promising approach to further investigate nocturnal cognitive processing dynamics.

Topic Area: LONG-TERM MEMORY: Episodic

C61 - Arousal state modulation of human hippocampal ripples across wake and sleep

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Hippocampal replay involves the reactivation of spiking activity patterns from previous experiences and is thought to underlie memory consolidation. These replay events can be captured as high-frequency oscillations—termed 'ripples'—in the hippocampal field potential. Ripples predominantly occur during states like sleep and awake rest, as these are offline periods thought to allow the replay of prior memories while limiting sensory interference. However, ripple rates vary dynamically across sleep stages and recent human studies have reported ripples during active tasks, suggesting their occurrence may not simply be driven by offline periods of inactivity. We propose a reframing of this offline view—whereby a common low arousal state is associated with ripple genesis, a state that is more prominent and persistent during certain stages of sleep and occurs transiently during waking. We recorded human hippocampal activity (iEEG) during overnight sleep and periods of wake, tracking arousal via sleep staging and pupillometry. Ripple rate varied profoundly across sleep stages, being maximal in NREM, reduced in REM, and minimal in wake. Interestingly, this modulation was stronger in anterior than posterior hippocampus. During wake, ripple rate similarly tracked arousal, increasing during small-pupil states, with the strongest modulation in anterior hippocampus. Altogether, across sleep and wake, ripple rate

increased when arousal dipped. These results reframe offline periods as transient states within a continuous arousal spectrum, providing opportunistic moments for consolidation. Mechanistically, these results bridge arousal and ripple physiology, aligning with evidence implicating drops in acetylcholine—an arousal-related neurotransmitter—in ripple genesis and memory consolidation.

Topic Area: LONG-TERM MEMORY: Episodic

C62 - The American Dream: Election Night Dreams Predict Overnight Change in Feelings about the Election and the Future

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Real-life experiences are often incorporated into our dreams. Does dreaming about those experiences affect how we feel about them? Prior studies suggest that dreaming may attenuate emotional reactivity overnight, with participants feeling less negative about an experience after dreaming about it. Here, we used the 2024 US presidential election to examine the relationship between dreaming and emotional reactivity in the context of a real-life emotional experience, hypothesizing that dreaming about the election would be associated with reduced negative feelings toward it the following morning. N = 931 American participants completed an online survey on the day of and the day after the 2024 US election. Participants rated their feelings about the election, their personal future, and the collective future of the country before and after election night and reported their dreams from that night. Of the 931 participants, 70% remembered a dream (N = 657) and half of all dreams were related to the election (N = 324). Contrary to our hypotheses, dreaming about the election was associated with intensified negative affect toward it next morning ($F(1, 651) = 9.90, p = .002$), as well as a more negative outlook toward both the personal future ($F(1, 651) = 5.56, p = .019$) and the collective future of the country ($F(1, 651) = 7.35, p = .007$). Contrary to emotional regulation theories of dreaming, these observations suggest that sleep and dreaming may amplify, rather than reduce emotional reactivity.

Topic Area: LONG-TERM MEMORY: Episodic

C63 - Reactivating spatial memories during sleep using multi-sensory cueing and an immersive virtual environment

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Sleep plays an active role in the consolidation of memories. During sleep, the neural traces supporting newly formed declarative memories are spontaneously reactivated. Targeted memory reactivation (TMR) is a technique that uses non-invasive sensory cues, such as odors or sounds, to preferentially reactivate associated memories during sleep. One avenue of TMR research that has not yet been explored involves the combined use of odors and sounds to selectively enhance memories. Here, we examine the interactive effects of multi-modal reactivation cues during sleep on consolidation in a realistic first-person memory task. We used the Minecraft Memory and Navigation task, a first-person, engaging spatial task that demonstrates sleep's contribution to spatial memory (Simon et al., 2022). Following memory encoding of unique locations and the environment which we enriched with odors and sounds, we reactivated the encoded memories during NREM sleep using the odors, sounds, or both. We hypothesized that rich, multisensory synergetic reactivation during sleep, compared to the unisensory reactivation, would maximally benefit spatial memory recall. Additionally, we explored the effect of different cueing regimes on sleep spindles and slow oscillations during NREM sleep. Our study reveals the contribution of memory consolidation during sleep to real-life spatial memories, and provides insight into whether multisensory cueing has synergistic, additive, or competitive benefits for consolidation.

Topic Area: LONG-TERM MEMORY: Episodic

C64 - Adjacent but Dissociable: Content-selective and generic retrieval-related effects

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Episodic memory retrieval engages both content-selective and 'core' recollection regions. Few studies have directly examined regional dissociations between category-selective and generic retrieval activity. We investigated the extent to which content-selective and core regions are segregated during successful recollection. 31 younger and 40 middle-aged adults underwent fMRI during an associative memory task. At encoding, participants viewed words paired with faces or scenes, and at retrieval, identified studied words and attempted to recall their associated image category. Recollection effects were operationalized as greater activity for correct vs. incorrect source retrieval. Content-independent effects were identified using a conjunction analysis that inclusively masked face and scene recollection contrasts (main contrast: FWE $p < .05$, mask: $p < .001$). Category-selective effects were identified with two exclusive masking analyses (main contrast: FWE $p < .05$, mask: $p < .05$). Content-independent effects were identified in the left hippocampus, dorsal and ventral parietal cortex, posterior cingulate cortex, medial prefrontal cortex, middle temporal gyrus, and bilateral putamen. Scene-selective effects were identified in bilateral parahippocampal cortex, medial

parietal cortex, and left lateral superior occipital cortex. Conversely, face recollection effects were observed in bilateral precuneus, medial prefrontal cortex, and left anterior temporal cortex. Our findings reveal a clear dissociation between content-selective and generic recollection effects within prefrontal, medial parietal, and left temporal cortices. The emergence of these effects in distinct, yet anatomically adjacent regions highlights the complexity of the functional neuroanatomy of episodic retrieval. Together, the findings advance our understanding of the neural basis of episodic memory retrieval.

Topic Area: LONG-TERM MEMORY: Episodic

C65 - Gradients of Hippocampal-Cortical Connectivity Capture Traits in Autobiographical Memory

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Autobiographical memory (AM) is a multidimensional construct encompassing diverse mnemonic traits that vary across individuals. Using functional MRI data from four sites comprising 446 young adults, we conducted a multi-site analysis. Specifically, we assessed individual differences using the Survey of Autobiographical Memory (SAM), focusing on the self-reported episodic, semantic, and spatial AM tendencies. Given prior evidence linking medial temporal-neocortical connectivity to traits AM and functional specialization along the hippocampal long axis (posterior: fine-grained details; anterior: gist-based recall), we characterized subject-specific hippocampal anatomy along the anterior-posterior hippocampal gradient (using hippunfold). We then derived gradient position-encoded connectivity profiles across 300 cortical nodes (Schaefer atlas) to examine their associations with trait AM scores. Specifically, connectivity between the right aHPC and the left angular gyrus, as well as the right superior frontal gyrus, showed significant associations with trait episodic AM. Additionally, right aHPC connectivity with the posterior visual area was associated with trait spatial AM. Together, these findings provide large-scale evidence that individual differences in autobiographical memory map onto graded variations along the HPC axis, offering a refined account of how mnemonic traits are embedded within hippocampal-cortical networks.

Topic Area: LONG-TERM MEMORY: Episodic

C66 - Neural Signatures of False and Veridical Remembering for Faces Shared by Perceptual and Semantic Similarity: A Preliminary fMRI Study

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False remembering of faces is often induced by similarity between studied targets and unstudied lures. Prior fMRI studies have linked perceptual features of faces to the occipital/fusiform face areas (OFA/FFA) and semantic features of faces to the anterior temporal lobe (ATL). However, it remains unclear how these neocortical

systems interact with the medial temporal lobe (MTL) regions during false remembering of faces. We analyzed preliminary data from healthy young adults performing an old/new recognition test for faces. Retrieval trials were categorized as Targets, lures sharing both perceptual and semantic similarity with their corresponding targets (PS-lures), lures sharing perceptual similarity only (P-lures), and lures lacking both forms of similarity (N-lures). Univariate contrasts comparing “old” versus “new” responses were computed separately for each condition. Significant activation in MTL and FFA was observed across all four conditions. In contrast, ATL activation emerged selectively for Targets. These preliminary results suggest that FFA responses to perceptual features contribute to both veridical recognition and false recognition, whereas ATL responses to semantic features are more tightly coupled to veridical remembering. Ongoing analyses will test these hypotheses at the representational and network levels by (i) using multivariate pattern analysis (MVPA) to quantify target-lure representational difference within FFA, ATL, and MTL, and (ii) using condition-specific functional connectivity to assess interactions among these regions. Taken together, this sketchpad report outlines a working model in which perceptual similarity engages FFA and MTL mechanisms that support both accurate and illusory remembering, while ATL-mediated semantic representations preferentially support veridical memory for faces.

Topic Area: LONG-TERM MEMORY: Episodic

C67 - Distinct Neural Pathway for Knowledge- and Event-Based Social Impression Formation

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Trustworthiness impressions are shaped not only by first encounters but also by memories that accumulate over time. Previous functional neuroimaging evidence implicates the dorsomedial prefrontal cortex (dmPFC) in impression formation, the medial temporal lobe (MTL) and retrosplenial cortex (RSC) in episodic memory, and the anterior temporal lobe (ATL) in social knowledge as semantic memory. However, little is known about how these systems support trustworthy judgments grounded in episodic and semantic memories for other people. We used functional MRI (fMRI) to scan young adults while they judged others' trustworthiness based on social traits learned as knowledge-based memories and on hypothetical actions learned as event-based memories, acquired before scanning. Univariate analyses showed significant ATL activation during knowledge-based judgments, and significant RSC activation during both knowledge- and event-based judgments. Multivariate pattern analysis (MVPA) indicated that activity patterns in ATL and RSC represented trustworthiness for both memory types, whereas activity patterns in the parahippocampal cortex (PHC) represented event-based trustworthiness only. Additionally, activity patterns in dmPFC reliably classified trustworthy versus untrustworthy impressions. Functional connectivity analyses revealed stronger dmPFC coupling with ATL and RSC during knowledge-based judgments, and with PHC,

hippocampus, and RSC during event-based judgments. Taken together, these findings suggest that dmPFC integrates social knowledge supported by ATL with event information supported by MTL to construct trustworthiness impressions for other people from long-term memory. These fMRI results advance a systems-level account of how mnemonic sources shape social evaluation and highlight distinct representational and connectivity signatures for knowledge- and event-based routes to trustworthiness for other people.

Topic Area: LONG-TERM MEMORY: Episodic

C68 - Effects of Self-Other Perspectives on Neural Mechanisms Underlying Survival-Related Memory Enhancement

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Survival-related memory enhancement (SME) is the superior memory encoded while imagining survival scenarios relative to non-survival scenarios. Although prior work implicates the importance of ventrolateral prefrontal cortex (vlPFC)–hippocampal interactions in SME, it remains unclear how the SME mechanisms are modulated by self and other perspectives. To tackle this issue, we used fMRI to examine multivariate activity (MVPA) and functional connectivity patterns while healthy young adults rated how useful objects would be in hypothetical survival (earthquake) versus non-survival (moving) situations from either a self- or other-related perspective, followed by recognition memory. Regions of interest included the amygdala, insula, anterior cingulate cortex (ACC), vlPFC, dorsomedial prefrontal cortex (dmPFC), and hippocampus. Behaviorally, SME—higher recognition accuracy for survival- than non-survival-encoded items—was significant in both perspectives. MVPA reliably classified survival versus non-survival encoding in the amygdala, vlPFC, and dmPFC in both perspectives; in the other-related perspective, activity patterns in the insula and ACC also classified survival versus non-survival encoding. Functional connectivity analyses revealed the SME-related connectivity between the hippocampus and vlPFC across perspectives. Furthermore, perspective-specific connectivity emerged: hippocampus–dmPFC connectivity in the self-related perspective, and hippocampus–insula/ACC connectivity in the other-related perspective. These results indicate that SME relies on a vlPFC–hippocampal core, with perspective-sensitive engagement of social-regulatory system (dmPFC) when imagining the self-related survival situation and interoceptive emotion–salience system (insula/ACC) when evaluating the other-related survival situation. Who we imagine at risk would systematically shape the neural architecture of SME and clarify how social perspective tunes goal-directed encoding under survival situations.

Topic Area: LONG-TERM MEMORY: Episodic

C69 - Memory reactivation during slow oscillation up-state was associated with reduced sigma-band entropy

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Targeted Memory Reactivation (TMR) during non-REM sleep strengthens memories, with efficacy critically depending on cue timing relative to slow oscillation phases. Based on the systems consolidation account, slow oscillation (SO) up states are associated with high neural plasticity and can be an optimal time window for TMR. However, empirical evidence is mixed, with neural mechanism remains unclear. We hypothesized that memory reactivation, initiated during the SO up-state, would elicit a more synchronized neural response, reflected as lower signal complexity. To test this, we pooled two overnight EEG datasets (Xia et al., 2024, N = 37; Chen et al., 2024, N = 35; total N = 72, 12,731 trials) employing similar TMR paradigms. We identified the SO phase at cue onset during N3 sleep and quantified the complexity of the subsequent time–frequency–decomposed sigma-band response (12-16 Hz) using trial-level fuzzy entropy. Linear mixed-effects modelling revealed a robust phase-dependent modulation of sigma-band entropy (FDR-corrected $p_{\cos} = .011$; $p_{\sin} = .190$). Specifically, entropy was significantly lower when cues were presented during the SO up-state compared to the down-state ($t(71) = -2.50$, $p = .015$). The phase of minimal entropy occurred near the SO peak ($\sim 333^\circ$), a window known to be critical for memory consolidation. These results provide a mechanistic explanation for the time-dependency of TMR cueing: up-state cueing organizes sigma power into a more synchronous, lower-entropy pattern than the down-state. This reduced complexity may reflect more regular neural dynamics underlying memory consolidation, offering a signature of why precise cue timing is crucial.

Topic Area: LONG-TERM MEMORY: Episodic

C70 - Neural Signatures of Event Boundary Effects in Episodic Memory Retrieval

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The present study explored how encountering event boundaries in narratives shapes memory retrieval processes, as indexed by ERPs. Participants listened to five-sentence stories in which a critical word in the third sentence either continued the ongoing event (no-boundary) or marked a transition to a new event (boundary), followed by two sentences confirming the action. Memory for these critical words was later assessed with an old/new recognition task while EEG-activity was recorded. As expected, critical words that indicated an event boundary were remembered better than no-boundary words. Electrophysiologically, both boundary and no-boundary words elicited old/new effects in the 300-500 ms and 500-700 ms time windows, typically associated with familiarity (mid-frontal) and recollection (parietal), respectively. Amplitudes for hits did not differ between boundary and no boundary words in the 300-500 ms window. Crucially, while between 500 and 700ms no reliable condition

differences were observed at parietal sites, boundary hits elicited a larger right-frontal positive slow wave than no-boundary hits. This component resembles the right-frontal old/new effect, typically associated with strategic retrieval monitoring and evaluation. The enhanced positivity for boundary words suggests that their successful retrieval was more demanding, given that these words marked a prediction failure during encoding that necessitated event model updating. This may have increased the need for strategic retrieval monitoring to accurately decide whether the word had been heard before. Overall, these findings indicate that while familiarity-based recognition appears insensitive to event boundaries, later strategic retrieval processes are modulated by the cognitive demands of event model updating during encoding.

Topic Area: LONG-TERM MEMORY: Episodic

C71 - Temporal Flow of Emotional Experiences Influences How Neutral Cues Reconstruct Memory

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Emotional experiences unfold within a temporal stream, surrounded by neutral moments that occur before and after. The current study examined how the temporal dynamics of emotion shape what neutral content “carries” about an emotional experience, facilitated through the strength of the associative binding to the central emotional event. Drawing on two theoretical perspectives, one emphasizing predictive binding of preceding neutral content to ensuing emotional experiences, and another emphasizing emotional context effects that linger to shape memory for subsequent content, we tested whether emotion interacts with cue position to influence episodic remembering. To test these ideas, participants encoded image triplets consisting of a neutral before-object, a negative or neutral middle-scene, and a neutral after-object. At retrieval, they were cued with either the before- or after-object and answered questions about the associated middle-scene. Across two independent samples, cueing with after-objects enhanced subjective memory specificity, precision, and emotional integrity—but not temporal-order memory—for negative relative to neutral scenes, supporting the lingering emotional context perspective. These findings suggest that emotional spillover at encoding fosters the integration of subsequent neutral information into the same affective episode. Moreover, retrieval of such after cues may reinstate the emotional context of the original scene, facilitating access to its emotional tone and detail. Together, the results reveal that what follows an emotional event plays a privileged role in reconstructing its memory, highlighting the dynamic, temporally extended nature of emotional event representation.

Topic Area: LONG-TERM MEMORY: Episodic

C72 - Semantic and episodic memory retrieval as internal attention

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Imagine that you are a contestant on Jeopardy! You must use clues on the board to retrieve a semantic memory, or some piece of factual information. During the break in the first round, you must use the host's question to retrieve an episodic memory and tell a story from your personal life to entertain the audience. Although the content of what you retrieve is different in these instances, both rely on turning your mind's eye inward. The retrieval state was initially proposed to specifically support episodic — as opposed to semantic — retrieval. However, recent evidence suggests that the retrieval state may reflect a domain-general internal attention process, in which case, both episodic and semantic retrieval should recruit the retrieval state. To test these alternatives, we conducted a human scalp electroencephalography (EEG) study in which participants performed three tasks requiring either episodic, semantic, or perceptual processing of word stimuli. We trained a multivariate pattern classifier to detect the 'retrieval state' — a brain state distinct from encoding recruited when participants attempt to access a stored experience — on an independent dataset. We tested this classifier on the three tasks. We find robust engagement of the retrieval state on both the episodic and semantic tasks, with no differences between the tasks. The perceptual task, in contrast, recruited the encoding state. These findings support the hypothesis that the retrieval state reflects a domain-general internal attention process.

Topic Area: LONG-TERM MEMORY: Episodic

C73 - How do children represent the world? Examining representational similarity for repeated and related stimuli in children and adults

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The proposed study aims to elucidate potential differences in how children and adults represent repeatedly seen items versus different items presented in the same context using representational similarity analysis (RSA). Behavioural work from our lab with children and adults has found that repetition gives adults a comparatively greater memory boost when recognizing previously seen items, yet also greater difficulty in discriminating between perceptually similar items. In adults, a greater difference between same-item and across-item pattern similarity has been shown to be larger for subsequently remembered compared to forgotten items in areas within the dorsal visual stream, medial temporal pole, and inferior frontal gyrus. Further, within-participant global similarity—the degree of similarity between representations of different items presented in the same experimental context—may indicate better memory. However, due to children's tendency to encode stimuli in highly variable ways and underdeveloped ability to integrate related stimuli during learning it is currently unclear whether we would expect similar integration-like global similarity signals in children. Similarly, children may also show a smaller difference between same-item and across-item similarity

levels if they do not represent repetitions of the same item as similarly as adults. Thus, participants will be shown some repeating and non-repeating items before testing their memory for old, similar, and completely novel items. In this Sketchpad Poster, we hope to elicit feedback on our planned analyses for single-trial RSA estimates to understand differences in how adults and children represent related and repeated experiences, and if this provides insight to our novel behavioural findings.

Topic Area: LONG-TERM MEMORY: Episodic

C74 - ERP Evidence for Distinct Temporal Dynamics of Masked Conceptual and Repetition Priming in Recognition Memory

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Processing fluency, the ease with which information is processed, affects recognition memory. In masked repetition priming, a briefly presented identical word preceding a recognition test item can increase false familiarity for unstudied words, as perceptual fluency is misattributed to memory. Conversely, masked conceptual priming enhances accurate recollection of studied items (Taylor & Henson, 2012). We investigated the neural correlates and temporal dynamics of masked repetition and conceptual priming during recognition memory using event-related potentials (ERPs) in N=32 participants. Behavioral results showed a cross-over interaction trend: conceptual priming increased recollection ($p = .076$, 3.24% priming effect) while repetition priming significantly increased false familiarity ($p = .002$, 4.48% priming effect). Classic old/new ERP effects were observed: FN400 on Fz indexed familiarity and the late positive component (LPC) on Pz indexed recollection. Fractional area latency (FAL) analyses revealed that conceptual primes significantly accelerated LPC for recollected items (739ms) compared to unrelated primes (756ms, $p = .01$). In contrast, repetition primes showed no such facilitation (744ms vs 738ms, $p = 0.42$). Furthermore, FN400 latencies for familiarity could not be estimated due to insufficient trial numbers. These findings suggest that conceptual priming selectively speeds up the recollection process indexed by the LPC, whereas no such effect is evident for repetition priming. Counter to the misattribution of fluency to familiarity that explains repetition priming effects, we suspect that conceptual primes enhance correct recollection by facilitating the reactivation of the original encoding trace. Future representational pattern-similarity analyses may shed light on this.

Topic Area: LONG-TERM MEMORY: Episodic

C75 - Visual attention's role in memory interference and hippocampal repulsion

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When events are highly similar, this can trigger 'repulsion' (or differentiation) of hippocampal representations. This phenomenon is thought to play an adaptive role in minimizing memory interference.

However, an important and open question is how hippocampal repulsion relates to visual attention. One possibility is that hippocampal representations of similar events only become distinct to the extent that different features of the events are visually sampled. From this perspective, hippocampal repulsion reflects differences in visual input. Alternatively, repulsion may be a direct reaction to the failure to differentially attend to similar events. From this perspective, hippocampal repulsion actually requires similarity in visual input. In the proposed experiment, participants will learn scene-object associations. However, some scenes will be highly similar (paimates). These paimates will differ only in one spatial quadrant (e.g., 'top right'). For some paimates, participants' attention during learning will be directed to the "diagnostic" quadrant; for other paimates, attention will be directed to a "non-diagnostic" quadrant. We hypothesize that when attention is directed to the diagnostic quadrant (relative to the non-diagnostic quadrant), this will facilitate learning but, paradoxically, will also reduce the degree of hippocampal repulsion. Preliminary data from behavioral pilot studies confirm that attention to diagnostic spatial locations improves memory performance and reduces interference. In planned fMRI and eye tracking studies, we will test our primary prediction that diagnostic visual cues reduce hippocampal repulsion and will conduct more fine-grained analyses that track the relationship between visual attention and hippocampal repulsion across stages of learning.

Topic Area: LONG-TERM MEMORY: Episodic

C76 - Hippocampal modulation via indirectly targeted noninvasive stimulation is intensity-dependent and region-selective

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How can hippocampal activity be modulated via noninvasive stimulation? Hippocampal Indirectly Targeted Stimulation (HITS) modulates hippocampal activity applying transcranial magnetic stimulation (TMS) to accessible locations of the hippocampal network in parietal cortex. HITS enhances memory performance and hippocampal connectivity measured via fMRI, yet the temporal electrophysiological dynamics of hippocampal responses mediating these effects remain unknown. Characterizing HITS-induced hippocampal activity with high temporal precision allows assessment of how stimulation intensity and location shape hippocampal dynamics, advancing our knowledge in underlying memory mechanisms and providing a framework to refine time-specific noninvasive neuromodulation strategies. We hypothesize that HITS evokes stronger hippocampal responses than out-of-network or sham stimulation, with effects increasing by intensity but losing selectivity at high intensity levels. We tested this hypothesis in N=4 individuals with refractory epilepsy implanted with intracranial electrodes in hippocampus and parahippocampal gyrus (n=28 contacts). We applied TMS at 60%, 80%, 100%, and 120% of resting motor threshold

under HITS, sham, and out-of-network (in S1) stimulation conditions. In a subset of the sample, HITS intensity produced progressively larger intracranial potentials immediately after TMS ($p = .04$; 4–62 ms) and more negative amplitudes later ($p = .04$; 488–576 ms). HITS responses were significantly more negative than sham and S1 at 100% intensity ($p < .01$; 385–509 ms). These results provide direct evidence of hippocampal responses to HITS and how they can be modulated in an intensity-dependent and region-selective manner. These results advance understanding of TMS effects on hippocampal activity and may contribute to developing effective noninvasive memory modulation strategies.

Topic Area: LONG-TERM MEMORY: Episodic

C77 - Distinct roles of the anterior and posterior medial temporal lobe in memory retrieval revealed by intracranial EEG

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The medial temporal lobe (MTL) is crucial for episodic memory, with anterior and posterior regions posited to differentially support memory. In this study, we aimed to elucidate the time-resolved contributions of anterior (aMTL) and posterior (pMTL) MTL to memory retrieval by examining pediatric intracranial EEG from 19 subjects (5.9-20.5 years). Subjects completed a scene recognition memory task and made old/new judgments during recognition. We analyzed high-frequency activity (HFA; 70-150Hz) for hit (old responses to studied scenes) and miss (new responses to studied scenes) trials. The timing of HFA differed between pMTL and aMTL, such that in pMTL, HFA peaked after scene onset, while in aMTL, HFA peaked at the time when subjects made retrieval responses. Successful retrieval effects (contrasting HFA between hit and miss trials) were analyzed by aligning pMTL data to scene onset and aMTL data to the old/new response onset. In the pMTL, there were no activity differences between hits and misses. In contrast, in the aMTL, hit trials were associated with increased HFA. Importantly, this anterior HFA increase occurred around the time of the retrieval response. This effect did not differ by age. Taken together, these findings support a functional gradient of the MTL and highlight the importance of aMTL activity in memory decisions across development.

Topic Area: LONG-TERM MEMORY: Episodic

C78 - Decoding Memory from Empty Space: Neural Reactivation During Gaze Reinstatement

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Research on episodic memory shows that people often direct their gaze toward locations where goal-relevant information was originally

encoded, even in the absence of visual input. This “looking-at-nothing” (LAN) behavior has been demonstrated to strengthen maintenance of visuospatial configurations (Olsen et al., 2014; Wynn et al., 2018), enhance the accuracy and fidelity of episodic recall (Johansson & Johansson, 2014; Johansson et al., 2022), and promote cortical reconstruction (Bone et al., 2018). It has been proposed that reinstating gaze locations serves as a retrieval cue that supports reactivation of the goal-relevant memory representations, yet direct neural evidence for content-specific reactivation during LAN has been lacking. To address this gap, we combined simultaneous EEG and eye-tracking with multivariate pattern analysis (MVPA) to decode category-specific neural activity during LAN in two independent datasets. Participants first encoded multi-element visual events composed of items from distinct categories (e.g., faces, butterflies, cars). In one dataset, they maintained the encoded event while viewing empty placeholders corresponding to the original element locations. In the other, they recalled previously encoded events while freely viewing a completely blank screen. Participants showed the expected LAN behavior, which was related to memory performance. Crucially, decoding of fixation-related EEG during LAN revealed category-specific neural activity reflecting the memory content associated with the fixated locations. Classification accuracies correlated with recall fidelity. These findings provide the first direct evidence of content-specific neural reactivation during LAN and demonstrate how gaze behavior supports episodic memory across maintenance and recollection.

Topic Area: LONG-TERM MEMORY: Episodic

C79 - Remembering when: neural mechanisms underlying repetition effects

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We often experience the same events more than once (e.g., seeing a Golden Retriever walking with its owner on your commute one day and again another day). How does this repetition influence our memory for when events occurred? Prior work has shown that greater similarity of medial temporal lobe activity patterns across repetitions predicts better temporal memory (Zou et al., 2023). One interpretation of these pattern similarity effects is that they reflect reinstatement of a prior event's ‘temporal context.’ In recent work, we used inverted fMRI encoding models to reconstruct the content of images that were temporally adjacent to a prior encounter with a scene image (Zou, Hutchinson, & Kuhl, 2025). In the present study, we will refine this method and will test for relationships between medial temporal lobe pattern similarity and temporal context reinstatement. We will also test whether temporal context reinstatement influences temporal memory accuracy and/or induces biases in temporal memory (Sherman & Yousif, 2025). Forty-four participants will complete three fMRI sessions. In each scan run, participants will view a stream of 3-s video clips with the instruction to encode them as part of a broader narrative (a ‘movie’). Critically, some clips will reappear, with repetitions either

occurring across scan runs (lag = minutes) or scan sessions (lag = days). At the end of each session, participants will be shown clips and will estimate when they were encountered. This study will reveal how repeated experiences and temporal context reinstatement shape temporal memory.

Topic Area: LONG-TERM MEMORY: Episodic

C80 - Emotions in motion: The influence of emotions on memory for videos

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Previous research indicates that emotional items are better remembered than neutral items. Furthermore, for negative stimuli, central details are better remembered at the cost of memory for peripheral details. However, emotional memory research has primarily relied on static affective stimuli such as pictures, which may have limited ecological validity, as real-world emotional experiences are multisensory and dynamic. The present study examined whether emotional valence influences content and contextual memory for video stimuli that are visually complex, narrative-based, and include audio. Young adult participants (N = 55) completed three experimental blocks in which they viewed four emotionally valenced news videos (two positive, two negative) and two neutral videos, presented in one of six locations on a screen. Videos were from a publicly available dataset previously rated for arousal and valence and were relatively brief (average length = 45 s). After each block, participants completed spatial memory and free recall tests for each of the six videos. Preliminary analyses indicate that fewer details were remembered from negative videos compared with neutral and positive videos and that memory for spatial context was less accurate for negative videos than for positive and neutral videos. Additional analyses will examine whether the type of details recalled differs across negative, neutral, and positive videos to determine whether worse detail recall from negative videos is driven by increased focus on central themes at the expense of peripheral details. These results will provide important new insights regarding how emotions influence memory for dynamic situations unfolding across time.

Topic Area: LONG-TERM MEMORY: Episodic

C81 - Effects of Medial Temporal Lobe Damage on Autobiographical Memory: A Meta-Analysis of Studies Using the Autobiographical Interview

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The hippocampus and surrounding extended medial temporal lobe (MTL) have been widely implicated in declarative memory, including autobiographical memory. Declarative memory distinguishes between

two forms of content – episodic (contextually rich) and semantic (factual) – where MTL damage often disrupts episodic content. The majority of these studies have employed laboratory experiments or standardized neuropsychological measures, but there is a growing appreciation for the assessment of naturalistic, real-life autobiographical memories, given their ecological validity. Here, we have conducted a meta-analytic review to evaluate the effects of MTL/extended MTL damage on naturalistic autobiographical memory assessed by the Autobiographical Interview, a widely used, standardized assessment that derives measures of internal (episodic) and external (non-episodic/semantic) details from freely recalled autobiographical memories. Given the large number of single-case studies, we have conducted separate group and case study meta-analyses. Preliminary group analyses demonstrate that individuals with MTL damage recall a significantly reduced number of internal details, compared to healthy matched controls, with no significant differences in external detail production. Case study analyses are ongoing. These results suggest that in the presence of various degrees and sites of MTL damage/dysfunction, autobiographical memory recall is predominated by semantic details amongst a paucity of rich contextualized details, demonstrating that the MTL system is necessary for the episodic nature of real-life autobiographical memory. These findings help to inform memory evaluation and prognosis in these individuals and certain clinical populations (e.g., MTL epilepsy/surgery), and demonstrates the Autobiographical Interview as a robust and informative tool in the assessment of naturalistic autobiographical memory.

Topic Area: LONG-TERM MEMORY: Episodic

C82 - Using Virtual Scenes to Examine the Neural Correlates of Spatial Recognition Memory

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Recognizing scenes and objects is central to episodic and autobiographical memory. Despite this, the neural circuitry underpinning key recognition memory processes – familiarity and recollection – remains underdetermined. Here we present a novel scene memory paradigm that reliably probes distinct memory processes involved in scene recognition. In our task, participants encode virtual scenes from a first-person perspective. They then complete a test phase consisting of novel scenes, half of which spatially correspond to scenes presented during the encoding phase. We have manipulated the number of stimuli, scene duration, and encoding task instructions (participants engage in self-generation to describe scenes) for use with epilepsy patients. This enables the study of the neural correlates of scene recognition in the unique setting of

presurgical intracranial recordings. Various facets of recognition memory can be probed using this task, including scene recall, familiarity-detection during retrieval failure, and subjective metacognitive experiences. We present data validating this paradigm in both typically-functioning and clinical epilepsy populations. Results suggest that participants can discriminate between spatially similar and spatially dissimilar test scenes based on familiarity-detection during retrieval failure. Our preliminary results show that distinct event-related potentials associated with scene recognition are observed in the anterior hippocampus and surrounding structures. This approach will enable the study of field potential correlates and unit activity in numerous pertinent brain regions that are commonly implanted with depth electrodes in this setting. Overall, the paradigm offers a unique way to measure nuanced memory processes and is suitable for both behavioral and cognitive electrophysiological research settings.

Topic Area: LONG-TERM MEMORY: Episodic

C83 - Astrocytic role in second-order threat conditioning in the amygdala-piriform cortex circuit

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Fear- and anxiety-related disorders involve maladaptive associative learning, where neutral cues acquire emotional salience through indirect associations. Second-order conditioning (SOC) models this phenomenon by pairing a previously conditioned cue (CS1) predicting an aversive event with a novel neutral cue (CS2). Our prior work identified reciprocal connectivity between the basolateral amygdala (BLA) and piriform cortex (PC) as a key substrate for SOC. Here, we investigated whether astrocytic signaling within the BLA contributes to SOC formation, hypothesizing that disrupting astrocyte activity would impair SOC and attenuate BLA-PC circuit engagement. Adult rats received viral vectors targeting astrocytes and projection-specific neurons in the BLA. For astrocyte inhibition, AAV2/5-GfaABC1D-hM4Di-mCherry was infused into the BLA; controls received AAV2/5-GfaABC1D-mCherry. To label BLA-PC projection neurons, a retrograde AAV-retro-CaMKII α -Cre was injected into the PC, and a Cre-dependent virus into the BLA. After three weeks, animals underwent a three-day olfactory-auditory SOC paradigm (tone-shock pairing, odor-tone pairing, CS2 recall). Clozapine-N-oxide (CNO) was administered 30 minutes before training or recall to inhibit astrocytic activity. Freezing to CS2 was the behavioral index of SOC memory. Brains were collected for c-Fos immunolabeling to assess neuronal activation. Silencing astrocytes in the BLA significantly reduced freezing to CS2 during both SOC acquisition and recall compared to controls. Analysis of c-Fos expression in BLA neurons and BLA-PC projection cells is ongoing. Preliminary findings indicate that astrocytic activity in the BLA is essential for encoding and retrieval of second-order threat memories. These results highlight a previously unrecognized glial contribution to higher-order associative learning within the amygdala-piriform cortex network.

Topic Area: LONG-TERM MEMORY: Other

C84 - Modelling Strength-Based Representations in Memory Using Spiking Neural Networks

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Reading words aloud, compared to silently, during encoding may enhance memory by strengthening representations. Computational modelling enables manipulation of representation strength and can be used to simulate memory. Our model, Encoding-based Strength Representation in Memory (ESRM), was created using the Nengo Python library. Nengo uses the Neural Engineering Framework to enable mapping cognitive models onto spiking neural networks. ESRM includes simplified hippocampal memory components that account for primacy, recency, and decay. It reinforces 'read aloud' words by creating an additional distinct, and general memory representation. Recall in ESRM is determined by neural populations competitively accumulating evidence of word representations to a threshold, using a previously established minimum of 30% to filter irrelevant evidence. An accumulation to threshold denotes successful recall. Results from 50 simulations with ESRM were compared to behavioural data (N=50) in which participants were presented with a set of words, one at a time, and asked to either read them aloud or silently, intermixed within-subjects. A 2 (Source: ESRM vs Human) x 2 (Cue: aloud vs. silent) mixed ANOVA revealed a significant effect of Cue, better memory for words read aloud than silently, but no effect of Source. We then compared memory under conditions with or without noise, to mimic real-world divided attention conditions. ESRM again replicated human data: the production benefit from reading aloud versus silently remained, though it was reduced in magnitude. ESRM can successfully be used to model the effectiveness of encoding techniques, expanding applicability to populations where attention may be compromised (aging, MCI, TBI).

Topic Area: LONG-TERM MEMORY: Other

C85 - From flexible to anticipatory processing: alpha and beta oscillatory signatures of feedback-guided strategy adaptation and memory updating

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While learning to navigate uncertainties in the environment, the human brain seeks to minimize future errors by continuously refining its internal model via memory updating (MU). Prior research demonstrates that feedback is crucial for MU and that anticipatory neural mechanisms influence performance feedback processing. This process is additionally modulated by memory certainty. However, as previous research has primarily examined post-feedback neural activity, certainty-related pre-feedback mechanisms are less well

understood. The present study examined how certainty modulates anticipatory processes preceding performance feedback and subsequent MU. We examined oscillatory brain activity prior to performance feedback in a reanalysis of EEG data previously published by Hassall and colleagues (2023). Twenty-one participants (16 female, M = 25.81 years) predicted the strength of six gnomes with varying certainty levels (high, medium, low) using an interactive sliding bar. Certainty levels were learned through exposure. Feedback on prediction accuracy was presented via an animated rising bar. Single-trial linear mixed-effects models with performance accuracy as the outcome variable revealed an interaction between certainty and learning stage: higher performance corresponded to increased pre-feedback alpha and beta power for lower certainty trials in late learning, but decreased beta power in early learning stages. These learning-related modulations in pre-feedback alpha and beta power suggest that initial learning is marked by adaptable exploratory processing. Subsequent learning exhibited increased alpha-mediated inhibition and beta-related anticipatory activity for lower certainty trials, indicative of dynamic strategy refinement and selective engagement of task-relevant information. These results demonstrate that certainty shapes preparatory oscillatory activity that supports feedback-based MU.

Topic Area: LONG-TERM MEMORY: Other

C86 - Feedforward and reconstructive computations engage dissociable neural modules during memory encoding

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How does the brain transform perceptual experiences into durable memory traces? Previous computational and behavioral work identifies at least two computational processes that explain substantial variance in the memorability of images in a dissociable manner: feedforward processing as captured by a deep convolutional neural network (DCNN) and reconstructive processing as captured by a sparse coding model (SPC). Yet whether and how these two computational processes may be dissociable neurally remains elusive. Here, we investigate how these two computational processes may map onto brain activities during memory encoding using 7T fMRI data from the Natural Scenes Dataset (NSD). Adopting computational architecture from previous work, we trained sparse coding models to reconstruct DCNN embeddings of the 73000 NSD stimuli and derived two computational signatures per image: distinctiveness and reconstruction error, corresponding to feedforward processing and reconstructive processing respectively. Behaviorally, we replicated previous findings: images with more distinctive and harder-to-reconstruct representations are retrieved more accurately and faster. We then combined these two computational signatures in regression models to predict activities in brain regions engaging in memory encoding suggested by previous literature, that is, visual regions, medial temporal lobe and frontoparietal regions. Interestingly, while

distinctiveness explains the most variance in visual regions, reconstruction error explains the most variance in the medial temporal lobe and frontoparietal regions. Together, these findings bridge the explanatory gap between memory behavior and the brain with computational modeling, revealing an integrated mechanism of memory encoding driven by feedforward and reconstructive computations across dissociable neural modules.

Topic Area: LONG-TERM MEMORY: Other

C87 - Rehearsal supports the rapid emergence of semantic and detail-rich memories in the neocortex

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Repeatedly rehearsing information can accelerate systems memory consolidation by shifting memory systems contributions towards the neocortex. However, it remains unclear whether rehearsal differentially affects specific aspects of memory, and where these are represented in the cortex. Here, we used functional MRI to assess the effects of repeated and one-time learning on semantic (category-level) vs. detail-rich (exemplar-level) memory aspects. Healthy, young adult participants (preliminary n=33) encode and recall unique associations between two visually presented objects either once (single items) or four times (rehearsed items) during fMRI. We test memory for category and exemplar information after 60min and 72h. Behaviorally, rehearsal globally facilitates short-term and long-term retention. During encoding, rehearsal rapidly increases functional activity in the precuneus, while the hippocampus and ventral visual stream show decreasing activity. Accordingly, the ventral visual stream displayed lower activity for rehearsed vs. single items across both retention intervals specifically during exemplar recall and activity changes were linked to better memory for details. In the precuneus, higher activity for rehearsed vs. single items emerged specifically for category recall at the 60min and 72h time points, while increasing activity during encoding mirrored increasing performance during exemplar recall. Together, rehearsal benefits the retention of semantic as well as detail-rich memory and induces rapid, long-lasting, and behaviorally relevant changes in neocortical networks. While changes in the ventral visual stream seem to specifically support memory for perceptual detail, the precuneus might contribute to category as well as detail-level memory.

Topic Area: LONG-TERM MEMORY: Other

C88 - Two wrongs make a right? Electrophysiological and behavioural comparisons of reward prediction error and prediction error in memory consolidation

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Previous research has examined reward prediction errors (RPEs) in reinforcement learning and semantic prediction errors (PEs) in language and perception, yet no study has directly compared their EEG-derived indices or their relationship to declarative memory encoding and consolidation within a common framework. While both types of prediction errors have been independently linked to modulations in theta oscillations, and changes in negative event-related potential amplitudes (feedback-related negativity, FRN, and N400, respectively), the extent to which they reflect distinct or overlapping neural mechanisms and how they influence declarative memory remains unclear. In this study in progress, participants (planned N=80) are completing a novel combined semantic-reward oddball-like roving paradigm (based on Lindborg et al., 2023), in which category shifts in both nouns and reward values are expected to independently elicit PEs and RPEs. EEG and behavioural data are being recorded during learning, immediate recognition and a delayed recognition phase, occurring 2 hours and 45 minutes later, testing recognition accuracy for the nouns using an old/new paradigm. It is expected that RPEs and PEs will elicit FRN and N400 components, respectively, and that stimuli inducing prediction errors will show downstream memory advantages. Linear mixed models will use single-trial FRN and N400 amplitudes, along with theta phase synchrony, as predictors of delayed recognition accuracy to determine whether the effects of RPEs and PEs on memory are additive, indicating separable systems, or interactive, suggesting overlapping systems. Preliminary findings are expected to clarify the degree of separability versus shared nature within predictive processing systems.

Topic Area: LONG-TERM MEMORY: Semantic

C89 - Unsupervised Machine Learning Identifies Unique Brain Structural Markers of Learning on a Gamified Working Memory Task in Older Adults

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Neurological markers of complex skill learning (> 10 hours) were assessed in 46 older adults (Mage = 71years) using the BirdWatchGame, a gamified working memory updating task. Individuals were clustered into two subgroups using unsupervised machine learning (ML) algorithms to five learning metrics: BlockSimpleScore, AsymptotePoint, RT for Correct Responses, RT Increase in Error-Correct Response Pairs, and Block d-prime. One-dimensional clustering for each metric and five-dimensional clustering combining all metrics revealed two distinct subgroups across all learning features. Statistical comparisons of 80 brain volumes and cortical thickness performed between clusters, correcting for multiple comparisons, showed significant differences in amygdala and basal ganglia for accuracy, but inferior frontal and frontal pole for RT and asymptote, and anterior cingulate for error

monitoring. The 5-D clustering showed group differences in fronto-parietal hubs of cognitive control and amygdala. Our results suggest the importance of using unsupervised ML models in order to classify complex skill learning using both single and combined metrics, since the type of learning outcome assessed or emphasized during cognitive training can have implications on neurocognitive plasticity.

Topic Area: LONG-TERM MEMORY: Skill Learning

C90 - Enhanced Cognitive Processing in Musicians: A Comparative ERP Study of Executive Functions

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This study investigates the influence of musical training on executive functions through a comparative analysis of event-related potential (ERP) components between musicians and non-musicians. A cohort of young adults (25 musicians and 25 non-musicians) completed the cognitive measures, including the TMT, Digit Span, Digit Coding, and a Stroop test, while neural activity was recorded using a 64-channel BioSemi ActiveTwo EEG system. Behavioral data revealed that musicians exhibited faster reaction times and higher accuracy, particularly in incongruent trials. No significant group differences were observed in other cognitive measures; however, musicians demonstrated significantly quicker completion times on TMT A and B. Preliminary grand-average ERP analysis, using independent-samples t-tests, revealed that non-musicians exhibited a stronger negative ERP response after presenting the incongruent stimulus (Window 0-150 ms), particularly at the Central channel. The mean ERP amplitude was -0.184 μ V for non-musicians compared to -0.774 μ V for musicians, with a statistically significant difference. In addition, musicians demonstrated significantly higher ERP activity, with a mean amplitude of 0.977 μ V at the Centro-parietal channels, compared to 0.007 μ V in non-musicians in the time window (-100 to 0 ms) before the correct response to the incongruent stimulus, suggesting higher preparation of processing and preparing for the correct response. Additionally, musicians exhibited a prominent P3b ERP component at T8, P7, O1, and O2 during incongruent trials, reflecting enhanced attentional allocation and sensory integration. The N2 component at AF3, AF4, F3, and F4 further underscores superior conflict monitoring and cognitive control in musicians. Keywords: ERPs, Executive Functions, Musicianship, EEG

Topic Area: METHODS: Electrophysiology

C91 - Dynamic Temporal Alignment of EEG and Music: A Novel Framework for Real-Time Music Cognition Research

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Cognitive neuroscience research on music cognition seeks to understand how musical experiences shape neural dynamics, emotion, and memory, particularly in cognitive decline associated with Alzheimer's disease and dementia. Although EEG and behavioral

techniques have advanced substantially, current tools still struggle to achieve the temporal precision needed to synchronize neural and musical data streams in real time, often resulting in fragmented interpretations of the dynamic interplay between sound and brain activity. To address this challenge, the present study introduces a real-time multimodal framework that synchronizes precise musical tokens—such as pitch-class sets and Roman numerals—with EEG data through a dynamically adaptive temporal model. The system aligns neural activity and auditory input within musical time—signature-sensitive analysis windows that expand or contract according to tempo. Implemented through signal computation, the framework enables simultaneous monitoring of EEG frequency bands in relation to musical events. Results indicate that EEG band activity within each musical measure tracks listener responses to specific musical tokens—chords, bass, soprano, root—with millisecond-level precision. The system captures neural correlations of these responses in real time, allowing precise mapping of valence-related neural dynamics to musical structure. By integrating EEG, acoustic, and behavioral signals within a unified temporal framework, this tool advances experimental precision in music cognition and therapeutic neuroscience. It provides a reproducible infrastructure for examining how harmonic features engage neural mechanisms of emotion and memory, supporting future applications in music therapy and translational research in cognitive neuroscience.

Topic Area: METHODS: Electrophysiology

C92 - A multi-stage real-time pipeline for intraoperative iEEG processing and functional mapping

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Background: Intraoperative mapping during brain tumor resection is essential for preserving critical cognitive and functional regions. In addition to direct electrical stimulation (DES), electrocorticography (ECoG) or intracranial EEG (iEEG) has been increasingly adopted for mapping due to its millisecond-level temporal resolution. However, current real-time systems are often limited to visualizing raw signals without automated quality assessment or functional analysis, making it difficult for neurosurgeons to make rapid, informed decisions during surgery. Methods: We present a two-stage MATLAB/Simulink pipeline for intraoperative iEEG processing. The first stage automatically evaluates signal quality by identifying extreme variability and detecting common artifacts—line, flatline, drift, baseline-shift, and electrode-popping noise—every 500 ms using robust statistical metrics. The second stage computes accumulating, time-locked high-gamma (70–150 Hz) activity in real time from preprocessed signals, generating an evolving evoked average aligned to stimulation events to continuously track cognitive and motor responses. Results: Using simulated and patient-derived datasets, the artifact detection stage achieved high accuracy in detecting each noise type (>90%). The high gamma response estimation stage showed strong correlation with offline gold-

standard analysis ($r = 0.94$, $p < 0.01$). System latency remained below 0.01 s, confirming suitability for real-time monitoring. Conclusion: This integrated real-time iEEG pipeline demonstrates robust noise rejection and reliable time-locked cognitive-signal detection, supporting its potential for intraoperative application. By unifying these approaches, the pipeline strengthens the precision and confidence of functional mapping during surgery. Its functionality can be extended to generate DES priority maps derived from evoked responses and predictive machine learning models of accumulating resting-state data.

Topic Area: METHODS: Electrophysiology

C93 - Short-Range Structural Connectivity Supports Local Structure–Function Coupling in Functional Network Patches Mapped with Precision Functional Mapping

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Understanding how structural and functional brain properties relate remains a central neuroscientific challenge. The leading model proposes a unimodal-to-heteromodal gradient, with high structure–function (SF) correspondence in sensory and low coupling in association networks. However, many brain networks consist of spatially distributed communities, and how SF coupling manifests at the community level remains unclear. We investigated local SF correspondence and hypothesized that spatially distinct network communities are connected by short-range U-fibers. We used multimodal neuroimaging data from 32 participants extensively scanned with multiband-multiecho fMRI and diffusion-weighted imaging (DWI). We combined precision functional mapping (PFM) to delineate individualized network organization with tractography to assess structural connectivity. SF relationships were examined across 20 networks. While global SF coupling did not exceed chance levels, local communities exhibited increased structural connectivity, measured by streamline counts and tested against rotation-based null distributions—suggesting that local anatomy supports functional coherence. We validated this finding by controlling for community size, shape, and orientation using a spin test, and by accounting for streamline length. To assess subject specificity, we projected each subject's functional communities onto all other participants and found that in 31 of 32 cases, within-community connectivity was maximal in the subject from whom the community was derived. All findings replicated across probabilistic and deterministic tractography. Our results reveal that mesoscale anatomy shapes functional organization and support the biological validity of individualized network topographies mapped with PFM. These findings highlight the role of U-fibers in defining local network patches and advance our understanding of SF coupling in the brain.

Topic Area: METHODS: Neuroimaging

C94 - Quality Assessment of Task-Based fMRI Data Obtained Using Single-Echo and Multi-Echo Sequences

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Introduction: Multi-echo (ME) functional magnetic resonance imaging (fMRI) is an emerging technique that aims to address signal dropout in regions with high magnetic susceptibility, such as the orbitofrontal cortex and medial temporal cortex. As opposed to single-echo acquisition, ME acquisition involves acquiring multiple volumes within a single repetition time, which can allow for recovery of signal dropout in these regions using optimal echo combination. **Objectives:** This study aims to determine the quality of task-based fMRI data acquired through single-echo and ME sequences using two image quality metrics (IQM): (1) temporal signal to noise ratio (tSNR), and (2) a novel Z-score technique that assesses quality by comparing against a set of hypothesized patterns. **Methods:** The Scanned Working Memory (SCANME) task was employed and included 20 healthy controls who underwent fMRI scanning. The fMRI data was preprocessed using Statistical Parametric Mapping 12. Following preprocessing, Constrained Principal Component Analysis for fMRI (fMRI-CPCA) was utilized to retrieve networks, and IQMs were calculated afterwards. **Results:** An inverse relationship was observed between tSNR and the novel Z-score technique. While longer echo times were associated with lower tSNRs, the average Z-scores were higher, indicating better network quality. **Conclusions:** While tSNR allows for a quick and easy method of obtaining IQMs, the novel Z-score technique may allow for a more accurate and in-depth determination of task-based fMRI data quality. Our future work is now employing this novel IQM to determine the quality of task-based fMRI data obtained using single band sequences versus multiband acceleration.

Topic Area: METHODS: Neuroimaging

C95 - Neuroimaging Biomarkers for Predicting Substance Use Trajectories in Adolescents: Insights from the ABCD Study

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Introduction: Early identification of individuals at risk for escalating substance use is crucial for preventative interventions. This study uses neuroimaging data from the Adolescent Brain Cognitive Development (ABCD) study to explore early brain markers predictive of substance use escalations. **Methods:** Adolescents with no substance use at baseline (ages 9-10) were followed for four years, and categorised into low-risk, mild escalation, and severe escalation groups based on their consumption patterns for alcohol, nicotine and other substances. Multimodal neuroimaging data, including T1-weighted, resting-state fMRI, and diffusion tensor imaging, were analysed using one-way ANOVA tests with family-wise FDR corrections to control for multiple comparisons. Topological analyses of brain networks were conducted

to assess network properties. Logistic regression models with 10-fold cross-validation were also employed to predict substance use status based on neuroimaging features. **Results:** The cohort included 319 participants (130 low-risk, 96 mild, 93 severe) with no demographic differences at baseline. Morphological alterations in posterior occipital regions and widespread microstructural changes were found in escalation individuals. Severe escalation was further distinguished by altered tensor diffusivity in the left cingulate and subparietal regions. Network analyses indicated varied clustering, local efficiency and small-worldness in escalation, suggesting impaired segregation and integration. Changes in betweenness and connectivity were observed within auditory and cingulo-parietal networks as well. Moreover, a combined model incorporating structural and functional markers achieved 72% accuracy in classifying escalation. **Conclusion:** Early-occurring neuroimaging, particularly within occipital, sensorimotor, and auditory systems, may underlie vulnerability to escalating substance use and serve as potential biomarkers for targeted early interventions.

Topic Area: METHODS: Neuroimaging

C96 - Comparing voxel- and deformation-based morphometry in pediatric ADHD

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Properly quantifying and interpreting brain morphometry in structural neuroimaging studies is challenging and may yield inconsistent findings due to varying methodological approaches and their underlying assumptions. However, by utilizing and comparing complementary approaches, we may be able to improve the accuracy and interpretability of these results (Goto et al., 2022). This study compared three morphometric methods—gray matter (GM) voxel-based morphometry (VBM), white matter (WM) VBM, and deformation-based morphometry (DBM)—for detecting structural differences in pediatric ADHD to better understand how combining methodological approaches may improve interpretability of findings and prevent processing errors. DBM represents volume changes through deformation fields, while tissue-specific VBM analyses decompose these changes into GM and WM contributions. T1-weighted MRI images from 106 children (58 ADHD, 48 controls; 8–13 years; 49.1% female) were segmented, registered, modulated, and smoothed at 6mm using CAT12. Statistical analyses involved threshold-free cluster enhanced multiple regression contrasts with age, sex, image quality, and total intracranial volume as covariates. Whole-brain analyses revealed focal reductions in ADHD across GM-VBM and DBM in temporal, frontal, and insular regions. ROI analyses showed GM reductions in bilateral temporal and orbitofrontal cortices, with the right superior temporal gyrus surviving correction. WM analyses revealed complex patterns with bilateral orbitofrontal and temporal reductions but occipital increases in ADHD. Visual and quantitative comparison demonstrates how DBM captures overall structural changes independent of tissue classification, while VBM reveals which tissues drive these effects, highlighting the nuance

involved in properly interpreting morphological differences through automated segmentation and the importance of multi-method analysis.

Topic Area: METHODS: Neuroimaging

C97 - From Empirical to Simulated Brains: Using Digital Twin Models to Identify Therapeutic Targets in MCI

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Brain stimulation techniques offer promising non-pharmacological interventions for improving cognitive function in mild cognitive impairment (MCI), but it is unclear which target regions of stimulation would be most effective. While in vivo brain stimulation studies yield the most direct data, obtaining causal insights is often challenging due to practical and ethical concerns that arise from clinical experiments. Here, we built the digital twin brain (DTB) model, which integrates multimodal empirical neuroimaging data from MCI participants to simulate the dynamics and interactions inside their brains, and identify regions that are most influential for recovering healthy brains from MCI brains through virtual perturbation. A total of 30 MCI participants and 26 healthy participants were included. We used the Hopf model to model each brain region, where each region's bifurcation parameter controls whether it's noisy or oscillatory. The brain structural connectivity was used to provide information for simulating global dynamics. Probabilistic metastable substates (PMS) were used to estimate dynamic functional patterns. Model optimization was achieved by minimizing the difference between the simulated and empirical PMS. By perturbing each region independently, we found that increasing excitability in bilateral superior temporal gyri, bilateral rostral anterior cingulate gyri, and right inferior frontal gyrus causally shift the MCI DTB's whole-brain metastable dynamics toward the healthy states. These results offer insight into the neural underpinnings of MCI in a more causal way and may inform future empirical brain stimulation therapies for MCI.

Topic Area: METHODS: Neuroimaging

C98 - White matter integrity in early midlife women with bilateral salpingo-oophorectomy

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Estrogens, a group of key ovarian steroids, play an important role in the regulation of cognition and brain structure, thus affecting later life Alzheimer's Disease (AD) risks. While current research has mainly focused on examining gray matter structural changes in the brain, less studies have reported on white matter changes, and it is not known how white matter related to estrogens loss in women in early midlife. Changes in white matter have been reported as one of the earlier pathologies of AD, with some markers showing up in mild cognitive impairment (MCI) pathology preceding AD. Therefore, the intersection of estrogens and white matter is crucial for understanding early

cognitive decline in women and why women are disproportionately affected by AD compared to men, as 2/3 of AD patients are women. We propose that estrogens affect both gray matter hippocampal volumes as well as white matter integrity in regions across the brain. Women with ovarian removal surgery, often as prophylaxis for ovarian cancer, are recruited along with age-matched premenopausal controls and diffusion tensor imaging (DTI) is performed. Women with ovarian removal demonstrated lower fractional anisotropy (FA) and higher mean diffusivity (MD) compared to controls. Women with ovarian removal taking estradiol therapy demonstrated an intermediate phenotype, with some recuperated but not a full regain in functioning. These preliminary results demonstrate the importance of studying white matter changes as an early biomarker of later life AD.

Topic Area: METHODS: Neuroimaging

C99 - Endogenous estrogen levels moderate the effects of transcranial direct current stimulation on working memory

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There is growing evidence that individual differences in baseline neural state may moderate effects of transcranial direct current stimulation (tDCS) on cognition. In females, fluctuations in estrogen are associated with differences in cortical excitability, but no studies have tested whether estrogen moderates effects of tDCS on cognitive performance. To address this, we applied high-definition tDCS over the left dorsolateral prefrontal cortex in N=37 female participants with normal menstrual cycles over four sessions: each participant received active (2mA) and sham stimulation during low estrogen and high estrogen menstrual cycle phases while completing an n-back working memory (WM) task. Preliminary results suggest that in low estrogen phases, tDCS slowed reaction time (RT) for misses and altered variability of RT for false alarms and misses. In contrast, no tDCS effects were seen under high estrogen, indicating effects of stimulation on WM-related inhibitory and monitoring processes may be more pronounced when estrogen levels are low. Furthermore, tDCS effects on RT variability under low estrogen differed by WM load: stimulation decreased RT variability for false alarms under moderate load, but increased RT variability for misses under high load. Taken together, our findings suggest that both the magnitude and direction of tDCS effects on WM function, particularly operations that rely on cognitive control, vary based on estrogen level and WM demands. These findings contribute to our understanding of individual differences that may underlie heterogeneity of cognitive responses to tDCS, and highlight the importance of hormonal state as a potential moderator of neuromodulation effects on cognition.

Topic Area: METHODS: Other

C100 - "Netflix" for Lucid Dreams: can preselected narrative cues during REM guide lucid dream content?

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Lucid dreaming, or the conscious awareness of being in a dream state, provides an avenue for dream content to be externally influenced with the dreamer's awareness of this influence. We present a mobile application that we designed to investigate whether consciously experiencing narrative content during sleep influences (a) dream content and/or (b) subsequent waking cognition and well-being. Our application detects sleep stages using audio analysis and wearable sensor data, and delivers lucidity induction cues during REM sleep. The cues are self-selected, by participants, from a library of "dream stories." Narratives include strategic pauses to encourage creative elaboration while maintaining a guided structure. Prior to using our app, participants complete baseline assessments, including knowledge mapping tasks, mood and anxiety inventories, health self-assessments, and a battery of cognitive performance measures. They then use the app nightly for several weeks, maintaining daily logs of app usage, lucid dream occurrences, and subjective sleep quality. Post-intervention, participants repeat all baseline assessments and provide qualitative feedback on their experiences. This design allows us to examine which cognitive and affective domains are sensitive to lucid dreaming practice, whether effects depend on dream success frequency or sleep quality changes, and how individual differences predict outcomes. We suggest that our application may serve as a platform for studying the impact of guided lucid dreaming on mental health and cognitive performance.

Topic Area: METHODS: Other

C101 - Can we reactivate a memory during sleep to improve respiration in people who stop breathing due to a sleep disorder?

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Obstructive sleep apnea is characterized by partial or complete cessation of breathing during sleep, which can have serious health consequences and represents a major public-health challenge. Treatment with Positive Airway Pressure devices is generally efficacious, but compliance is inadequate for many people. Here, we sought to determine whether a novel non-invasive method can improve respiration in people with this sleep disorder. We reasoned that sounds associated with behavioral responses may reactivate those responses during sleep. We recruited people with sleep apnea not currently receiving treatment. Participants trained to inhale nasally with their mouth closed while pressing their tongue against the back of their teeth, which can open the airway. They trained over multiple days to repeatedly produce this response to an auditory stimulus, the spoken phrase "breathe in." Then, during an 8-hour overnight session with polysomnographic recordings, we monitored for a decrease in respiratory flow and each time either presented these stimuli or

marked when stimuli would have been presented (sham). We compared the severity of sleep-disordered breathing between alternating stimulation and sham periods. Partially collected data indicated that respiratory event duration was shorter during stimulation than during sham, along with a lower oxygen-desaturation index (number of times oxygen levels drop by 4% from baseline per hour of sleep). More data will be collected to determine whether there is sufficient evidence to move ahead with planning further tests and developing ways to offer this sort of treatment in the home environment with wearable technology.

Topic Area: OTHER

C102 - Mental Time Travel without Visual Experience

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Visual mental images help us recall autobiographical memories (AMs) and envision the future, collectively referred to as mental time travel (MTT). It is unclear how congenitally and late blind individuals, without the opportunity to encode visual images, engage in MTT. Our study included three groups: congenitally blind (CB; n = 21), late blind (LB; n = 22), and sighted controls (CTL; n = 34). Participants answered mental imagery questionnaires (Vividness of Visual Imagery Questionnaire, Plymouth Sensory Imagery Questionnaire) and completed the Autobiographical Memory Interview and Scene Construction (SC) Interview. During 3-Tesla fMRI scans, participants retrieved AMs and engaged in SC based on auditory word cues. Interviews were scored for episodic details (e.g., perceptual, thoughts/emotions) and combined into unified MTT scores. Results showed that the CB group only rated visual mental imagery lower than the other groups across questionnaires (all $p < .001$). In the interviews, no group differences were found for the ratio of episodic details to total word count ($p = .16$). While interviews of CB participants were characterized by a significantly lower proportion of perceptual details, the proportion of conceptual details (i.e., thoughts/emotions) was significantly higher than that in the CTL and LB group (all $p < .05$). fMRI analyses revealed that the MTT of CB participants was characterized by higher precuneus activation compared to CTLs ($p < 0.0001$), while the parahippocampal place area was more activated in CTLs compared to the other groups (all $p < 0.001$). Results suggest that the absence of vision changes the content of MTT but keeps episodic reliving intact.

Topic Area: OTHER

C103 - High field strength fMRI reveals Reward Prediction Error-based learning signals in the Ventral Tegmental Area

Reward learning depends on reward prediction errors (RPEs) –the difference between expected and actual outcomes. In primates, dopaminergic neurons in the ventral tegmental area (VTA) and substantia nigra (SN) fire in proportion to RPE magnitude. Direct evidence of RPE-related activity in the human midbrain, however, remains limited due to the midbrain's small size, deep location, and high susceptibility to physiological noise. Using high-resolution 7-Tesla fMRI, this study examined whether BOLD activity in dopaminergic midbrain nuclei varies with computationally defined RPEs. Ninety healthy adults (56 females; aged 18–30 years) completed an event-related reward-learning paradigm, in which participants learned stimulus–outcome associations. Data were preprocessed (motion correction special normalization), corrected for physiological noise (breathing, cardiac), and analyzed using SPM12 and PhysIO toolbox. At the first level, BOLD variability was modeled using a set of predictors scaled by the magnitude of the RPEs. Second-level analyses (FDR-corrected $p < .05$) revealed that activity in dopaminergic midbrain regions scaled as a function of positive prediction errors. Similar associations were observed in the activation of the striatum, hippocampus, salience, and frontoparietal networks. In dopaminergic nuclei and the hippocampus, these associations were pronounced early in learning but diminished as learning progressed. In the salience and frontoparietal networks, associations between BOLD amplitude and RPE remained consistent across the paradigm. These findings provide direct evidence of RPE-related BOLD activity in human midbrain dopaminergic nuclei and establish a foundation for investigating dopaminergic learning signals in humans using fMRI.

Topic Area: OTHER

C104 - Interhemispheric EEG connectivity before and after callosotomy

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Callosotomy, a surgery involving the severing of the corpus callosum, is a re-emerging treatment for severe and pharmacologically intractable epilepsy. We recently reported that a callosotomy patient with minimal spared fibers had conserved functional connectivity measured with fMRI (Santander et al., 2025). Here, we report an analysis of functional connectivity measured with electroencephalography (EEG). We investigated both intra- and interhemispheric connectivity pre-callosotomy and after partial or full callosotomy. Patients recordings reported here include LJ (1 Pre, 3

Full), EM (1 Pre, 1 Partial), and BT (1 Partial). Clinical EEG recordings with electrodes (18 used) placed according to the 10-20 system and recorded at 512 Hz. Data were analyzed from eyes-open and eyes-closed conditions. For each recording session EEG was band-pass filtered (0.1-30Hz), epoched by condition, baseline-corrected, and underwent threshold rejection (± 80 mV). Correlations were computed for each electrode pair and converted to R2 to estimate the shared variance across pairs of electrodes. T-tests were performed for each recording session between inter and intra hemispheric R2 which yielded a significant difference ($p < .05$) for all but one recording, such that intrahemispheric shared variance was higher than interhemisphere (Cohen's d : min=0.088, max=0.271). For the only full callosotomy patient in this sample (LJ), this difference was not significant in the first recording post-callosotomy (57 days) (open: $t(151)=1.56$, $p=0.12$, closed: $t(151)=0.887$, $p=0.377$). Results suggest connectivity measured by EEG may be dependent both on the completeness of the callosotomy and time-from-surgery.

Topic Area: OTHER

C105 - Timbral context modulates the frequency following response

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Music is often polyphonic and requires perceptual segregation of concurrently occurring instruments. Little is known about how concurrent instrument tones are processed subcortically, so that they can be perceptually segregated. Accordingly, the goal of this study was to understand how the timbre of one instrument impacts subsequent processing of that same instrument when combined with a second instrument, using the frequency following response (FFRs). Participants were presented with sequences that consisted of a priming tone that was either a guitar or a piano tone, immediately followed by a composite tone consisting of both instruments. EEG data was averaged into two separate FFRs. Both FFRs were evoked by the combined piano and guitar tone; the only difference between the two FFRs was which tone came first: guitar or piano. The FFR was analyzed using the strength of stimulus-to-response correlation (SRC) to both instrument tones in isolation and spectral power analyses at harmonic frequencies for each instrument in isolation. Results suggest instrument-specific neural priming. Guitar primed FFRs correlated more strongly with the guitar tone compared to the piano tone, ($p < .001$, $d=1.54$). Guitar priming enhanced SRC between combined-tone responses and guitar stimuli compared to piano-primed conditions ($p < .001$, $d=0.76$). Piano priming showed no significant SRC enhancement ($p=0.29$). Spectral analysis revealed instrument-specific enhancements: guitar priming increased spectral power at the harmonics in the guitar tone, while piano priming enhanced power at the harmonics in the piano, both $p < .001$. These findings demonstrate timbre-based priming influences on the FFR and highlighting context sensitivity in early auditory processing.

C106 - Causal mechanisms linking the reward system to sleep-dependent memory consolidation

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Music provides a powerful framework for studying neuroplasticity as it engages distributed brain networks and activates the reward system, particularly the striatum, via dopamine release. This dopaminergic activity not only enhances subjective pleasure but also facilitates learning and memory by promoting synaptic plasticity. Transcranial magnetic stimulation (TMS) offers a causal approach to probe this system where excitatory stimulation of the left dorsolateral prefrontal cortex (DLPFC), functionally connected to the striatum, has been shown to increase music-evoked pleasure, while inhibitory stimulation suppresses it. Here, we report preliminary results from a within-subject experiment (N=24; 11 male, 13 female) investigating whether TMS-induced modulation of music-evoked reward influences musical learning and its consolidation across sleep. Participants completed two counterbalanced sessions of intermittent theta burst stimulation (iTBS; excitatory) or continuous TBS (cTBS; inhibitory) over the left DLPFC. Before and after stimulation, participants rated the pleasantness of piano excerpts, and autonomic measures (electrodermal activity, heart-rate variability) were recorded. They then performed a melody-learning task, underwent immediate performance assessment, and wore a home EEG device overnight to capture sleep physiology (slow oscillations, spindle density). Performance retention was reassessed after 24 hours. Preliminary findings show that iTBS increased subjective pleasantness and physiological arousal compared to cTBS, with corresponding trends toward enhanced post-sleep retention. Exploratory analyses of sleep EEG are used to characterize relationships between stimulation conditions, sleep physiology, and overnight memory gains. These results support a causal role of reward system activation in motor skill learning and consolidation, advancing our understanding of how pleasure, neuroplasticity, and memory interact.

Topic Area: PERCEPTION & ACTION: Audition

C107 - Auditory hemispheric lateralization for speech and melody: from cortex to subcortex

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Hemispheric lateralization is a fundamental feature of human brain organization, yet existing models are almost exclusively derived from cortical data, leaving subcortical contributions largely unexplored. This gap reflects limitations in spatial resolution of conventional

neuroimaging, that can now be overcome with ultra-high field 7-Tesla magnetic resonance imaging (7T-fMRI). Building on recent evidence that cortical auditory asymmetries arise from differential sensitivity to spectrotemporal modulations in natural sounds, this study investigates whether such lateralization already emerges at subcortical stages of auditory processing. Using 7T-fMRI, twenty-three healthy adults listened to auditory stimuli while BOLD signals were acquired at 1.4 mm³ isotropic resolution. The imaging field of view included bilateral auditory cortices as well as medial geniculate bodies and inferior colliculi. Participants heard 125 previously validated stimuli comprising speech-only, vocalized melody-only, and song excerpts containing both speech and melody. Item-identity decoding using searchlight classification successfully replicated well-established cortical asymmetries, with stronger left-hemispheric representations for speech and right-hemispheric representations for music. Crucially, preliminary analyses indicate reliable event-locked BOLD responses in subcortical nuclei, opening the door to testing lateralized encoding in these subcortical areas. Ongoing work focuses on modeling structure-specific neurovascular dynamics in subcortical regions to enable multivariate decoding analyses comparable to those performed in the cortex. Subcortical functional asymmetries would indicate that lateralized spectrotemporal tuning is established early in the auditory hierarchy, whereas their absence would suggest that spectrotemporal tuning differences arise primarily at the cortical level through selective weighting of subcortical inputs.

Topic Area: PERCEPTION & ACTION: Audition

C108 - fNIRS resting-state frontoparietal dysconnectivity in older adults with MCI predicts spatial navigation in a virtual floor maze test

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Spatial navigation is a sensitive indicator of dementia. Although Virtual Reality (VR) enables environmental control, most studies rely on non-immersive, in-place navigation. We developed a VR Floor Maze Test (VR-FMT) to assess real-space navigation and evaluate its sensitivity in detecting early dementia risk. Sixty-five cognitively normal (CN) adults and individuals with mild cognitive impairment (MCI) completed neuropsychological testing, fNIRS scans, and VR-FMT under two conditions: walking and keyboard. Mazes were presented with and without walls. While walking, MCI participants had significantly longer path lengths ($p=.020$), especially in the walls condition ($p<.037$). No significant effects were found in the keyboard condition. Only among those with MCI, better navigation performance in the walls condition was associated with greater use of route strategies ($p=.049$). The MCI Group was characterized by weaker connectivity overall in the PFC (interhemispheric and PFC-PPC), but stronger interhemispheric connections in the PPC than the CN group ($pFDR<.05$). While walking,

we found a significant interaction for frontoparietal connectivity on path length ($p < .001$). Simple slopes show that lower frontoparietal connectivity among the MCI Group was associated with longer path length specifically in the walls condition ($p = .008$). None of the same three-way interactions were significant in the keyboard condition ($p > .26$). Navigation deficits in MCI appear rooted, in part, by navigation strategies mediated by functional connectivity between prefrontal and parietal regions—highlighting critical networks involved in spatial navigation beyond the medial temporal lobes. The VR-FMT is a promising tool for early detection of navigational deficits in dementia.

Topic Area: PERCEPTION & ACTION: Development & aging

C109 - Inverted U-shaped prefrontal activation during speech-in-noise perception reflects neural inefficiency in older adults

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Older adults often have difficulty understanding speech in noisy environments, even in cases where there is no discernible peripheral hearing impairment. Successful speech perception in noise depends on the coordinated engagement of perceptual and cognitive control systems, which may become less efficient with age. The present study used functional near-infrared spectroscopy (fNIRS) to examine prefrontal oxygenation (oxyhemoglobin; HbO) during a speech-in-noise recognition task in 34 older adults (age range: 63–83 years). Participants listened to sentences presented at five levels of background noise corresponding to signal-to-noise ratios (SNRs) of +4, +2, 0, -2, and -4 dB and repeated the final word of each sentence. fNIRS signals were recorded over the bilateral prefrontal cortex to index cortical activation associated with listening effort. Linear mixed-effects analyses revealed a significant inverted U-shaped relationship between HbO and listening difficulty. Bilateral prefrontal activation increased with rising noise levels but declined at the most adverse condition, indicating that neural engagement intensified with task demands until processing capacity was exceeded. Higher left prefrontal activation near the peak of the curve was associated with lower speech recognition accuracy. While both age and hearing loss predicted poorer accuracy, only age significantly predicted stronger HbO responses. These findings provide evidence for neural inefficiency in aging; whereby increased prefrontal activation represents greater resource expenditure without corresponding behavioral benefit. Overall, age-related difficulties in understanding speech in noise appear to stem from altered efficiency of cortical resource allocation, reflecting a shift from efficient to effortful neural recruitment.

Topic Area: PERCEPTION & ACTION: Development & aging

C110 - The differential effects of ketamine on principal neurons and interneurons in the ventral posteromedial nucleus (VPM) of the thalamus

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Evidence from our group suggests that sub-anesthetic ketamine reduces levodopa-induced dyskinesias associated with the treatment of Parkinson's disease and that this may be through ketamine's action on subcortical motor circuits. Ketamine's impact on subcortical circuits is poorly understood. The ventral posteromedial nucleus (VPM) of the thalamus is a key region involved in thalamocortical communication. In motor diseases, the VPM exhibits hyperexcitability and impaired cortical signaling, contributing to disrupted sensorimotor integration. Evidence suggests that sub-anesthetic ketamine preferentially binds to NMDA receptors on parvalbumin-expressing (PV) GABAergic interneurons, resulting in reduced activation of PV neurons and a release of inhibition of excitatory neurons. However, this hypothesis has rarely been tested. To address this, we measured the activities of large populations of putative PV and principal cells in the VPM given the importance of this region for motor control. We implanted male/female Sprague-Dawley rats ($N=5$) with Neuropixels probes, and acquired recordings from the VPM (AP: 3.35mm ML: 2.8mm DV: 5.25–6.5mm) while rats explored an open field. Rats were injected with two doses of ketamine (20 mg/kg, i.p.), with each injection separated by 2 hours. Neurons were subdivided into putative PV neurons and principal cells by examining each neuron's firing rate and waveform width. Analysis of >250 VPM neurons revealed varied responses to ketamine. While investigation of the selective effects of ketamine on each putative PV and principal cells is ongoing, we found that ketamine increased the overall firing rate of VPM neuron subtypes and decreased bursting activity. Support: NIH R01 RF1AG081767, R01 NS122805-03

Topic Area: PERCEPTION & ACTION: Motor control

C111 - Functional Brain Networks Underlying Motor Area Activation During Motor Execution and Motor Imagery Tasks

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Introduction. Functional magnetic resonance imaging (fMRI) retrieves reliable spatial patterns and blood-oxygen-level-dependent (BOLD) signal changes associated with each pattern, referred to as cognitive modes. This study examined the anatomical and temporal characteristics of cognitive modes elicited during Motor Imagery and Motor Execution tasks. Methods. 43 healthy participants completed fMRI sessions while performing motor tasks under two conditions: (1) imagining squeezing a foam ball with the right, left, or both hands (Imagery), and (2) executing the same actions (Execution). Task-timing-related cognitive modes were extracted using Constrained

Principal Component Analysis for fMRI, a data-driven dimensionality reduction method designed to isolate task-related BOLD variance. Repeated-measures ANOVA was used to assess significant main effects and interactions across task conditions in BOLD change measures. Results. Activation in the response and initiation modes, and deactivation in the default mode DM, were strongest during executing relative to imagining. Imagined movements tended to recruit bilateral regions more broadly. Focus on Visual Features (FVF) showed suppression during all single-hand conditions (imagine and execute), possibly due to the requirement of suppression of irrelevant visual information (the task-irrelevant side of the screen) to support task performance. Discussion. Novel findings from this study were that imagined movements recruited more bilateral regions than actual executing, and more evidence that the FVF mode is suppressed when aspects of the visual display had to be ignored. These findings characterize the anatomical and temporal patterns of cognitive modes engaged by the Motor Imagery and Motor Execution tasks, with implications for targeting brain stimulation and pre-surgical planning.

Topic Area: PERCEPTION & ACTION: Motor control

C112 - Elucidating the Neurodevelopment of Multisensory Integration in the Common Marmoset

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Multisensory integration (MSI) is the ability to integrate sensory inputs from multiple modalities to efficiently perceive and navigate the environment. It is one function typically disturbed in neurodevelopmental disorders such as Autism Spectrum Disorders (ASD). To better understand the development of MSI, there is a need for a model that develops quickly and demonstrates analogous human brain functioning. Transgenic marmoset models (*Callithrix jacchus*) of ASD are currently developed worldwide as the ideal primate for neurodevelopmental studies. First, it is necessary to understand typical neurodevelopment of MSI, answering this key question: How are multiple senses encoded and combined by the marmoset brain across development? I am collecting behavioral data from multisensory tasks designed to elicit MSI in conjunction with structural and functional neuroimaging. To this end, I will uncover the neurodevelopment of MSI by correlating brain activity and structure with task performance over the two-year neurodevelopmental period. I hypothesize that a similar parieto-frontal network seen in humans will activate for MSI in the common marmoset that is refined with age as well as modulated by stimuli valence and an increase in myelin content within this network. This research will have significant further impacts such as helping to characterize the neurodevelopment of ASD and other MSI-related neurological disorders in humans.

Topic Area: PERCEPTION & ACTION: Multisensory

C113 - Working Memory Prioritization Effects on Neurophysiological Mechanisms of Sensory and Motor Processing Using EEG

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When certain list positions are prioritized by associating them with high reward, individuals can maintain those rewarded positions in a heightened state of accessibility. This finding is termed the prioritization effect. Within working memory, this effect typically results in faster response times or improved accuracy for prioritized items. The processes underlying the prioritization effect are not fully understood but some evidence suggests that there is enhanced sensory processing, motor processing, or both contributing to performance benefits of prioritized stimuli. In Experiment 1 (n=135) we used a reward-based probe-recognition paradigm and ruled out an alternative hypothesis that pop-out effects drive the effect in the present paradigm while replicating the prioritization effect. To test the neurophysiological mechanisms of the prioritization effect, Experiment 2 was conducted (n=29, with ongoing data collection). Participants completed the same task while their brain waves were recorded to measure event-related potentials (ERPs) that are sensitive to early sensory (P1 and N1) and later motor (Lateralized Readiness Potential; LRP) processing. We hypothesize that (1) When viewing a prioritized high reward (25 points) item, sensory-evoked activity will be greater compared to when viewing a non-prioritized low reward (3 points) item and (2) When a prioritized high reward item is shown and tested, response preparation will be enhanced compared to when a non-prioritized low reward item is shown and tested. Results will contribute to the understanding of the physiological processes linked with reward-based prioritization and whether performance benefits are the result of enhanced sensory processing, motor response preparation, or both.

Topic Area: PERCEPTION & ACTION: Other

C114 - Striatal and hippocampal theta neuromodulation split human timing

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Human interval timing is widely attributed to deep subcortical circuits, yet these mechanisms have been hard to test causally without surgery. Here we used biophysically optimized transcranial temporal-interference stimulation (tTIS) to focally modulate either the right putamen or the left hippocampus while participants performed temporal estimation and reproduction, two mechanistically distinct timing tasks. Theta (5 Hz) tTIS over the right putamen selectively and transiently degraded temporal precision in estimation, increasing Weber fractions without shifting the point of subjective equality, whereas beta-band stimulation and theta over the left putamen were ineffective, demonstrating frequency- and hemisphere-specific striatal involvement. In reproduction, the pattern reversed across sites: putaminal theta biased responses toward over-reproduction, whereas

hippocampal theta biased them toward under-reproduction, revealing a double dissociation between striatal and hippocampal theta in human timing. Concurrent pupillometry mapped these behavioral effects onto distinct physiological signatures: striatal theta amplified cue-locked, decision-related pupil bursts linked to temporal comparison, whereas temporal principal component analysis (PCA) of duration-scaled pupil signals showed that hippocampal theta selectively altered an encoding component that predicted subsequent reproduction bias. A mechanistic Laplace-timeline model with decaying (“past”) and ramping (“future”) units reproduced these bidirectional effects when striatal versus hippocampal dynamics were selectively slowed, providing a single computational account of the dissociation. Together, these results show that human interval timing can be fractionated into complementary theta-sensitive subcortical computations and establish tTIS as a noninvasive route to deep, circuit-level causal tests in time cognition.

Topic Area: PERCEPTION & ACTION: Other

C115 - How Semantic and Perceptual Information Shape Object Memorability

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Some images are better remembered than others, but the factors that make certain images more memorable remains unclear. Previous research suggests that these differences in memorability cannot be solely explained by perceptual features, suggesting semantic information plays a crucial role. However, even among real-world objects that are rich in semantic content, item memorability varies greatly, raising the question of whether high memorability objects rely on semantic information differently to low memorability items. This experiment examines how semantic and perceptual information contribute to object memorability and whether the neural dynamics of processing semantic vs perceptual information differ between high and low memorability items. To address this, participants completed an associative memory task with images varying in perceptual (line drawing vs photograph) and semantic aspects (objects typically found inside vs outside a house). Following the paradigm and analysis approach of Linde-Domingo and colleagues (2019), EEG data are being analyzed using clustering methods to determine the temporal sequence of the neural activity associated with semantic and perceptual processing during image recall. Specifically, we aim to identify the peaks that correspond to maximal neural differences in four comparisons: photographs vs. line drawings (i.e., perceptual features) and indoor vs. outdoor (i.e., semantic features) for each high and low memorability image. These clusters will reveal the time course of accessing perceptual and semantic information to contribute to image recall. We predict that highly memorable objects will evoke earlier semantic-related ERP clusters compared to low memorability objects, indicating faster recruitment of semantic information during recall.

Topic Area: PERCEPTION & ACTION: Vision

C116 - Does the Visual Word Form Area Exist for a Non-Latin Script?

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A region specialized for recognizing visual word forms, Visual Word Form Area (VWFA), has been proposed in the left ventral occipitotemporal cortex (VOTC). Having been explored mostly in Latin scripts, its presence in non-Latin script users like Arabic remains unclear. Fifteen native Arabic and L2 English speakers were presented with Arabic words, English words, scrambled words, and line-drawn objects in separate blocks while they looked for consecutive image repetitions. A previously established VWFA parcel was set as a search space for subject-specific localization. Frequently enough, a contrast of Arabic words > Scrambled words (or Arabic words > Objects) did not delineate any reliable contiguous clusters (of ≥ 10 voxels) at a lenient threshold of uncorrected $p < 0.05$. We therefore took top 10% of voxels from this parcel, irrespective of the statistical threshold, as the presumptive VWFA. These voxel sets showed evidence of reliability: They remained almost identical across two separate sessions of our experiment. Moreover, Arabic-selective and English-selective voxels were functionally separable. However, using the same criterion, we could also define a ‘scrambled word form area’ (Scrambled words > Arabic words & Objects). The identities of such voxels also did not change across sessions. In addition to subject-specific analyses, group GLM revealed massive bilateral deactivation along the VOTCs for Arabic word contrasts. However, the VWFA parcel was selectively spared from this deactivation. Overall, while the VWFA parcel might be sensitive to visual words in Arabic speakers, this sensitivity could not be reliably attributed exclusively to word form processing, even in small clusters.

Topic Area: PERCEPTION & ACTION: Vision

C117 - Decoding neural activity patterns during perception and visual mental imagery

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Although visual imagery representations have been described as “perception-like”, shared neural markers of imagery and perception remain unclear. Results are also mixed regarding the temporal dynamics of imagery versus perception, with some work suggesting that significant imagery decoding is delayed relative to perception. To further explore these topics, the proposed research will examine the emergence of neural activity patterns during imagery and perception and assess if decoding accuracy varies based on individual

differences in imagery ability. Participants will perform a visual recall task (adapted from Bainbridge et al., 2021) while EEG is recorded. Each trial, target images will be studied, followed by a distractor task. Studied images will then be visualized and vividness will be rated. Given some previous EEG studies (e.g., Wolff et al., 2017) suggest that visual impulse stimuli reactivate memory states during maintenance, some imagery trials will include a brief visual impulse to improve imagery decoding accuracy. The Vividness of Visual Imagery Questionnaire (VVIQ) will index imagery strength. Multivariate pattern analysis will be used to decode category information from EEG activity. Decoding analyses will focus on classifying imagined and perceived segments into broad categories of objects versus scenes, however, detailed comparisons will also be tested (e.g., exemplars within each category). If imagery is “perception-like”, cross-decoding accuracy between perception and imagery is predicted to increase with imagery strength. If, however, cross-decoding accuracy does not correlate with imagery strength, results may instead suggest a distinction in the neural regions supporting perception and even high-vividness imagery.

Topic Area: PERCEPTION & ACTION: Vision

C118 - Aesthetic appreciation is modulated by emotional valence, psychological and physical distance of visual images

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Previous research associates N1 and LPP components of event-related potentials (ERPs) to emotional processing, with both psychological and physical distance modulated the magnitude of these components. Although the same components are implicated in aesthetic appreciation, with N1 reflecting automatic perceptual discrimination and LPP reflecting emotional salience and evaluative attention, it remains unclear whether the ERP effects observed in aesthetic evaluations are mediated by emotional valence, and whether psychological and physical distance has the same effects on perceived aesthetics reflected in subjective liking. To address these questions, 22 participants were recruited to view realistic photographs (psychologically close) and their AI-transformed artistic counterparts (psychologically distant), while simultaneous recordings of the ERPs elicited by individual images were collected, focusing on early (N1) and late (LPP) components. Participants' subjective ratings of their liking of individual images revealed preferences for positive over negative valence, for art images over photographs, and for medium- over small-sized images. Despite significant correlation between subjective valence ratings and liking ratings, ERP results demonstrated dissociable and interactive effects between them. Specifically, magnitude of N1 positively correlated with liking but negatively with valence. For magnitude of LPP, it positively correlated with liking of positive images but negatively correlated with liking of negative images. On the other hand, physical distance negatively correlated with both N1 and LPP, but psychological distance positively correlated

with LPP. In summary, the present results identified the neurophysiological correlates of subjective liking of visual images, whose magnitude was also modulated by valence, psychological distance, and perceived physical distance interactively.

Topic Area: PERCEPTION & ACTION: Vision

C119 - Is spontaneous level-1 visual perspective taking modulated by the constancy of another agent's presence?

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Altercentric interference refers to delayed or less accurate responses that occur when another agent's visual perspective differs from an observer's own. Our previous study demonstrated that, after controlling for directional orienting effects, such interference persists even when the agent is completely task-irrelevant, suggesting automaticity in level-1 visual perspective taking (VPT). However, whether such automaticity truly exists remains debated. Specifically, it remains unclear whether VPT is triggered in a stimulus-driven manner by the mere presence of another agent. To address this issue, the present study examined whether altercentric interference is modulated by the constancy of the agent's presence. If VPT is truly stimulus-driven, interference should appear only when the agent is present, and its magnitude should be comparable regardless of whether the agent is present consistently or only intermittently. In a preregistered online experiment, 100 participants were randomly assigned to either a Constant group, in which the agent appeared on every trial, or a Variable group, in which agent-present and color-block trials were randomly intermixed. All participants reported the number of balls visible from their own perspective. Results showed significant altercentric interference in the Constant group, replicating our previous finding. In the Variable group, the interference emerged not only on agent-present trials but also on color-block trials, and these effects were comparable to those in the Constant group. This indicates that altercentric interference is unlikely to reflect a stimulus-driven mechanism selectively tied to the presence of an agent, and may instead arise from domain-general or contextual processes.

Topic Area: PERCEPTION & ACTION: Vision

C120 - Age-Related Difference in Peripheral Information Benefits for Face Perception

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While younger adults typically fixate on the eyes for face identification, many older adults tend to fixate on the nose, which generally contains less information for identification. It remains unclear whether the age-

related fixation differences reflect covert sampling mechanisms, such as differential reliance on peripheral information. The current study addresses this gap. We recruited 76 younger ($M = 26.2$ years) and 34 older adults ($M = 63.2$ years) to complete a face identification task under two gaze-contingent conditions that simulated either tunnel vision (the Window condition) or a blindspot (the Mask condition). We varied the size of the window and mask (range of diameters = $[1.5^\circ - 8.5^\circ]$) to control for available information in central and peripheral regions. Overall, performance was much higher in the Mask than the Window condition. As more information became available (smaller Mask or larger Window), accuracy improved for both age groups, but at different rates: the age gap in performance slightly reduced in the Mask condition, but moderately widened in the Window condition. Together, these findings suggest that older adults are less efficient and flexible in integrating information from the peripheral regions for face identification. Our ongoing analyses are focused on using eye-movement data to explain the mechanisms underlying the behavioral results.

Topic Area: PERCEPTION & ACTION: Vision

C121 - Neural and Behavioural Time Courses of Rapid Danger Detection

Kathleen Botha¹ (kathleen.a.botha@gmail.com), Freya Chaytor¹, Evelyn Young¹, Dominika Prihodova², Adrian Bartolome¹, Hee Yeon Im^{1,3}; ¹University of British Columbia, ²University of Edinburgh, ³BC Children's Hospital Research Institute

To ensure safety, we must identify danger instantaneously. Prior research on gist perception demonstrates that humans can recognize basic scene properties within tens of milliseconds. This study examines the time course of danger detection to determine whether danger can be extracted as semantic gist from complex workplace scenes to rapidly engage the brain's attention and action systems. Using ChatGPT-4.0, we generated 186 dangerous images depicting real-world occupational accident scenarios and an additional 186 nondangerous images. Low-level visual features, scene backgrounds, and human body poses were matched across dangerous and non-dangerous image pairs to minimize the influence of salience-based visual processing. Images were presented for 14, 42, or 126 msec, followed by a mask stimulus. Behavioural responses and neural activity (EEG) were recorded from 18 participants aged 19–65. Participants performed above chance at 42 msec, with higher accuracy at 126 msec. At 14 msec, participants exhibited below-chance sensitivity and a highly conservative bias against reporting danger. Event-related potentials mirrored behavioural patterns, with neural differences between dangerous and non-dangerous images evident only in the 42-msec and 126-msec conditions. Prominent peak differences were observed across posterior, central, and frontal channels 220–300 msec after the stimulus onset. Frontal positivity was greater for dangerous than non-dangerous images, whereas central negativity and posterior positivity were greater for non-dangerous images. These results highlight the temporal dynamics of rapid danger

detection via semantic gist perception, demonstrating that humans can discriminate dangerous from nondangerous scenes within 42 msec, thereby enabling efficient evaluation of dangerous environments.

Topic Area: PERCEPTION & ACTION: Vision

C122 - Analyzing distinct and overlapping neural circuits that process spatial and non-spatial context cues during hierarchical decision-making

Omar Zeid¹ (ozeid3@gatech.edu), Eric Schumacher¹, Thackeray Brown¹; ¹Georgia Institute of Technology

Decision-making based on environmental cues is a fundamental trait of cognition – involving multiple brain regions such as the hippocampus, prefrontal cortex, and basal ganglia. There is evidence that spatial and non-spatial cues are processed differently in the brain. Similarly, cases where the status of one cue will dictate the response to a different cue (“hierarchically related” cues) produce different activation patterns at higher and lower hierarchical levels. Surprisingly, these fields of spatial memory and cognitive control have been largely independent, with the former being conducted largely with non-spatial stimuli and the latter conducted without modeling control states in the brain, despite many neurological conditions having cognitive deficits in both. Thus, we adapted a high-resolution fMRI study from a psychophysical variation of an AX-continuous performance task (AX-CPT) that a former student piloted. Participants observed environmental cues in a virtual space and needed to pick whether the resulting scene was one of a set of “Target” scenarios. The cues that conditionally determine whether a scene is a Target scene are either “Non-Spatial” or include “Spatial” cues (i.e., the direction they are facing in the environment). Thus, we are investigating behavioral and neuroanatomical differences between processing spatial and non-spatial cues within a hierarchical context. So far, our behavioral pilot data align with recent, non-spatial AX-CPT work. Also, our previous work predicts that the neural circuits in the Spatial and Non-Spatial trials will have significant differences (e.g., with hippocampal activation seen during Spatial trials) despite significant overlap in the putamen and prefrontal cortices.

Topic Area: THINKING: Decision making

C123 - When Reward and Punishment are Both Present: Optimistic Learning Bias in Approach-Avoidance Conflict Reinforcement Learning

Haoyu (Allen) Zhang¹, Cendri Hutcherson¹, Yanxi (Elinor) Zhu², Charl Margaux Elcano¹, Zhen Wu², Rutsuko Ito¹, Andy Lee¹; ¹University of Toronto, ²Tsinghua University

Adaptive decision-making often involves approach-avoidance conflict (AAC), where one option can lead to reward and/or punishment, while another option typically results in a safer outcome. Such behaviour often requires the learning of each option's associated outcome/s (e.g., reward and punishment probabilities), a process effectively described by reinforcement learning (RL). Previous research in

humans and other mammals has shown that such learning can be characterized by an optimistic learning bias, with positive outcomes being weighted more strongly than negative ones, thereby producing optimistic value estimates for chosen actions. However, most work has examined reward and punishment learning separately, leaving open the question of whether this bias extends to AAC RL. Across three behavioural experiments (total N = 260), we addressed this question using a paradigm in which participants were required to choose between a conflict choice (higher probability for reward with the possibility of punishment) and a safe choice (lower probability for reward only). In one task version, reward and punishment were both monetary (gain vs. loss), while in another version, monetary reward was pitted against a subjectively equated aversive food punishment. RL modelling of choice data revealed that when both outcomes were monetary, optimistic learning emerged for both reward and punishment. Interestingly, when punishment was aversive food, the bias primarily influenced punishment learning but not reward learning. We discussed the implications of these findings, highlighting how shared neural mechanisms of punishment learning and AAC processing may contribute to this bias.

Topic Area: THINKING: Decision making

C124 - Neural representations of metacognitive learning and the organization of future decision-making

Yoshinori Nanjo¹; ¹RIKEN Center for Brain Science, Japan,
²Hitotsubashi University, Japan

Self-estimation of our cognition is a hallmark of adaptive decision-making. Metacognition allows us to monitor internal computations and regulate cognitive control, yet how such self-estimation is calibrated through experience and deployed to shape future decisions remains poorly understood. We combined a random-dot motion discrimination with incentivized confidence reports to test whether discrepancies between expected and expressed self-estimation generate prediction-error signals that update an internal mapping from sensory evidence to self-estimation, and to identify the cortical representations of this learning. Participants made perceptual choices and reported confidence on each trial while recording neural activity using functional magnetic resonance imaging (fMRI). A computational learning account in which prediction-error signals updated an internal evaluation criterion explained progressive calibration of self-estimation in the absence of changes in perceptual sensitivity and captured prospective carryover to future choice policy, expressed as modulations of response caution and weighting of sensory evidence. Neuroimaging revealed cortical representations of self-estimation learning: pregenual anterior cingulate encoded prediction-error magnitude at evaluation; anterior prefrontal cortex encoded the prospective influence of these signals on later adjustments; and dorsal anterior cingulate expressed control-related implementation. Task-dependent functional coupling between anterior prefrontal and cingulate territories during evaluation predicted the magnitude and direction of subsequent policy change, and across participants, neural sensitivity to self-estimation learning

correlated with the degree of behavioral reorganization. These findings show that metacognitive evaluation of our cognition is adaptively calibrated through learning and prospectively deployed, providing a cortical mechanism by which self-evaluation organizes future decision-making.

Topic Area: THINKING: Decision making

C126 - Effects of a memory-minimizing strategy on individual differences in neural activity during consumer decision making in older age

Louis J. Giacalone¹ (louisgiacalone2027@gmail.com), Christina Yu¹, Eric J. Juarez¹, Joanna Salerno¹, Kennedy A. Black¹, Elizabeth J. Marsh¹, Felipe De Brigard¹, Roberto Cabeza¹, Gregory R. Samanez-Larkin¹; ¹Duke University

This study examines individual differences in functional neural activity between a subset of older adults who either did or did not spontaneously adopt a memory-reducing strategy in a decision-making task. Healthy adults from the community completed a memory-based consumer decision task, in which they were asked to memorize product ratings and choose the best option. A subset of older adult participants (N=10) spontaneously adopted a strategy whereby they summed ratings and made decisions based on fewer bits of information, thus reducing demands on memory. A matched group of participants (N=10) who did not use this strategy and instead maintained multiple (un-summed) ratings in memory were selected for group comparisons of neural activity during decision making using fMRI. Whole-brain analyses revealed a group by memory interaction in bilateral triangular portions of the inferior frontal gyrus extending into the middle frontal gyrus. Memory related activation was greater in these regions for participants who held more information in memory compared to those who adopted the strategy. In a small sample of participants, this study identifies preliminary evidence for reduced memory-related neural activation in lateral frontal cortical regions in a subset of older adults who employed a shortcut to make memory-based consumer decisions. When cognitive demands increase in decision-making tasks, some older adults may discover shortcuts that disengage neural memory systems.

Topic Area: THINKING: Development & aging

C127 - Associations between motivated learning and iron in brain tissue across adolescence

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Adolescence is a crucial period of neurocognitive development for motivated learning. The dopamine system, including major projections

from midbrain structures to the striatum, is central to motivated learning. Maturation of the dopamine system is a putative mechanism underlying normative increases in adolescent reward-driven behaviors, such as better learning. However, limited or invasive measurement of dopaminergic processes have hindered investigation of the neurodevelopment of reward systems in youth. MRI-derived R2' is a promising non-invasive inferential measure of past dopamine activity. Specifically, R2' indirectly quantifies brain-tissue iron, which co-localizes with dopamine vesicles as a byproduct of past dopamine synthesis. Here, we leverage this innovative measure (R2') and a non-concurrent probabilistic reinforcement learning task to investigate developmental associations in a cross-sectional sample (N = 70, 12-24 years old). We fit a series of mixed-effect logistic binomial regression models on learning, finding a winning model including age, time, and interaction terms ($\chi^2(2) = 9.74$, $p < .01$). Learning improved across youth, plateauing in adolescence into young adulthood. We calculated R2' from regions of interest, including the ventral striatum, caudate, and putamen. Across all striatal regions, R2' had significant positive correlations with age (all $ps < .05$), suggesting that striatal tissue iron increases with age. These results inform our understanding of the development of the dopaminergic reward learning system using non-invasive brain imaging. Applications include improving education, mitigating risky behaviors, and diagnosis and treatment of mental health disorders.

Topic Area: THINKING: Development & aging

C128 - Fractionation of the default network during visual and verbal forms of imaginative thinking

Mariam Hovhannisyan¹ (mhovhannisyan@arizona.edu), Shanshan Ma¹, Matthew D. Grilli¹, Jessica R. Andrews-Hanna¹; ¹University of Arizona

Human imagination – the ability to form mental representations not currently available to the senses –links many seemingly disparate complex mental phenomena, spanning autobiographical memory to mentalizing. Much of the work in this field has focused on the role of the default network (DN) in supporting such manifestations of imaginative thinking, yet there is less research on how subsystems within the DN support verbal vs. image-based forms of imagination and are sensitive to the construal level with which participants engage in imaginative thought. To begin closing this gap, we developed a novel fMRI task in which participants (ages 18-35) visualized and categorized concepts that varied in their abstract vs. concrete properties. Self-report ratings confirmed that task manipulations were successful in inducing low-level visual (“mind’s eye”) and high-level verbal (“mind’s mind”) modes of imaginative thinking, in line with a recent framework of imagination (Andrews-Hanna & Grilli, 2021). While aspects of the DN were recruited for both tasks, we observed greater engagement of the hippocampus and other regions within the medial temporal lobe subsystem when participants visualized concepts, as well as for concrete compared to abstract concepts. In contrast, left inferior prefrontal cortex and other regions within the

dorsal medial prefrontal cortex subsystem were recruited more when participants categorized concepts, as well as for abstract compared to concrete concepts. These results suggest that the DN fractionates depending on the representational form and level of construal of imaginative content, with implications for understanding more complex forms of thought.

Topic Area: THINKING: Other

C129 - Bluntly Speaking: The Influence of Cannabis on Thought Content and Dynamics

Jen Burrell¹ (jenbur@psych.ubc.ca), Alina Buschhueter², Hamidreza Jamalabad², Kalina Christoff¹; ¹University of British Columbia, ²Philipps-Universität Marburg

Nearly one-third of Canadians used cannabis in 2024, with 48% of young adults aged 20-24 reporting having tried cannabis in the previous year (Canadian Cannabis Survey 2024, 2024). The frequent use of recreational cannabis highlights the importance of understanding the neurocognitive mechanisms underlying cannabis use. To date, cannabis research has largely focused on its adverse effects on executive functioning and memory. However, no research has directly examined the conscious experience of cannabis intoxication. In other words, we lack a basic scientific understanding of the altered state of consciousness engendered by cannabis consumption. To investigate the alterations in conscious experience elicited by cannabis, we measured the dynamics of participants' thought streams during the Think Aloud paradigm (Raffaelli et al., 2021), in which participants were audio-recorded as they spoke aloud the contents of their conscious experience for 12 minutes. Participants identified as regular cannabis users, having used cannabis at least once a month over the prior three months, completed two 60-minute remote experimental sessions following the Naturalistic Cannabis Administration Protocol (St. Pierre et al., 2022), one sober and one immediately following the inhalation of cannabis. Using dynamical system modelling and semantic network analysis, along with experience sampling, we investigated alterations in thought content, valence, and temporality, which enable us to understand the changes occurring in the stream of thought due to cannabis. These findings begin to elucidate how cannabis acutely alters the way people think.

Topic Area: THINKING: Other

Poster Session D

Monday, March 9, 2026, 8:00 – 10:00 am, Fairview/Kitsilano Ballrooms

D1 - Auditory task-related aperiodic EEG activity in autism spectrum disorder (ASD)

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Autistic individuals have an increased auditory perceptual capacity relative to allistic individuals, meaning autistic individuals can process an increased amount of information at any one time (Karhson & Golob,

2015; Remington & Fairnie, 2017). However, the underlying potential mechanism for increased perceptual capacity in ASD remains unclear, and reports of increased “neural noise” in ASD may obscure the underlying brain dynamics (Paul et al., 2024; Simmons et al., 2007). Therefore, the present study examined the aperiodic slopes (the 1/f component) of the EEG signal in autistic and allistic individuals during an auditory selective attention task. Twenty-five ($n = 12$ ASD) IQ and age-matched participants (ASD: 22.5 years $\pm$ 4.1; Controls: 22.8 years $\pm$ 5.1) completed the Adolescent/Adult Sensory Profile questionnaire prior to performing a modified 3-stimulus (target, non-target, and distractor) auditory oddball detection task. Aperiodic EEG components were extracted from the neural power spectra using the Fitting Oscillations and One Over F (FOOOF) tool. Results revealed a significant interaction between group and perceptual load for the aperiodic exponent during the distractor trials ($F(1,23) = 7.05$, $p = 0.015$, $p\text{-adj} = 0.043$), characterized by a steeper slope in low perceptual load trials in ASD participants. Steeper slopes of the aperiodic exponent have been previously characterized as indicating stronger cognitive engagement and increased vigilance states. As such, in ASD, there is greater cognitive engagement with distractors even when perceptual demands are low. This mismatch between load and cognitive engagement in ASD may provide a plausible mechanistic bridge to understanding “autistic burnout”.

Topic Area: ATTENTION: Auditory

D2 - Math Among the Stars: an ERP Study of Narrative Framing Effects on Children's Arithmetic Processing

Sarah Martinez¹ (sarah-alyssa@live.com), Vanessa Cerda¹; ¹Texas A&M International University

Evidence suggests that many school-aged children struggle to sustain attention once mathematics shifts from concrete, story-based contexts to abstract symbols. Narrative and fantasy contexts have been shown to improve motivation and time-on-task, but the neural effects during arithmetic processing remain unknown. This study will investigate whether embedding simple multiplication problems within a fantasy narrative increases children's attention, engagement, and identity alignment compared to problems presented in a neutral context. Children aged 8–11 (3rd-5th grade) will verify simple multiplication problems (e.g., $2 \times 4 = 8$?) presented across two conditions: a fantasy-framed space mission and a neutral condition without narrative context, while event-related potentials (ERPs) are recorded. We will focus on ERP components indexing attention, including the P200 (early sensory-attentional processing) and the P300 (target detection during arithmetic verification). Simultaneous behavioral measures will be recorded, including accuracy, mean reaction time, and reaction time variability as markers of attentional stability. After each condition, children will complete a brief engagement questionnaire with an identity subscale assessing feelings of belonging and self-concept as learners. It is expected that fantasy contexts will elicit larger and/or faster P200 responses and larger P300 amplitudes, reflecting stronger attentional engagement. Behaviorally, we expect faster, more stable

responses, higher accuracy, and greater self-reported engagement and identity alignment in the fantasy condition. These anticipated findings would provide early evidence that meaningful narrative contexts can modulate neural attention and identity-relevant motivation during arithmetic, bridging educational psychology and developmental cognitive neuroscience.

Topic Area: ATTENTION: Development & aging

D3 - Modulation of Target-Related Spectral Dynamics Induced by Methylphenidate During an Oddball Task: A Pilot Study in a Mexican ADHD Population

Paloma Acacia Guzman Garcia^{1,2}, Claudia Xochitl Perez Ortiz¹, Ricardo Caraza¹; ¹Neurociencias Cognitivas y Neuroplasticidad, Hospital Zambrano-Hellion, ²Escuela de Medicina y Ciencias de la Salud, Tecnológico de Monterrey

Attention-deficit/hyperactivity disorder (ADHD) affects approximately 7% of Mexican youth, underscoring the need for context-specific neurophysiological markers. We investigated whether quantitative EEG (qEEG) during a visual oddball task captures changes in time–frequency dynamics in ADHD and their modulation after methylphenidate administration in a Mexican cohort. This pilot study enrolled 11 ADHD patients (7F/4M; 8–23 years, 15.18 ± 6.12) and 11 controls (4F/7M; 8–29 years, 19.80 ± 7.83), each completing two EEG sessions; the ADHD group performed pre- and post-methylphenidate recordings. EEG (16-channel, g.tec, 10/20) was processed in MATLAB/EEGLAB. We computed event-related spectral perturbation (ERSP), inter-trial phase coherence (ITPC), and sensor-level coherence, and compared intra- and inter-group differences ($\alpha = 0.05$). At baseline, ADHD showed greater delta-band event-related synchronization (ERS) at Fz relative to controls, consistent with slow-wave frontal predominance. After methylphenidate, low-frequency ERS increased over frontocentral sites, while lateral/posterior electrodes showed stronger event-related desynchronization (ERD), suggesting task-specific suppression of ongoing rhythms. Alpha-band ERS also rose at posterior sensors (PO7, Oz, Pz, P4) with medication, consistent with enhanced visuospatial attentional engagement. ITPC increased at higher frequencies, most prominently over right centro-parietal regions, indicating improved stimulus-locked phase alignment. Coherence was greater in controls across bands at baseline; in ADHD, methylphenidate produced notable parieto-occipital gains (e.g. P4–PO8), suggesting partial normalization of attentional-visual network coupling. These results support methylphenidate-related shifts toward more organized, phase-locked, goal-directed cortical dynamics during attention. Future work will expand the cohort and examine associations between oscillatory/phase metrics and neurocognitive performance to refine the clinical utility of qEEG biomarkers.

Topic Area: ATTENTION: Development & aging

D4 - Attentional State, Not Trait, Predicts Learning from Educational Videos

Jens Madsen¹ (jmadsen@ccny.cuny.edu), Lucas Parra¹; ¹The City College of New York

Attention is essential for learning, yet it remains unclear whether poor academic outcomes stem from enduring attentional traits or from transient lapses in focus. Using electroencephalography (EEG), we examined how neural and trait-level measures of attention predict learning from short educational videos. Across four experiments, 152 participants completed assessments of inattention, hyperactivity, working memory capacity, and GPA, then viewed 3-6-minute educational videos while EEG recorded brain activity. Neural synchrony across viewers, measured by inter-subject correlation (ISC), served as an index of attentional state. Higher ISC predicted better quiz performance, whereas self-reported inattention did not. Working memory capacity and GPA were independent predictors of test scores and were positively associated with neural attention. These results indicate that acute attentional engagement, rather than trait-level inattention, determines learning success from short, structured videos. The findings highlight how EEG synchrony can capture meaningful fluctuations in attentional state and inform the design of engaging educational materials.

Topic Area: ATTENTION: Multisensory

D5 - Attentional engagement strengthens the neural representation fidelity of narrative features

Anna Coriveau^{1,2} (coriveau@uchicago.edu), Jin Ke³, Monica D. Rosenberg^{1,2,4}; ¹Department of Psychology, University of Chicago, ²Institute for Mind and Biology, University of Chicago, ³Department of Psychology, Yale University, ⁴Neuroscience Institute, University of Chicago

Although watching movies and listening to stories requires prolonged attention, fluctuations in attention lead to varying levels of engagement with these narratives. Do ongoing changes in attention affect the fidelity with which stimuli are represented in the brain? To test this question, we collected functional MRI data from 60 participants who watched or listened to four naturalistic narratives: two audio-visual movies, one silent movie, and one podcast. Following scanning, participants re-watched/heard all narratives while reporting their continuous subjective engagement using a slider bar. Narratives were segmented into visual scenes and spoken sentences. We extracted visual and auditory representations using the convolutional neural networks AlexNet and Wav2Vec for scenes and sentences, respectively. Brain representations were defined as voxel-level beta estimates for all scenes and sentences using least squares separate modeling. To compare stimulus and brain representations, we calculated representational dissimilarity matrices (RDMs) reflecting 1-Euclidean distance between brain- or stimulus-level representations for pairs of stimuli in high- and low-engagement timepoints separately. Finally, we compared the correlation of brain and stimulus RDMs for high- vs. low-engagement moments in all brain regions. Results revealed that high engagement is associated with increased alignment

($p < .05$) between brain and stimulus representations in large swaths of the brain across narratives. Findings suggest that changes in engagement during narratives dynamically modulate neural representation fidelity, indicating an increase in stimulus-driven processing with greater attention.

Topic Area: ATTENTION: Multisensory

D6 - Effects of Perceptual Load on Sustained Attention States

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Perceptual load is known to enhance focused attention. Here we investigated whether perceptual load enhances or instead drains sustained attention, while using EEG to identify the associated neurophysiological correlates. 34 participants performed the gradual-onset-continuous-performance task, discriminating target (10% of trials) from non-target images that gradually transitioned to each other. Perceptual load was manipulated with image-overlaid salt-and-pepper mask. States of sustained attention were classified as “in-the-zone” or “out-of-the-zone” ($\pm 1SD$ or beyond $\pm 1SD$ from the intra-subject mean, respectively). Both high (vs. low) perceptual load and out-of-the-zone (vs. in-the-zone) states resulted in reduced accuracy, indicating increased attentional demand. In addition, the duration of in-the-zone states was shorter under high compared to low perceptual load. EEG results showed increased midfrontal theta power, and reduced parietal and occipital alpha power, during in-the-zone (vs. out-of-the-zone) states, and during conditions of high (vs. low) load. Additionally, an interaction of zone, load, and within-trial time, revealed that while the effect of perceptual load was found over the early period of new image (gradual) emergence, attentional-zone effects extended over a longer peri-transition period. These results suggest that sustaining attention under high perceptual load involves increased demands on midfrontal theta activity thought to reflect cognitive control and increased cortical excitability (seen with alpha suppression) at perception-critical time periods. While these were involved in sustaining in-the-zone states over a longer trial period. Together with the shortening of in-the-zone periods under high perceptual load, the results support a draining effect of perceptual load on sustained attention.

Topic Area: ATTENTION: Nonspatial

D7 - Neurophysiological basis underlying transition between attentional states

Sairamya Nanjappan Jothiraj¹ (sairamya.nanjappanjo@ucalgary.ca), Julia Kam²; ¹Postdoctoral Associate, ²Associate Professor

The human capacity to flexibly allocate attentional resources towards internal (attending to our inner thoughts) and external (attending to the external environment) states is essential for optimal performance in everyday situations. Although past functional neuroimaging studies have predominantly implicated the frontoparietal control network (FPCN) and ventral attention network (VAN) in attentional control, the

neurophysiological basis particularly inter-network communications underlying attentional switching remains largely unknown. To address this, we examined intracranial electroencephalography recordings from 20 patients with intractable epilepsy during an attention switching task. Our results revealed differential patterns of low frequency activity when switching to internal compared to switching to external attention within FPCN and VAN. A random forest within subject model successfully classified these two switching conditions using spectral power measures with a balanced accuracy of 87%. Notably, FPCN and VAN showed stronger phase synchronization at theta, alpha, and beta with the dorsal attention network or the default mode network as a function of the switching condition, with the direction of the information flow primarily going from FPCN and VAN to the other two networks. Finally, some of these connectivity measures were associated with subjective ratings of the switching experience, highlighting their functional significance. These findings offer new insight into how coordinated network activity supports attentional switching, which may have implications for interventions aimed at enhancing attentional regulation in clinical populations.

Topic Area: ATTENTION: Other

D8 - Novelty-Driven Attentional Shifts During Concept Learning

Madeline Bloomberg¹ (madeline.bloomberg@mail.utoronto.ca), Michael L. Mack¹; ¹University of Toronto

During new concept learning, attention is tuned to relevant features and systematically shifts when learning goals change. However, less is known about how attention operates when new information must be integrated into existing concepts. The hippocampus supports concept learning by engaging distinct pathways that serve complementary functions: the monosynaptic pathway extracts regularities and the trisynaptic pathway (TSP) encodes distinct episodes. We propose that encountering conflicting information triggers a novelty-induced encoding state in which TSP-related differentiation of exceptions can be observed through attentional reallocation that enables learners to update their concept representations. Using a delayed rule-plus-exception paradigm, eye-tracking measures, and model-based analyses with SUSTAIN, we will investigate how attention is tuned during learning and how it is reallocated in response to conflicting information. In our paradigm, learners will first acquire a general category rule. After mastering it, they will learn to categorize cross-over exceptions, stimuli that share features with rule-following items from the opposite category making them highly confusable. We expect that attention will be quickly directed towards diagnostic features during rule learning but expand to incorporate additional features when exceptions are encountered to facilitate category updating, and to differentiate exceptions from members of the opposite category. Eye-tracking data will show how this attentional reallocation aligns with model-based representational updates. Together, these findings will clarify how interactions among attention, learning, and memory enable the flexible formation and updating of concepts and identify the behavioural and computational signatures that capture this flexibility.

Topic Area: ATTENTION: Other

D9 - Cognitive modes underlying attentional control deficits in schizophrenia: A functional magnetic resonance imaging (fMRI) study

Madeleine Evora¹, Ava Momeni², Paul Metzack³, Aida Momeni⁴, Amber Lu⁵, Helen Hsiao⁶, Todd S. Woodward⁷; ¹BC Mental Health and Addictions Research Institute, ²Faculty of Medicine, University of British Columbia, ³Hotchkiss Brain Institute, University of Calgary

The current functional magnetic resonance imaging (fMRI) study examined the anatomical and functional patterns associated with attentional control deficits in schizophrenia. Participants completed a trivalent task switching paradigm in which they alternatively completed three tasks (i.e., identify colour, parity, or letter case), while viewing stimuli with one (univalent), two (bivalent), or three (trivalent) dimension(s). This required participants to counteract their attentional capture by biasing their attention away from up to two task-irrelevant dimensions. Three cognitive modes emerged via constrained principal component analysis (CPCA): (1) Multiple Demand (MD), (2) Language (LAN), and (3) Default Mode B (DM-B). Relative to neurotypical participants, patients with schizophrenia showed impaired task performance, muted but sustained activation of the MD mode, hypoactivation of the LAN mode, and hyperdeactivation of the DM-B mode. Moreover, the muted and sustained activation of the MD mode was associated with higher scores on hallucinations and delusions, while the hypoactivation of the LAN mode and the hyperdeactivation of the DM-B mode were associated with higher scores on poverty of speech and flattened affect. Thus, attentional biasing impairments in schizophrenia may reflect reduced engagement of task-positive MD and LAN modes and excessive suppression of task-negative DM-B mode, with mode-specific associations to symptom severity.

Topic Area: ATTENTION: Other

D10 - Impaired slow temporal sampling and cortical network coordination during natural speech listening in children with developmental language disorder

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Neural tracking of slow temporal modulations (< 10 Hz) in speech supports the extraction of prosodic and syllabic structure critical for comprehension, and also for language acquisition by infants. Temporal Sampling (TS) theory proposes that developmental language disorders arise from atypical cortical encoding of these slow prosodic and syllabic rhythms. However, direct source-level neurophysiological evidence from children with Developmental Language Disorder (DLD) remains scarce. We recorded magnetoencephalography (MEG) while 9-year-old children with DLD and typically developing controls listened to a narrated story. Computational modelling of this story quantified the temporal rates

relating to prosody and syllable structure. Using individualised source reconstruction, we quantified lagged speech–brain coherence and frequency-specific functional connectivity across bilateral auditory and speech-language cortical regions. Children with DLD showed significantly reduced speech-brain coherence in the 0.9–2.5 Hz range (prosodic structure), spanning bilateral auditory cortex and inferior frontal regions. At syllabic rates (2.5–5 Hz), coherence reductions were more spatially restricted and predominantly right-lateralised within superior temporal cortex. No reliable group differences were observed at higher modulation frequencies (5–9 Hz or 12–40 Hz). However, functional connectivity analyses revealed frequency-dependent alterations in inter-regional phase synchronisation across all bands, indicating disrupted large-scale cortical coordination during speech processing in DLD. These findings provide direct source-level MEG support for TS theory, identifying reduced slow-rate neural alignment as a key mechanism in developmental language disorder. The selective impairments in slow temporal speech sampling in DLD alongside altered cortical network dynamics during naturalistic speech perception would have profound developmental effects.

Topic Area: ATTENTION: Other

D11 - Does a “wait-and-search” strategy account for the item heterogeneity benefit in multiple object tracking?

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Multiple object tracking (MOT) is the ability to visually track a set of moving targets among moving distractors. Tracking performance typically benefits from item heterogeneity. Specifically, once motion stops, observers more accurately report target locations if, during motion, each item was unique in colour and/or shape, rather than identical. This benefit may reflect improved tracking ability. Alternatively, it may render continuous tracking unnecessary by enabling a “wait-and-search” strategy, where participants wait to relocate targets based on their identities just before motion stops and items become identical. Previous attempts to discourage the “wait-and-search” strategy (i.e., articulatory suppression, unpredictable motion duration) do not eliminate the heterogeneity benefit. To further assess if the heterogeneity benefit reflects a “wait-and-search” strategy, we compared visual search and MOT accuracy. Participants searched for or tracked four targets among 12 distractors. In both tasks, heterogeneity was introduced by making each item a unique combination of four colours and four shapes. The four targets could have the same colour, shape, or no common features. The search task mirrored the MOT task except that items were hidden behind identical diamonds during motion and participants were informed that items may switch places behind the diamonds. Thus, the search task could only be completed through a “wait-and-search” strategy. Search accuracy when targets had the same shape or no common features was significantly worse than MOT accuracy, suggesting that participants cannot solely rely on a “wait-and-search” strategy to produce the MOT heterogeneity benefit.

Topic Area: ATTENTION: Spatial

D12 - Decoding target validity in probabilistic cueing conditions using ERPs and alpha oscillations

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Probabilistic cueing biases spatial attention toward likely target locations, with high cue validity enhancing sensory processing. This enhanced processing is reflected by amplified early event-related potentials (ERPs) and strengthened anticipatory space-based effects in alpha-band (8–12 Hz) activity. Previous studies have used multivariate pattern classification to decode target location and validity, measuring both ERPs and alpha-band activity across cueing paradigms (instructional vs probabilistic), and found that higher decoding accuracy is associated with a stronger magnitude of target processing and faster reaction times. However, these studies only examined single cueing conditions, preventing direct comparison across cueing probabilities. Therefore, in the present study we have performed multivariate pattern classification on ERPs and alpha activity to decode target validity across two probabilistic cueing (Posner) paradigms. In Experiment 1 (80/20 condition), an arrow cue predicted the target location (left or right) with 80% validity; in Experiment 2 (50/50 condition), target validity was 50%. Using the alpha-based decoder, in the 80/20 condition, decoding accuracy rose significantly above chance 200 ms before target onset and persisted until 1200 ms after onset, $p = .008$, cluster-corrected, $n = 7$, whereas in the 50/50 condition, significance only emerged from around 150 ms to 250ms post-target. Ongoing analyses will apply the same decoding procedure to the same EEG datasets using multichannel ERPs. By contrasting 80/20 vs 50/50 probabilistic cueing with decoding, we show that the onset and duration of alpha-band signals distinguishing cued-target validity are modulated by cue reliability, providing a temporal marker of when expectations shape attentional control.

Topic Area: ATTENTION: Spatial

D13 - APOE4-Related Alterations in Reward Circuitry and Prosocial Effort-Based Decision Making in Older Adults at Risk for Alzheimer’s Disease

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Apathy is a common neuropsychiatric syndrome in Alzheimer’s disease (AD) linked to functional decline and deficits in effort-based decision making (EBDM). Aging is characterized by enhanced prosociality, behaviours that benefit others and society. APOE4 carriers, a genetic risk group for AD, are at heightened risk for apathy. Apathy is associated with structural and functional changes in the reward network, including the ventral tegmental area (VTA), nucleus

accumbens (NAc), and anterior cingulate cortex (ACC). Whether resting-state functional connectivity (rsFC) within the reward network contributes to EBDM impairments in APOE4 carriers remains unknown. Fifty-two cognitively unimpaired older adults (Mage = 68.48, 18 APOE4 carriers) with a familial history of AD completed a computerized task deciding whether to exert effort (button presses) for prosocial (charity donations) and self-oriented (monetary) rewards. APOE4 carriers and non-carriers were compared on task performance and ROI-to-ROI rsFC within the reward network. Non-carriers were more willing to exert effort for prosocial than self-oriented rewards at low-to-moderate values. APOE4 carriers showed equivalent willingness to exert effort for both reward types but required larger rewards to initiate effort than non-carriers. Relative to non-carriers, APOE4 carriers exhibited reduced VTA-NAc and NAc-ACC rsFC. VTA-NAc rsFC was associated with greater willingness to exert effort for low-to-moderate compared to high prosocial rewards, while NAc-ACC rsFC correlated with smaller rewards needed to initiate effort. These findings suggest APOE4 carriers demonstrate early alterations in reward processing during EBDM, highlighting a potential neural target for preserving motivation in those at genetic risk for AD.

Topic Area: EMOTION & SOCIAL: Development & aging

D14 - Targeted memory reactivation of rescripted content during sleep to reduce intrusive memories of traumatic film content

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Individuals living with post-traumatic stress disorder (PTSD) often experience intrusive, trauma-related memories that come to mind inadvertently. They are often distressing and can prevent those with PTSD from living full lives. Imagery Rescripting Therapy (ImR) is an effective therapy used to re-script the traumatic narrative into a more positive, resolved outcome, resulting in decreased symptoms. Our study leveraged sleep's established benefit for memory consolidation to promote ImR and reduce intrusions in an analogue trauma design. Targeted memory reactivation (TMR), a technique to unobtrusively reactivate specific memories during sleep, has recently been used to reactivate ImR of autobiographical memories and improve emotionality for these memories. In our study, participants watched a distressing film then engaged in an adapted version of ImR to rescript the film's content. They then took a nap in one of three conditions: TMR targeting the rescripted ending, TMR of neutral content, and no-TMR. We compared the number of intrusions between groups and noticed a trend towards less intrusive memories for consolidation biased towards the resolved ending. We will also analyze electroencephalography data from the nap to determine which spectral bands most predict this effect. These results inform us on how sleep is involved with trauma recovery, potential issues with consolidating unprocessed versions of the trauma, and most importantly the

potential benefits of TMR, an at-home scalable intervention for clinical populations.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

D15 - Affective neural processing during sleep correlates with depression symptoms

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During sleep, brain networks supporting cognitive functions are activated, leading to improved cognitive performance. We hypothesize that networks involved in affective processing are likewise active during sleep, and that their activity governs mental well-being in health and disease. We investigated this process using multivariate EEG decoding across wake and sleep. We further examine the relationship between activation patterns during sleep and individual differences in depression symptoms as assessed by standardized questionnaires. EEG was recorded from 64 channels in 52 healthy participants during an emotional-picture-viewing task (positive vs negative images) and during a subsequent nap. Using time-domain decoding analyses, we show that affective activation during sleep and restful wake correlated with depression symptoms, measured using Beck's Depression Index (BDI-II). These findings suggest that the spontaneous activation of affective networks during sleep reflects stable inter-individual differences in affective traits. This study offers insight into the neural mechanisms underlying affective processing during sleep and wakeful rest, with implications for how this implicit processing impacts psychological well-being, and highlights the potential of combining EEG decoding with psychological assessments to better understand individual differences in sleep-related affective processing. Taken together, these results provide evidence that spontaneous affective processing during sleep contributes to depression symptoms, with potential implications for identifying sleep-related biomarkers of affective disorders

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

D16 - Conversational engagement predicts interpersonal neural synchrony

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How is interpersonal connectedness reflected at the neural level? Previous joint-action studies have linked Inter-Brain Coupling (IBC) in the alpha band to synchronized attention/behaviors, whereas theta band IBC could reflect aligned cognitive strategies and shared intentions. Extending beyond highly controlled paradigms, our study investigated how two brains jointly facilitate naturalistic, spontaneous conversations. Specifically, we were interested in whether conversational engagement predicts IBC in the alpha and theta frequency bands. We recorded the dual-EEG ("hyperscanning") of 24 dyads while they engaged in conversations on common topics, after

which they provided behavioral ratings related to conversational engagement. For each electrode pair, we calculated instantaneous and listener-trailing (time lag ~170ms) IBC using Gaussian Copula Mutual Information. Then, for each type of IBC and frequency band, we fitted a linear mixed effects model to test whether IBC could be predicted by conversational engagement and at which region of interest (ROI). Our results revealed that conversational engagement significantly interacted with ROI in predicting both alpha instantaneous synchrony and theta listener-trailing coupling. Follow-up analyses showed that higher conversational engagement predicted greater instantaneous alpha IBC at ROI pairs involving the frontal areas, possibly reflecting the immediate, bottom-up alignment required for successful attentional and behavioral engagement. In contrast, higher conversational engagement was associated with lower theta listener-trailing IBC at the homologous medial-central ROI. This could indicate a more efficient cognitive alignment, with less effortful predictive processing required. Collectively, our study demonstrates that conversational quality is dynamically reflected in multiple facets of IBC.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

D17 - Adaptive Changes in Spontaneous Brain Activity After Virtual Reality Height Training in Healthy Individuals

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The fear system is an evolutionarily conserved mechanism enabling rapid threat detection and response, yet its adaptive regulation and underlying neurocognitive processes remain partly unknown. Exposure-based interventions can gradually shift threat processing from automatic emotional reactivity and bottom-up vigilance (amygdala–insula–ACC) toward top-down regulation and safety learning (vmPFC/dlPFC). Beyond task-related neural changes, resting-state activity reflects the consolidation of adaptive neural reorganization. Previous resting-state studies of other phobia extinction show prefrontal–limbic reorganization, reflecting reduced baseline emotional arousal and threat monitoring. Findings on height fear are limited to sensorimotor–visual spontaneous networks, suggesting diminished attention to external threat cues but leaving broader extinction mechanisms unclear especially in the healthy. Thirty healthy adults (Height = 16; Control = 14) completed four evaluation sessions within two weeks, including fMRI (both resting-state and height-fear-video watching task) and VR-based behavioral assessment. The height group trained at virtual high altitude, while control group walked on a virtual ground. Repeated VR-based height exposure significantly reduced subjective peak fear (Group × Session,

$p = 0.046$). A mixed-design ANCOVA on ReHo maps (DPABI V9.0_250415; GRF-corrected, voxel $p < 0.001$, cluster $p < 0.05$, two-tailed) revealed a potential Group × Session interaction in the right supramarginal gyrus. Preliminary results show a trend of greater fear reduction and adaptive modulation in height group. Ongoing analyses mainly focus on motion data and integrate ROI validation, resting-state connectivity (SN, CEN, motor networks) and task-evoked activation (amygdala, ACC) to clarify how resting-state–related intrinsic regulation and consolidation processes and task-state–related external threat and emotional response jointly shape height fear extinction in healthy individuals.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

D18 - Comparing effects of reward and punishment motivational contexts on cognitive control and downstream memory

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Reward and punishment motivation both promote cognitive performance and memory formation, but may do so by separable neuromodulatory systems leading to distinct profiles of cognitive effort and memory representations. Specifically, reward motivation has been linked to ventral tegmental area (VTA)/dopaminergic activity while punishment has been linked to locus coeruleus (LC)/norepinephrine activity, with both neuromodulator pathways altering activity in cortical regions key to cognition. Reward has been suggested to enhance memory both through enhanced attention at encoding as well as via post-encoding consolidation, but the extent to which reward-motivated memory is predicted by task engagement at encoding is unclear. Further, little is known about how attention at encoding, vs. post-encoding processes, might contribute to punishment-motivated memory. To compare motivated cognitive control performance and downstream memory under reward and punishment contexts, we conducted an fMRI study examining reward- vs. punishment-motivated performance in a face-word Stroop paradigm (valence between-groups; N=48 young adults each), and tested the extent to which motivational context and task performance at encoding predicted incidental 24-hour memory for face stimuli from the Stroop paradigm. Preliminary behavioral data indicate expected conflict effects as well as distinct effects of reward and punishment on Stroop performance, whereby incentive-related speeding was greater under reward. Planned analyses will examine trial-level item and source memory as a function of motivational context, task conflict, and Stroop performance, as well as examining the extent to which reward vs. punishment-motivated performance are linked with activity in neuromodulatory nuclei and in prefrontal/hippocampal regions critical for cognitive control and memory encoding.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

D19 - When Avatars Go To School: The Effect of Virtual Reality on Learning

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Crises like the COVID-19 pandemic and hurricanes Helene and Milton highlight the need for innovative educational solutions that engaged students when they cannot access physical classrooms. Virtual reality (VR) offers a promising next step, where students interact with peers, teachers, and content in immersive spaces that simulate real-world experiences. This study investigated how VR environments influence learning in college students. Participants engaged in a group memory task either in a 2D computer-based setting or a VR “classroom,” taking turns answering general knowledge questions and receiving teacher feedback directly or indirectly through others. A surprise retest measured error correction as a function of environment and feedback type, with self-reported emotional, physical, and task experience and heart rate variability (HRV) measures as mediating variables. VR reduced the typical self-error advantage observed in-person and in 2D conditions: Participants learned nearly equally from their own and others’ mistakes, suggesting heightened social focus in VR. While behavioral analysis showed that VR did not yield higher overall error correction than 2D, self-reported data further indicated that VR participants felt their environment positively affected engagement compared to 2D participants. Physiological data from recorded HRV did not significantly predict error correction performance, although VR and 2D environments differed marginally in HRV patterns. These results indicate that while HRV-based arousal did not account for learning differences, VR promoted comparable engagement and improved attention to others’ errors. Overall, VR may enhance shared attention and engagement through immersive sensory cues, helping overcome the typical advantage for learning from one’s own mistakes.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

D20 - Emotional contexts stored in long-term memory modulate delayed neural responses during scene recognition

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Emotion and memory both play crucial roles in guiding behavior, yet the neural mechanisms underlying their interaction remain incompletely understood. This fMRI study investigated whether emotional contexts stored in long-term memory (LTM) influence scene recognition. The experiment consisted of three tasks: a learning task (Day 1), a testing task (Day 2), and a delayed memory recognition task (Day X, where X indicates the number of days elapsed). On Day 1, participants (N = 25) encoded the spatial location of a target object in scenes presented with either negative or neutral emotional contexts. On Day 2, they performed a target detection task involving both previously learned (“old”) and novel (“new”) scenes. Several days later (Day X), participants underwent fMRI scanning while completing an old/new recognition task. Behavioral results revealed faster response times for old compared to new scenes, and for neutral compared to

negative scenes. Interestingly, discrimination performance (d' scores) for old versus new scenes was higher for neutral compared to negative scenes. fMRI analyses showed stronger and more widespread activation in the left prefrontal and bilateral parietal cortices for old versus new scenes, particularly in the negative condition compared to the neutral condition. Finally, activation magnitude in the parietal cortex was inversely correlated with the number of days elapsed, suggesting that shorter delays were associated with stronger neural responses to negative scenes. In conclusion, these findings highlight the interactive role of emotional context and LTM in shaping memory recognition over time.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

D21 - Inhibitory stimulation of the dorsolateral cortex impairs emotional regulation via disrupted frontoparietal and cingulo-opercular connectivity

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Implicit emotion regulation (ER) is a form of affective control that is executed without conscious effort or intention. Used habitually, it is very important for psychological well-being, yet its neural mechanisms are not well recognized. Here, we tested the causal role of the dorsolateral prefrontal cortex (dlPFC) in implicit ER using a within-subject design combining inhibitory transcranial direct current stimulation (tDCS), EEG-based connectivity analyses, and a self-control priming paradigm. Across three stimulation sessions (sham, left cathodal, right cathodal), participants (N = 35) passively viewed negative and neutral images under conditions of implicit regulation (REG) or no regulation (NREG). In the sham session, implicit ER reduced emotional reactivity, reflected in decreased Late Positive Potential (LPP) amplitudes and prestimulus alpha suppression in the right visual cortex—replicating prior findings and indicating modulation of both anticipatory and sustained processing stages. However, these effects were abolished following dlPFC inhibition. Directed connectivity analyses further revealed tDCS-induced disruptions in both within-network frontoparietal connectivity and cross-network interactions between frontoparietal and cingulo-opercular systems, particularly in the theta (3–7 Hz) and beta (15–30 Hz) bands. These findings support the idea that implicit ER engages large-scale cognitive control networks, with the dlPFC acting as a hub for dynamic coordination of visual and executive systems. Contrary to models that treat implicit ER as independent of cognitive control, our results indicate that even automatic regulatory processes depend on intact top-down circuitry and frequency-specific communication across networks.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

D22 - Breathprints of bilingual proficiency: Exhaled Volatile Organic Compound (VOC) biomarkers and GSR indexed cognitive load in English and Hindi

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The human body operates as an intricate physio-chemical system, continually generating volatile organic compounds (VOCs) via endogenous bio-chemical processes, which are emitted primarily through respiration and skin. While, non-invasive markers that track cognitive load during real-world language use could provide scalable assessment of language skills, whether breath chemistry provides such a marker has not been explored in details. We present the results obtained by conducting an experiment with 253 participants involving two reading – response tasks: They read a paragraph in English/Hindi and answered in English/Hindi. The performance results were assessed by an independent expert, who was not part of this study as a “blind assessment” meaning no details about the objective and mandate of the study were disclosed to the expert. Galvanic Skin Response (GSR), facial skin temperature, and exhaled VOCs were measured before the tasks, during tasks, and after completion. Four VOCs (acetone, isoprene, methanol, and m/z 43.039) were analysed as biochemical markers to assess the language proficiency. Our results demonstrate that cognitive load, as modulated by language processing demands, produces consistent and interpretable changes in specific VOC emissions. These findings establish VOC profiling as a promising, non-invasive modality for assessing language proficiency and related change in cognitive performance, independent of direct behavioural task scoring. This integrated, multimodal approach enhances our understanding of the biochemical signatures underlying cognition and highlights the potential of VOC profiling as a non-invasive biomarker for assessing language proficiency, with significant applications in educational assessment and the early detection of language-related disorders such as dyslexia.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

D23 - Neural Correlates of Curiosity: A Scoping Review

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Curiosity is a strong motivator that drives learning through cultivating a desire for knowledge. It is hypothesized that curiosity functions as a reward and activates brain areas implicated in reward processing. However, the extent to which this finding holds across studies with various tasks and samples is unknown as there is no systematic synthesis on the neural correlates of curiosity. We conducted a scoping review to examine how neuroimaging studies measure curiosity and what neural mechanisms are implicated in curiosity. In total, 1354 abstracts were screened, 55 articles went through full-text review, and 35 articles (11 EEG, 6 MRI, and 20 fMRI) met the criteria for inclusion. Across neuroimaging modalities, 58% of studies included trait curiosity measures and 44% included state curiosity measures. Trivia was the most common task used to study state curiosity (n=12), while other tasks included magic tricks, gambling, and distorted images. In task-based fMRI studies, areas of salience, higher order thinking, and reward networks were most commonly implicated in curiosity. These included the prefrontal cortex, frontal gyrus, cingulate, insula, striatum, and the parahippocampal gyrus as the most commonly reported areas of activation. The strong prevalence of higher order thinking and salience regions with more limited findings from the reward circuit suggests that perception and attention may have a more prominent role in curiosity than once previously thought. Results from this scoping review increase understanding of how the brain generates and experiences curiosity, supporting the development and refinement of motivation theories.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

D24 - Machine Learning Decoding of Emotional Valence from Intracranial Cortical and Subcortical Electrophysiological Signals

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Both cortical and subcortical brain regions are involved in emotion generation, but the extent to which neural activity in these circuits supports decoding of emotional valence remains unclear. Here, we investigated the feasibility of decoding emotional valence from intracranial recordings in patients with Parkinson's disease. We recorded local field potentials (LFPs) from the subcortical subthalamic nucleus (STN) and sensorimotor cortex of two participants chronically implanted with intracranial EEG. Participants performed an emotion rating task in which each trial consisted of viewing an image followed by a valence rating on a continuous scale (-50 to +50). Each participant completed five sessions (300 trials per session; 1,500 images in total). Spectral power features were extracted from LFPs for each trial, spanning image-viewing and valence-rating periods. Logistic regression and support vector machine classifiers were trained to discriminate between (1) positive versus negative valence and (2) neutral versus non-neutral stimuli. Performance was evaluated with 5-fold cross-validation and permutation testing against chance. Across participants, classifiers achieved statistically significant above-

chance decoding accuracy for both valence contrasts. We further found that decoding strength varied across brain regions and individuals. These findings demonstrate the feasibility of decoding subjective valence responses from intracranial STN and sensorimotor LFP activity during an emotion rating task. This supports the idea that signals from circuits commonly characterized to be motor-related can be leveraged to probe affect-related dynamics, motivating future work to characterize spatial and temporal specificity, dissociate affective representations from salience and motor factors, and explore applications of adaptive neuromodulation for affective symptoms.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

D25 - Neural state shifts in response to changing affective context

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Affect may impose structure on ongoing experience. Recent behavioral studies have found that changes in affect influence the organization of events in memory and align with reported event boundaries. Neural representations of affect are distributed throughout the brain including in subcortical brain areas and in the cortical hierarchy of regions implicated in processing continuous experience. How dynamic changes in affect influence the neural parsing of experience remains unclear. We hypothesize that neural states reflect affect such that there are slower changes in neural state in stable as compared to highly variable affective contexts. We applied a Hidden Markov Model-based neural segmentation algorithm to identify shifts in multivariate activation patterns in fMRI movie-watching data from the Emo-FiLM database (n=28). We used continuous affect ratings of the film stimuli to identify films high and low in affective surprise. Preliminary analyses indicate that the rate of neural state shifts in the angular gyrus and middle occipital lobe was significantly lower for films with more stable compared to more variable affective surprise. Unexpectedly, the rate of shifts was higher for films with more stable compared to more variable affective surprise in the amygdala and hippocampus (Wilcoxon rank-sum tests: p s < .001). These preliminary findings suggest that affective context may shape the dynamics of neural states at different timescales in different regions. Future work will assess the degree of alignment between affective surprise and neural state transitions across the cortical hierarchy and in subcortical emotion-related brain regions.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

D26 - Dynamic Reconfiguration of Large-Scale Brain Networks During Naturalistic Emotional Stimulation

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Emotions in real-world contexts unfold dynamically, engaging large-scale brain systems in time-varying configurations. Studies using naturalistic stimuli show greater variability in emotional responses

compared with controlled designs (Mishra, Srinivasan, & Tiwary, 2022; Horvat, Kukulja, & Ivanec, 2015). While specific brain regions have been linked to particular emotions, the connectivity dynamics underlying both basic and cognitively complex emotions are not fully understood. We applied dynamic functional connectivity (dFC) analysis to examine how emotional processing reorganizes core cortical networks during naturalistic stimulation. We analyzed 3T fMRI data from the StudyForrest project, in which 15 healthy adults (mean age = 29.4 years; range = 21–39; 6 females) watched the full-length film Forrest Gump. Following preprocessing and ICA-based denoising, signal independent components were categorized into major intrinsic networks using the Yeo 7-network atlas (Yeo et al., 2011), including the salience network (SN), central executive network (CEN), default mode network (DMN), visual(VN), somatosensory(SMN), and limbic networks(LN). A sliding-window approach (30s) with k-means clustering ($k = 4$) (Allen, 2014) identified recurring connectivity patterns. We observed transitions from low-connectivity periods to emotionally engaged configurations marked by increased coupling between key networks (SN, CEN, DMN) and enhanced intra-network connectivity within the DMN. Connectivity states were aligned with time-resolved emotion annotations (Labs et al., 2015), with a dominant low-connectivity state showing high dwell time and transient high-connectivity states moderately associated with emotional intensity. These findings demonstrate reproducible dynamic network reconfigurations during naturalistic emotional experiences, supporting the integration of emotion and cognition.

Topic Area: EMOTION & SOCIAL: Emotional responding

D27 - Uncertain Hearts: Imprecise Interoceptive Beliefs in Alexithymia

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Interoception refers to the perception of internal bodily signals such as heartbeats. Previous studies have shown that alexithymia, defined as difficulty in identifying and describing emotions, is associated with reduced interoceptive accuracy. However, traditional interoceptive tasks, including the heartbeat counting and discrimination tasks, mainly reflect subjective beliefs about one's heart rate rather than interoceptive accuracy. This study examined the relationship between alexithymia and interoceptive belief using the Heart Rate Discrimination (HRD) task developed by Legrand et al. (2022). Seventy Japanese university students (49 women; $M = 21.0$ years, $SD = 2.22$) completed the HRD task and self-report questionnaires assessing alexithymia (TAS-20), autistic traits (AQ), depression (SDS), anxiety (STAI), and interoceptive sensibility (MAIA). The HRD task quantifies belief bias (α : deviation from actual heart rate) and precision (β : estimation uncertainty) under interoceptive and exteroceptive conditions. It also provides a confidence index that

captures metacognitive awareness of one's interoceptive belief. Holm-corrected partial correlations controlling for SDS, STAI, and AQ revealed that, in the interoceptive condition, β correlated positively with TAS-20 total ($pr = 0.06$, $p = 0.038$) and Externally Oriented Thinking (EOT; $pr = 0.14$, $p = 0.021$), while α correlated with Difficulty Describing Feelings (DDF; $pr = 0.11$, $p = 0.022$). Under the exteroceptive condition, β and α correlated negatively with EOT. These findings suggest that alexithymia is characterized by unstable and biased interoceptive beliefs, which may impede emotion recognition and promote somatization by misinterpreting bodily sensations as physical symptoms.

Topic Area: EMOTION & SOCIAL: Other

D28 - White Matter Integrity and Creativity in the Aging Mind

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Although aging is associated with declines in white matter integrity and some cognitive abilities, creativity often remains stable, suggesting possible neural compensation or reorganization. We examined associations between white matter microstructure and creative potential and achievement in middle- and older-aged adults to identify neural mechanisms supporting creativity in aging. A subset of 76 cognitively unimpaired participants from the Vanderbilt Memory and Aging Project completed the Abbreviated Torrance Test for Adults (ATTA), Creativity Assessment Questionnaire (CAQ), Behavioral Inventory for Creative Behavior (BICB), and Kaufman Domains of Creativity Scale (KDCS). Composite scores were derived for artistic and scientific creative achievement (CAQ, KDCS) and everyday creativity (BICB, KDCS). Participants also underwent diffusion tensor imaging (DTI). Images were manually inspected for artifacts and processed using standard FSL and tract-based spatial statistics pipelines. Fractional anisotropy (FA) values were extracted and voxel-wise linear regressions examined associations between DTI metrics and creativity measures, controlling for age and sex. Participants were mostly female (56.3%), non-Hispanic White (67.1%), college educated ($M=16.63 \pm 2.30$), and had a mean age of 62.18 years ($SD=7.06$). ATTA scores were not associated with FA in any region (all $p>0.466$), nor were creative achievement composite scores associated with FA in any region (all $p>0.069$). No associations were found between white matter integrity and creative potential or achievement in middle- and older-aged adults. Because creativity relies on diverse cognitive processes, age-related compensatory neural recruitment may underlie the observed absence of associations. This theory remains speculative and warrants further investigation into the neural mechanisms underlying creativity in aging.

Topic Area: EXECUTIVE PROCESSES: Development &aging

D29 - Does Bilingualism Protect against Cognitive Decline? Cross-sectional and Longitudinal Evidence from Ethnically Diverse Older Adults

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The benefits of bilingualism for maintaining late-life cognition remain controversial, with mixed evidence across populations. We conducted the first large-scale, longitudinal investigation of bilingualism in an ethno-racially diverse cohort, with 4,140 participants at baseline (1,013 bilingual) and 1,760 individuals (522 bilinguals) with up to four follow-ups. Cognitive outcomes included dementia status (unimpaired vs. probable dementia) and scores on executive function and episodic memory factors, with ethnicity and gender as potential moderators. Longitudinal analyses revealed that bilingualism predicted slower episodic memory decline irrespective of ethnicity, gender, education, baseline age, and practice effects. However, the cross-sectional associations between bilingualism and cognition varied by ethnicity and gender. These findings suggest that while the influence of ethnicity on the cognitive effects of bilingualism in cross-sectional differences may reflect sociodemographic factors, the longitudinal benefit of bilingualism on memory is consistent with a neuroprotective benefit. Overall, this study provides novel insights into how bilingualism shapes cognitive aging and highlights its potential for promoting late-life cognitive resilience.

Topic Area: EXECUTIVE PROCESSES: Development &aging

D30 - Associations Between Early Life Adversity, Brain Aging Trajectories, and Impulsivity in Youth

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Early life adversities (ELA), encompassing instances of abuse and neglect, profoundly affect neurodevelopmental systems that support cognitive health and emotion regulation. Recent evidence suggests that ELA may alter "brain age," a machine learning derived biomarker that indicates deviations from expected neural maturation. Several studies report brain age may predict risk for cognitive health outcomes like dementia. However, little is known about trajectories of brain aging and how these trajectories influence behaviors contributing to such risks. This project addresses this gap by investigating how ELA relates to brain age trajectories and whether these patterns are associated with behavioral correlates, specifically impulsivity. Youth aged 14-22 were sampled across four waves of the IMAGEN study. Leveraging a time-series clustering algorithm sensitive to non-linear changes, seven unique brain aging trajectories were identified. Associations between ELA, characterized through a composite of self-reported experiences, and brain age trajectories were examined to elucidate if differential

levels of ELA mapped to specific patterns of neurodevelopment. ELA was significantly associated with three trajectories; two demonstrated unique patterns of increase in brain age over time while one demonstrated a decrease. This study then tested how brain age trajectory and ELA interacted to influence impulsivity. Results indicate that higher ELA and a trajectory marked by decreasing brain age over time significantly associated with impulsivity. These findings highlight that ELA may not uniformly accelerate brain aging, but rather contribute to heterogeneous trajectories that confer facets of risk and resilience.

Topic Area: EXECUTIVE PROCESSES: Development &aging

D31 - Neural Correlates of Menopause: An investigation of Working Memory and Grey Matter Volume Changes in the UK Biobank Database

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Menopause occurs 12 months after a woman's final menstrual period. It represents a major endocrine transition marked by declining estrogen levels that may influence brain structure and cognition. Neuroimaging studies have reported reductions in grey matter volume (GMV) across frontal, cingulate, and parietal regions during menopause, though findings are mixed and often limited by small samples. Large population datasets such as the UK Biobank provide an opportunity to clarify the neural correlates of menopause at scale. Participants were categorised as pre-menopausal (N = 656), perimenopausal (N = 167), or post-menopausal (N = 2512) based on menstrual history and self-report. Age-matched male comparison groups were also created. Verbal working memory (WM) was assessed using the numeric memory task, in which participants recalled number sequences (2–12 digits) in reverse order. GMVs were extracted from T1-weighted MRI scans for key regions implicated in WM- the inferior, middle, and superior frontal gyri, anterior cingulate cortex, and superior parietal lobule. Planned analyses include two-factor ANCOVAs testing sex × menopause stage effects on WM and GMV, correlations between GMV and WM across the full sample, and hierarchical regressions assessing whether menopause stage predicts WM performance via GMV changes in fronto-parietal-cingulate regions. Age and education will serve as covariates. We anticipate lower GMV and modest WM reductions post-menopause. This study aims to elucidate how menopause influences brain structure and WM within a large population sample—addressing gaps in earlier small-scale studies. This Sketchpad abstract outlines our study rationale, design, and planned analyses for feedback before final modelling.

Topic Area: EXECUTIVE PROCESSES: Development &aging

D32 - Neural and behavioral mechanisms of cognitive control in patients with movement disorders undergoing deep brain stimulation surgery

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Cognitive control involves processing sensory information from the environment and identifying relevant cues to govern actions. Cognitive control occurs in an anticipatory (proactive) or late-corrective (reactive) manner. Patients with Parkinson's disease (PD) often exhibit impaired cognitive control and altered scalp potentials compared to healthy controls. However, the spatiotemporal dynamics of these EEG signals remain debated. We investigated the neural basis of cognitive control in patients with movement disorders using subdural electrocorticography (ECoG) recorded during deep brain stimulation (DBS) surgery. Six patients (four PD and two essential tremor) performed the AX-continuous performance task (AX-CPT) intraoperatively. The task evaluates proactive and reactive control by requiring context-dependent responses to a conditioning cue – probe stimulus sequence. To assess neural dynamics of cognitive control, two six-contact subdural ECoG strips were temporarily placed: one anteriorly over dorsolateral prefrontal cortex (DLPFC) and one posteriorly over the primary motor cortex (M1), ipsilateral to the DBS implant. All but one PD patient showed equal or lower error rates (<10% difference) and faster response times (0 - 300 ms) in the proactive compared to the reactive context. Spectral power analyses revealed increased theta (3-8.47 Hz) and lesser beta (12-32.8 Hz) activity in DLPFC during the anticipatory response interval in the proactive compared to the reactive context. This pattern may reflect active maintenance of task goals/responses and preparation of executive control networks. Ongoing analyses aim to further characterize the spatiotemporal organization of spectral power across recording sites, hemispheres, and patient groups to better understand disease-related alterations in cognitive control.

Topic Area: EXECUTIVE PROCESSES: Goal maintenance & switching

D33 - Susceptibility to proactive interference contributes to depression-related episodic memory impairments across the adult lifespan.

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Depression has well-known impacts on social and emotional well-being but is also associated with cognitive impairments affecting everyday functioning. Deficits in executive functions, as well as reduced volume of the prefrontal cortex supporting these functions, are well-established features of depression. Critically, they may also contribute to impaired episodic memory performance often experienced with depression, particularly when demands on executive functions are high. In the current study, we explore how varying levels of depressive symptoms influence susceptibility to proactive interference, measured covertly as neural reactivation of older,

competing memory associations, and ability to resolve it during associative memory encoding, in individuals across the adult lifespan. We recruited individuals aged 18-75 years old who completed a proactive associative memory interference task during fMRI scanning. Individuals saw objects paired with either a face, a scene, or a color, some of which were presented multiple times with multiple different associates. Participants were instructed at retrieval to recall only the most recent associate. We find that greater neural reactivation, measured using multivariate pattern analysis (MVPA), of the previously paired image category (proactive interference) during encoding predicts a higher proportion of memory errors for re-paired items, particularly in individuals with depression. This suggests that depression-related memory deficit may be partially attributable to impaired ability to overcome interference from competing information.

Topic Area: EXECUTIVE PROCESSES: Monitoring & inhibitory control

D34 - Neural evidence of suppression failure in working memory under high semantic activation

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Suppressing the maintenance of an item in working memory reduces immediate access to it and degrades the quality of its representation in long-term memory. Preliminary behavioral evidence has shown that the efficacy of suppression is hindered, however, for memoranda that promote semantic activation, e.g. by grouping items that share a semantic category. One possible mechanism could be that semantic activation changes an item's representation into a format inaccessible to the suppression mechanism (e.g., chunking), resulting in failure of suppression regardless of the level of engagement of the cognitive operation. We address this hypothesis with multivariate pattern analysis of EEG data. On each trial, participants (N=34) first encode four images that were either grouped (high semantics) or interleaved (low semantics) by category, then are cued to either maintain or suppress one of the items, and finally respond to a memory probe. The key behavioral finding is that suppressed items on interleaved trials show poorer accuracy compared to maintained items ($p=0.017$, $BF_{10}=4.76$) and compared to suppressed items on grouped trials ($p=0.014$, $BF_{10}=5.84$). Furthermore, we demonstrate, for the first time in EEG data, successful decoding of maintenance suppression using power in six canonical frequency bands decomposed across 64 electrodes in 100 ms time bins. Interestingly, increased neural evidence for suppression engagement on grouped trials correlated with increased accuracy (failed suppression) compared to interleaved trials ($p=0.067$, $BF_{10}=1.34$). These results provide new insights into the neural mechanisms by which semantic activation impairs suppression in working memory.

Topic Area: EXECUTIVE PROCESSES: Working memory

D35 - The Neural Mechanisms of Working Memory Under Acute Stress

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Acute stress is known to impair working memory (WM), but the underlying neural mechanisms remain unknown. We investigated the hypothesis that acute stress disrupts top-down modulatory input from the prefrontal cortex (PFC) to sensory regions that store WM representations weakening representational fidelity in these regions. This hypothesis was motivated by (1) well-established findings that acute stress triggers hyperdopaminergic release in PFC, impairing its function, and (2) recent proposals that top-down input from PFC to sensory regions sculpts the precision of sensory WM representations. To test our hypothesis, we had participants complete a modified N-back WM task with face and scene stimuli across separate stress and control sessions while recording brain activity using fMRI. Stress was induced using the socially evaluative cold pressor test. We predicted that acute stress would result in (1) PFC hypoactivation; (2) reduced distinctiveness of WM representations in sensory regions; and (3) reduced connectivity between PFC and sensory regions. Preliminary analyses from four subjects showed that stress impaired WM performance (accuracy and reaction time), consistent with previous findings. In line with our first two predictions, we observed a trend toward reduced BOLD activation in the PFC and lower classification accuracy when decoding within-category (attended vs. ignored) stimuli from face-selective visual regions. Future analyses will incorporate functional connectivity measures, physiological markers of stress, and account for baseline differences in participants' dopamine function in order to further elucidate how stress alters WM processes.

Topic Area: EXECUTIVE PROCESSES: Working memory

D36 - Cardiovascular Risk Moderates the Association Between Traumatic Brain Injury Severity and Attention in Hispanic/Latino Adults

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Although cognitive deficits are common immediately following traumatic brain injury (TBI), recovery is often expected. Less is known about long-term cognitive effects in adults, particularly among Latino populations who face disparities in TBI care and a high prevalence of cardiovascular disease (CVD) risk factors. We hypothesized that greater TBI severity (moderate-to-severe vs mild) would be associated with poorer cognitive performance and that this association would be stronger with greater CVD risk. Participants were 57 Latino adults aged 46-85 years from the TBI Model System database. Cognitive performance was assessed using the Brief Test of Adults Cognition by Telephone (BTACT), including immediate/delayed word recall, backward digit span, category fluency, and backward counting. Linear regression examined associations between TBI severity and cognition, and moderation analyses tested whether CVD risk modified these

relationships. Models adjusted for age, sex, education, socioeconomic status, and language. Moderate-to-severe TBI was associated with poorer backward counting performance compared to mild TBI ($b = -5.52$, $p = .03$). CVD risk significantly moderated this association (interaction $b = -8.40$, $p = .048$), such that higher CVD risk was associated with worse backward counting among moderate-to-severe TBI ($r = -.55$, $p = .007$) but not in the mild TBI group ($r = -.11$, $p = .48$). Fisher's r -to- z comparison indicated a trend toward group differences ($z = 1.81$, $p = .07$). Backward counting, a measure of attention/working memory, may be sensitive to long-term cognitive vulnerabilities following severe TBI. Elevated CVD risk appears to exacerbate these deficits, underscoring the importance of vascular health in cognitive outcomes following TBI among Latino adults.

Topic Area: EXECUTIVE PROCESSES: Working memory

D37 - Cortical latency predicts reading fluency from late childhood to early adolescence

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Progressive development of reading comprehension fluency from late childhood to early adolescence is remarkably linked to changes in the temporal dynamics of visual word recognition. EEG/ERP based measures of how an individual participant's cortical timing for visual word recognition change over development are limited by low reliability. We present a novel approach to this challenge that models cortical latency to visual word forms by extracting phase values from Steady-State Visual Evoked Potentials (SSVEPs) for each participant. The resulting precise and reliable timing information for neural signatures underlying visual word form processes help account for the development of fluent reading comprehension. Typically developing readers ($n = 68$), aged 8–15 years, viewed streams of four-character stimuli presented at 3 Hz, which evoked large significant power spikes from every participant. Linear phase by frequency functions across harmonics at 3, 6, and 9 Hz were consistent with a delay model, indicating a mean latency of 170 milliseconds. Subject-level latencies revealed (a) high internal consistency ($r = .94$); (b) stability across variations in character-level (letters, unfamiliar pseudo-characters) and word-form level (words, nonwords, pseudofont strings) manipulations; (c) a linear relationship with age; and most remarkably, (d) a strong relationship with individual variation in the fluency of reading comprehension, that was (e) mediated by word naming speed. Results suggest a promising new approach for investigating the neural basis of reading development across several levels of processes, with temporal precision at the individual level that holds translational significance for promoting population-level fluency in reading comprehension.

Topic Area: LANGUAGE: Development & aging

D38 - The Unique Role of Language in Reshaping Perception: Enhanced Neuronal Distinction

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Language shapes perception through measurable neurobiological mechanisms. This research demonstrates that verbal labels causally enhance perceptual discrimination through a novel mechanism termed Enhanced Neuronal Distinction (END). Across three controlled experiments, participants learned to associate novel pseudowords with initially indistinguishable tactile vibration patterns delivered to the fingertip. Discrimination accuracy improved significantly only when tactile patterns were paired with consistent verbal labels, not with inconsistent labels or matched non-verbal auditory stimuli such as musical tone sequences. Functional MRI revealed that this behavioral enhancement corresponded with strengthened connectivity between auditory and somatosensory cortices, providing direct neural evidence for language-driven perceptual reorganization. END theory explains these findings through Hebbian learning principles: when similar percepts activate largely overlapping neural populations, verbal labels recruit distinct phonological networks from perisylvian language areas. This creates enlarged cross-modal cell assemblies that reduce proportional overlap between perceptual representations, enabling discrimination of previously confusable stimuli. The specificity of verbal labels over non-verbal auditory controls reveals language as a unique neuroplastic agent, not through semantic content, but through integration within pre-established linguistic networks developed during language acquisition. Musical tones, despite being equally distinct and learnable, lack access to these extensive neural infrastructures, resulting in smaller, less effective assemblies. These findings establish language as a powerful driver of neuroplasticity and perceptual change, offering the first integrated framework bridging behavioral demonstrations of linguistic relativity with biologically plausible neural mechanisms. Implications extend to cognitive neuroscience, learning biology, and theories of language-thought interaction.

Topic Area: LANGUAGE: Other

D39 - In-scanner individualized theta-band tACS as a neuromodulatory pathway for enhancing language processing

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Roughly one in five adults in the United States experiences difficulty encoding and understanding written language, yet existing interventions for language comprehension (LC) have shown limited success. Low LC in adults is characterized by largely intact but slow single-word reading, and this reduced automaticity cascades into effortful comprehension. Previous research suggests that such "effortful LC" is both supported and mitigated by dynamic communication between the cognitive control network (CCN) and the

reading–language network (RLN). In the present study, participants completed two sessions of individualized theta-band transcranial alternating current stimulation (tACS; 2 mA, 25 min) targeting the left dorsolateral prefrontal cortex and the left angular gyrus while reading scientific passages: Session 1 delivered stimulation during MRI, and Session 2 delivered stimulation outside the scanner, immediately followed by EEG. Our results revealed enhanced engagement of frontoparietal control and default-mode subsystems associated with integrative language processing in the stimulation group. Multimodal joint independent component analysis of fMRI and EEG data identified a significant P600 component in the post-stimulation group, engaging a distributed control–language network with medial default-mode coupling, consistent with strengthened syntactic–semantic integration. Whole-brain GLM comparing stimulation- versus sham-related change showed coordinated modulation across CCN, DMN, and medial temporal systems. These findings provide preliminary evidence that individualized theta-band tACS enhances cross-network communication supporting encoding resilience—the ability to sustain comprehension and integration under cognitive demand—suggesting a mechanistic pathway for neuromodulatory enhancement of language comprehension.

Topic Area: LANGUAGE: Other

D40 - Extracting visual and linguistic responses to continuous natural sign language

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While we communicate, our brains often must parse and process a continuous barrage of sensory information in real time. Although a lot is left to be discovered, the study of natural connected speech has yielded vast insight into how the brain receives, encodes, and transforms acoustic information into neural representations that carry meaning. We have also gained tremendous insight into how these processes are affected by other sensory inputs or cognitive processes like attention and predictive processing. Yet we cannot be sure whether the knowledge is general or relevant only to speech. Studies of natural sign language are yet few and the field is ripe for study. To understand signed language more specifically and natural language more broadly, it is imperative to develop our current tools to fit the structure of other languages. In this presentation, we will highlight relevant similarities and differences between speech and sign and discuss their implications on how we analyze neural data recorded during sign. We will also present preliminary analysis of electroencephalography (EEG) recorded while fluent signers watched a short story in American Sign Language (ASL). ASL videos will be analyzed in terms of their low-level physical structure, such as luminance changes or sign pose estimation, and higher-level structures associated with linguistic content and meaning. Temporal response functions will be fit to EEG using these aforementioned stimulus features derived from the ASL videos. Finally, we'll discuss

some caveats, benefits, and potential fruitful future directions in the study of sign language processing.

Topic Area: LANGUAGE: Other

D41 - Investigating hippocampal predictive processing in speech-based statistical learning

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Statistical learning (SL) is a fundamental learning mechanism that supports the extraction of regularities from the environment to support many different aspects of perception and cognition. The hippocampus has been proposed to play a central role in SL, but current evidence regarding its involvement is mixed. While neuroimaging evidence suggests that the hippocampus is involved in SL, prior intracranial EEG data do not directly support a role for the hippocampus. To reconcile these conflicting findings, we hypothesized that the hippocampus does not directly support learning but rather retrieves already learned regularities to generate predictions of upcoming stimuli. In the current study, 21 patients with drug-resistant epilepsy implanted with intracranial depth electrodes listened to a continuous speech stream containing repeating “hidden” trisyllabic words. In the following test phase, participants made speeded responses to specific target syllables embedded within shorter snippets of the speech stream while their brain activity was recorded. At the behavioral level, we found faster reaction times to syllables in later, more predictable positions within a word, compared to word-initial syllables. At the neural level, preliminary event-related potential (ERP) analyses revealed a subset of electrode contacts that showed an ERP effect prior to the onset of a target syllable, relative to non-target syllables, suggesting task-relevant predictive processing. These electrode contacts were mainly located within the hippocampus, insula, and middle temporal cortex. These results suggest that the hippocampus is part of a network of brain regions that supports the prediction of upcoming syllables as a consequence of statistical learning.

Topic Area: LANGUAGE: Other

D42 - Reading the signs: Encoding models generalize from English to ASL in novice signers

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As someone learns a new language, do they map new information onto a semantic space that overlaps with language they already know? Evidence suggests that early-stage learners rely heavily on their established language to scaffold new learning, but many prior studies only utilize small lists of single words. Large language models (LLMs) have provided new avenues to probe neural processing of complex semantic information embedded in realistic utterances. Given recent findings that LLMs trained in different languages can be aligned to a

shared embedding space with respect to semantic meaning, we sought to determine whether neural representations of language similarly converge on a shared neural substrate in novice learners. We present data from 32 English-speaking, nonsigning participants who underwent fMRI scanning before and after a three-week introductory course in American Sign Language (ASL). We found that after (but not before) learning, a voxelwise encoding model trained on the mapping of LLM embeddings to neural responses to English was able to predict neural responses to an independent set of ASL sentences in several regions including bilateral posterior superior temporal sulcus (pSTS) and left superior temporal gyrus (STG). The pSTS in particular has been implicated in sign language processing when cognitive demand is high, as in novice learners. As well as demonstrating the ability of encoding models to learn semantic mappings that generalize across language and modality, these results shed light on the neural underpinnings of emerging comprehension skills in the first few weeks of exposure to signed language.

Topic Area: LANGUAGE: Semantic

D43 - What is so difficult about abstract words, anyways? A neuromechanistic explanation using brain-constrained neural network models

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It is well known that young infants first learn words with concrete meaning, whereas abstract ones are typically acquired later. To obtain clues about the underlying causes and mechanisms, a brain-constrained neural network model with spiking neurons and unsupervised Hebbian learning was trained on instances of concrete and abstract concepts. Before word learning, concrete and abstract concept formation was simulated based on the similarity structure of objects, actions and scenes exemplifying instances of the concept. Subsequently, conceptual instances were co-presented with word forms to establish semantic links and direct grounding of symbols in the world. When instances of concrete concepts (e.g., different DOGs or HAMMERS) were learnt, the network built conceptual representations as neuronal circuits which consistently activated to each of these instances and remained reverberant, thus revealing a mechanism of working/active memory. Such concept formation was impossible for abstract concepts (e.g., FORCE, OBEY). The resultant neuronal circuits selectively responded to their grounding instances, but failed to generalize to the whole concept or to reverberate. When learning a word form for each concept, abstract symbols developed fully functional neural circuits with generalized activation and working memory, comparable with those of concrete symbols. However, we found a delay in forming representations for abstract relative to

concrete symbols. Our results suggest that well-known differences in developmental trajectories of different symbol types are caused by structural dissimilarities between the real-world events these symbols are used to speak about. We discuss the underlying neural mechanisms and the psychological and linguistic differences they relate to.

Topic Area: LANGUAGE: Semantic

D44 - Bilateral Neural Efficiency in Lexical Tone Learning: Evidence from sEEG

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A dual stream model of language processing postulates that while spectrotemporal cues of spoken language are processed bilaterally, lexical-semantic processes and linguistically relevant articulatory features are left-dominant, respectively subserved by the ventral and dorsal streams. Investigation of lexical tone learning is particularly interesting as it affords the opportunity to evaluate whether left lateralization occurs as a result of learning to integrate pitch into lexically relevant units. In a 3-day learning paradigm, nine treatment-resistant epileptic patients learned to map novel tonal syllables onto pseudowords with assigned meanings while undergoing stereo-electroencephalography (sEEG). Each day, participants completed two sessions of a three-stage task: exposure (encoding of sounds to form meaningful word associations), retrieval practice with feedback, and testing without feedback. Participants improved significantly across the three days. Electrodes showing a significant increase in high-gamma activity (HGA) after sound onset were chosen as responsive contacts. Using representational similarity analysis (RSA), we identified widespread sound-encoding contacts covering bilateral auditory regions and left putamen, defined by an increase in representational distance of HGA across tone patterns from Day 1 to Day 3. Correct trials showed a significant reduction of HGA in left superior temporal gyrus (STG) and right Heschl's gyrus compared to incorrect trials. Furthermore, connectivity decreased in bilateral STG-insula, right STG-putamen and left STG-middle temporal gyrus (MTG) during exposure and testing, suggesting more efficient encoding and reduced retrieval efforts in lexical tone learning. While lending support to components of the dual stream model, the results provide additional insights into processing efficiency during language learning.

Topic Area: LANGUAGE: Semantic

D45 - Affect and the neural perception of grammaticality

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Affective state is known to influence cognitive processing (Loftus et al., 1987). However, its role in perception of grammatical structure in sentences remains understudied. In an event-related potential (ERP) study, we examined whether dispositional affect interacted with syntactic processing, using stimuli from Osterhout and Holcomb's seminal paper on the P600 effect, a marker of syntactic anomaly (Osterhout & Holcomb, 1992). To this end, 25 participants read sentences (critical words are underlined) such as (i) The broker planned to conceal the transaction *_was_ sent to jail vs. (ii) The broker persuaded *_to conceal the transaction _was_ sent to jail. We did not replicate the previous P600 finding at 'to', however, the P600 effect downstream at 'was' did replicate. Next, based on previous work in our lab, we hypothesized that individuals who reported more positive affect would show larger P600 effects at 'was'. Our results did show a significant positive correlation between positive affect scores and P600 amplitude. Furthermore, in a related behavioural web-based study, we found that Likert scale acceptability judgments on these same stimuli also positively correlated with positive affect. That is, grammatical sentences received higher ratings by individuals with high positive affect. Taken together, these findings suggest that the underlying neural mechanism for positive affect allows for better perception of grammatical structure.

Topic Area: LANGUAGE: Syntax

D46 - Heritage Bilinguals Adaptively Tune Prediction of Grammatical Category Across Languages

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Prediction is a core function of the brain, allowing efficient processing by pre-activating likely upcoming information. During reading, prediction is evident in the timing and pattern of eye movements. Little is known about how bilinguals predict grammatical categories during reading and whether such prediction generalizes across languages. This study examined word-category prediction by testing how parafoveal preview validity modulated reading behavior in monolinguals and Spanish-English heritage bilinguals. We employed a boundary-change eye-tracking paradigm, manipulating the validity of parafoveal preview and target word categories (noun vs. verb) during reading. English monolinguals and heritage bilinguals tested in L2 read English sentences; a different group of heritage bilinguals, tested in L1, read Spanish sentences. Skipping rate, first-fixation duration, and total time on the target region were analyzed with mixed-effects models. English monolinguals showed preview-validity effects across

all measures, indicating that effects of prediction during reading begin at the earliest levels of processing. In contrast, bilinguals tested in English showed preview-validity effects on first-fixation duration and total reading time but not on skipping, suggesting early and late facilitation without riskier eye movements. A significant Group × Preview Validity × Word Category interaction was found in total times, revealing lingering preview-validity effects for nouns but not for verbs, only in bilinguals. In bilinguals assessed in Spanish, preview validity influenced only first-fixation duration. Across bilinguals, greater daily English use predicted stronger preview-validity effects. These findings reveal that the brain's predictive mechanisms differ between monolinguals and bilinguals and are tuned by bilinguals' language use and grammatical category.

Topic Area: LANGUAGE: Syntax

D47 - The Neural Dynamics of Hierarchical Syntactic Structures During Language Comprehension

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Human language comprehension relies on the brain's capacity to build syntactic structure in real time, yet the neural mechanisms underlying this process remain poorly understood. Most neuroimaging studies of syntax have focused on identifying the spatial localisation of syntactic processing, while others relied on controlled stimuli, restricted frequency ranges, simplified syntactic representations, or computational models that do not reflect incremental sentence processing. As a result, little is known about how neural oscillations coordinate to support syntactic structure building during continuous, naturalistic speech. This study addresses this gap by developing a neurobiologically grounded model of how interactions across oscillatory frequency bands from delta to low gamma support syntactic processing during naturalistic spoken language comprehension. A magnetoencephalography (MEG) dataset from 27 participants listening to four English narratives was used, with structural MRI data from 12 participants enabling source localisation. Syntactic structure was modeled using a psycholinguistically plausible parser that constructs incremental hierarchical representations, generates predictions, and resolves syntactic ambiguity as linguistic input unfolds. From this model, five syntactic features were derived, each reflecting key stages in the construction of hierarchical syntax. Using multivariate temporal response functions (mTRFs), frequency bands are examined for syntactic feature encoding, with reconstruction accuracy and RMSE scores analysed using linear mixed effects and Bayesian modeling. Preliminary findings indicate theta, beta and low gamma contributions in bilateral temporal and frontal brain regions. These findings offer an emerging mechanistic and temporally precise account of syntactic structure building, advancing our understanding of how the brain constructs syntax during naturalistic language comprehension.

Topic Area: LANGUAGE: Syntax

D48 - The impact of aging on sharp-wave ripple associated slow gamma oscillations: implications for memory consolidation

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Memory degradation is a natural part of the cognitive aging process. Sharp-wave ripples (SWRs), bouts of fast oscillatory (100-250 Hz) neural activity in the hippocampus, are important for memory consolidation. During SWRs, transient increases in slow gamma (20–50 Hz) power in the CA1 region of the hippocampus are thought to be important for organizing neural spiking in precisely ordered sequences. While some changes in SWR features have been reported in aged subjects, it is unknown whether age affects SWR-associated slow gamma. In this study, we recorded electrophysiological signals from the CA1 subregion of the hippocampus while young and aged rats performed a complex memory-guided task. We filtered the raw local field potential into slow gamma and SWR frequency bands, allowing us to assess and compare SWR-associated slow gamma activity between the young and aged animals and ask whether these differences correlate with performance differences on our task. Studying these differences strengthens our understanding of how the neural mechanisms underlying memory change across aging.

Topic Area: LONG-TERM MEMORY: Development & aging

D49 - Dynamics of Emotional States and Event Boundary Perception during Naturalistic Video Viewing

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A great deal of research has demonstrated that emotional arousal modulates memory for static words, images, or slide shows. With more naturalistic stimuli such as movies, people tend to segment continuous experience into discrete events, and the boundaries between events can powerfully influence memory. Little is known about how emotional arousal and valence changes interact with event segmentation (Chen & Swallow, 2025), and how these interactions affect memory performance. Here, we used the “emotional compass” task developed by McClay et al. (2023) to investigate the relationship between fluctuations in emotional states, event segmentation, memory, and brain activity evoked during viewing of an episode of the TV show *Curb Your Enthusiasm*. One participant group used the emotional compass to report continuous emotional valence and arousal changes, whereas another group completed an event segmentation task during the same episode to indicate the time points at which they perceived event boundaries. Measures of emotional fluctuation and change speed were calculated, as well as event segmentation density and agreement across the time course. Preliminary analyses revealed significant correlations between perceived event boundaries and emotional fluctuations and demonstrated that emotional valence changed more markedly and rapidly around event boundaries. These findings highlight the dynamic interaction between emotion and event

segmentation in a naturalistic context, and forthcoming analyses incorporating behavioral and neuroimaging data will further elucidate this complex relationship.

Topic Area: LONG-TERM MEMORY: Episodic

D50 - Working memory demands modulate memory brain state engagement

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A growing body of evidence suggests a strong overlap between the domains of memory and attention. Specifically, encoding new experiences may reflect external attention (focusing on sensory information), whereas retrieval of previously stored representations may reflect internal attention (focusing on stored information such as task goals). Maintaining information in working memory recruits internal attention, meaning that to the extent that mnemonic states track attention, they should be recruited in service of working memory. Our aim in the present study is to directly connect encoding and retrieval brain states with external and internal attentional states. Using scalp electroencephalography, we conducted a working memory task in which participants performed either a target detection task or a change detection task. The logic of this approach is that working memory maintenance is needed for change detection, but not for target detection. Using multivariate decoding of mnemonic brain states, we find significantly greater retrieval state evidence during the delay interval of the change detection task compared to the target detection task. We find that encoding state evidence during the display interval tracks set size across both tasks, whereas retrieval state evidence during the delay interval selectively tracks set size in the change detection task. Together, these results suggest that memory states map onto the internal/external axis of attention.

Topic Area: LONG-TERM MEMORY: Episodic

D51 - Shifting Perspectives: The Time Course of Visual Perspective Change in Autobiographical Memory

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Autobiographical memories enable us to recreate past events but are inherently reconstructive and prone to change. Although events are initially experienced from our own eyes, memories can be later retrieved from an alternative, observer-like perspective in which people can “see” themselves within their mental imagery. These shifts in visual perspective may reflect how memories are consolidated and transformed over time, yet the timing of this effect remains unclear. We investigated how visual perspective changes as a function of memory remoteness. Participants selected and dated over 200 autobiographical memories from the past five years and provided subjective ratings of own eyes and observer perspectives. This approach allowed us to model how memory age (in days) predicts perspective ratings with high temporal precision using mixed-effects

models. Consistent with prior work, observer ratings increased with memory age. Novel results, obtained using a log-linear mixed-effects model, indicated that perspective shifts occur rapidly at first and then attenuate with time. To further capture potential nonlinearities and identify when change stabilizes, we fitted a Generalized Additive Mixed Model (GAMM). Results revealed a rapid early shift within days, followed by a later plateau for both own eyes and observer memory perspectives. These findings characterize the temporal trajectory of perspective transformation in autobiographical memory, providing the first fine-grained behavioral evidence for when memories are most susceptible to change. The observed pattern parallels consolidation accounts involving rapid early transformation followed by relative stabilization over time.

Topic Area: LONG-TERM MEMORY: Episodic

D52 - The effects of event segmentation on temporal organization of free recall using staged events

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Understanding how people segment continuous experiences into meaningful events is fundamental to memory formation. Event boundaries—the moments when one experience ends and another begins—has been found to support episodic memory organization. However, most prior studies have relied on artificial or highly structured boundaries that do not reflect the complexity of real-life experience. The present study investigates how event segmentation affects episodic memory organization—particularly the temporal structure—using naturalistic, real-world staged events. In this paradigm, participants completed an audio-guided tour of two art exhibit sections followed by a delayed free recall task. To define event boundaries, external raters were recruited to identify meaningful event changes within the tour. To assess temporal organization across event boundaries, we conducted lag-conditional response probability (lag-CRP) analysis. Based on the rated event segments, Participants' recall transitions were classified into either within- or between-event lags. Preliminary results showed greater temporal clustering for items recalled within the same event than across events, such that participants were more likely to recall the next item when it belonged to the same event segment. Forward asymmetry analysis further revealed a significant bias towards forward transitions within event segments compared to across events. Together, these findings indicate stronger temporal clustering for items within the same events than across event boundaries. Moreover, even in the absence of event boundary manipulation, participants identified meaningful event boundaries in naturalistic settings, albeit with greater individual variability compared to controlled laboratory tasks.

Topic Area: LONG-TERM MEMORY: Episodic

D53 - Mnemonic Ramping: Exploring the unique temporal dynamics of encoding and retrieval success over time

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Memory retrieval success is frustratingly variable. This variability may stem from difficulty in sustaining the retrieval mode, which orients attention internally towards reinstated information (Tulving, 1983). Reinstatement itself additionally takes time to establish (Dougherty, Patil & Duncan 2025). While second-by-second retrieval variability has been studied, naturalistic retrieval is often more prolonged. Therefore, here we studied how these sources of variability interact to shape our retrieval success across minutes, and the uniqueness of this relationship to retrieval versus tasks with similar attentional and mnemonic demands. Participants completed twelve blocks of associative encoding and retrieval, each varying between 67.5s-99s, intermixed with six blocks each of shape counting and arithmetic (42.5-57.5s) that served as mnemonic distractors and comparators for time-success relationships across externally and internally oriented tasks, respectively. Preliminary data (n=26) demonstrate that retrieval varies significantly over time, with performance decreasing within blocks ($p < 0.05$) despite memory improvements across blocks ($p < 0.001$). This performance decrement was mirrored in the internally oriented arithmetic task ($p = 0.05$), but not in externally oriented shape counting ($p = 0.99$) or encoding ($p = 0.36$), despite similar difficulty. Interestingly, while retrieval performance within a block decreased, retrieval performance was at its lowest on beginning trials ($p < 0.001$) before rapidly ramping up. This effect was mirrored in encoding ($p < 0.001$), but not in either attention task (arithmetic $p = 0.99$, shape counting $p = 0.97$). This pattern of temporal profiles across tasks suggests that (1) it is more challenging to sustain attention to internally than externally generated content and (2) engaging memory-specific processes common to encoding and retrieval takes multiple seconds.

Topic Area: LONG-TERM MEMORY: Episodic

D54 - Dissociable neural codes for episodic sequence structure across spatial and non-spatial contexts

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Episodic memories unfold as structured sequences that must be bound to, and sometimes protected from, changing context. We developed two matched, naturalistic tasks (City = object-location during navigation; and Soccer = object-person on "team" backgrounds) in which six-step sequences occurred, to test hippocampal-cortical coding of context over time. Participants (N=18, age=18-35) performed interleaved City/Soccer blocks during fMRI. Memory for objects was tested after each sequence; half with changed background. Background memory was later probed end-of-block to assess contextual interference. Trial-wise betas supported representational-similarity measures of context separation among items sharing a background during encoding versus test. Time-resolved models quantified network-engagement dynamics across sequences. Behaviorally, background tests showed higher accuracy

for same-context versus changed-context items. On changed-context trials, responses were biased toward the test background, indicating interference. Neurally, context shaped representations: City items sharing a background were decorrelated across sequences (evidence for greater background separation) in parahippocampal/posterior-medial circuitry. Critically, individuals with stronger neural separation within medial-PFC made fewer competitor intrusions, linking representational control to resistance against context-driven confusion. Time-resolved contrasts further dissociated systems: City engaged parahippocampal/posterior-medial cortex throughout the sequence (sustained scene-context scaffolding), whereas Soccer recruited anterior cingulo-parietal control regions early and posterior hippocampus later (early control phase followed by hippocampal pattern completion/detail-rich reinstatement). These results show that context separation and temporally structured network recruitment jointly support sequence learning in naturalistic settings. They suggest a medial-PFC pathway for resisting interference and complementary temporal roles for posterior-medial cortex and hippocampus, beyond simple anterior/posterior or spatial/non-spatial dichotomies.

Topic Area: LONG-TERM MEMORY: Episodic

D55 - The impact of conceptual novelty on digital information foraging

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Traditional reward foraging frameworks examine how people gather information and decide between known options with a depleting reward value (i.e., exploit) and unfamiliar options with an unknown reward value (i.e., explore). However, gathering information often occurs in the absence of extrinsic reward, such as when scrolling online. When scrolling, value signals may be guided by novelty, wherein variability in new content may influence whether people stay on a given online platform (exploit) or switch to a new platform (explore). Here, we tested whether variation in conceptual novelty (i.e., the semantic uniqueness of information) influenced explore/exploit decisions. Forty-nine participants (Mean age = 29.1) watched video feeds consisting of twelve trial-unique videos. Low novelty feeds consisted of videos drawn from the same category (i.e., 12 different videos of the same TikTok dance), while high novelty feeds contained multiple videos drawn from four different categories. On each trial, participants made decisions to either exploit the current video feed or exit the current video feed and explore a new video feed. Decisions to explore a new video feed incurred a time delay cost. Results showed that individuals watched more videos ($p = .002$) and made fewer explore decisions ($p = .003$) in high versus low novelty feeds, consistent with exploitation. Moreover, survival analyses showed that high novelty feeds were associated with a significantly decreased risk of explore decisions by 31.3% (HR = .69, $p = .007$). These findings suggest that conceptual novelty can meaningfully influence explore/exploit decisions, specifically by promoting exploitation.

Topic Area: LONG-TERM MEMORY: Episodic

D56 - Associations between memory performance and hippocampal and medial temporal sub-regional volumes in cognitively healthy young and middle-aged adults

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Prior findings regarding the relationship between medial temporal lobe (MTL) subfield volumes and memory performance are mixed. Here we utilized 'Automated Segmentation of Hippocampal Subfields' (ASHS) to investigate associations between MTL subfield volumes and memory performance in cognitively healthy adults. Thirty-six young (18-27 years) and 43 middle-aged (44-56 years) participants completed a neuropsychological test battery from which four principal components were derived, termed 'memory', 'speed', 'fluency', and 'crystallized IQ'. T1-weighted and high-resolution T2-weighted scans were collected in a separate MRI session in which participants performed an episodic memory task comprising sequential item and source memory judgments. Structural images were processed through ASHS and manually edited to obtain volumetric data for hippocampal subfields and surrounding MTL regions. All volumes were adjusted for ICV. Item and source memory performance were lower in middle-aged relative to young adults. Parahippocampal cortex (PHC) volume was greater in young relative to the middle-aged adults, whereas subiculum volume was greater in the middle-aged sample. Initial regression models revealed no significant interactions between age group and volume for the prediction of cognitive performance. Total hippocampal volume (including CA1, CA2/3, dentate gyrus and subiculum) was positively associated with source, but not item, memory performance. Hippocampal volume was not reliably associated with the off-line memory component score but did correlate positively with general cognitive ability (derived by averaging across the four component scores). These findings are consistent with other reports of a positive association between hippocampal volume and episodic memory performance in healthy adults.

Topic Area: LONG-TERM MEMORY: Episodic

D57 - Comparison of mass univariate and trial-wise measures of neural selectivity and their relationships with memory performance

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We compared three metrics of category-related neural selectivity: a GLM-based mass univariate metric, and two other metrics, one univariate (the difference in mean activity elicited by preferred vs. non-preferred categories, scaled by the pooled trial-wise standard deviation - 'differentiation index') and one multi-voxel (within vs. between-category pattern similarity). During fMRI scanning, young (N

= 41; ages 18–27) and middle-aged participants (N = 45; ages 45–56) viewed a series of face and scene images paired with concrete words and generated a scenario linking the two pair members. At test, participants judged whether each test word had been studied and, if so, whether it had been paired with a face or a scene. Selectivity during encoding was examined in the face-selective fusiform face (FFA) and occipital face areas (OFA), and the scene-selective parahippocampal place (PPA) and medial place areas (MPA). In scene-selective regions, the three selectivity metrics were robustly correlated. In face-selective regions, the correlations were restricted to the FFA. The differentiation index derived from the MPA, PPA, and FFA, and the pattern similarity metric from the MPA, were each positively associated with source memory performance. The differentiation index derived from the MPA and PPA, and the pattern similarity metric from the FFA, correlated with item memory performance. By contrast, mass univariate selectivity metrics were uncorrelated with either behavioral measure. These findings highlight commonalities and differences among univariate and trial-wise measures of neural selectivity, with the univariate differentiation index emerging as the strongest predictor of memory performance.

Topic Area: LONG-TERM MEMORY: Episodic

D58 - Dissociable engagement in rostrolateral prefrontal cortex during retrieval monitoring and relational reasoning

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Rostrolateral prefrontal cortex (RLPFC) has been consistently implicated in retrieval monitoring and relational reasoning. However, few studies have examined its role across these domains within the same individuals, prompting the question of whether there are core characteristics that engage RLPFC or if there are distinct subregions responsible for distinct processes. A previous study found overlap in activation of left RLPFC between a verbal analogy task and a source memory retrieval task, using tightly matched word stimuli (Westphal et al., 2016). To address the question of whether this overlap in activation extends to other stimulus types and task designs, we collected fMRI data from 35 healthy young adults who completed a relational memory task and four versions of a relational reasoning paradigm that reliably engages RLPFC. During memory encoding, participants studied word pairs and decided whether the two words were related. At retrieval, they viewed pairs of previously seen words and judged whether the pair was Intact (words paired together at encoding) or Recombined. Participants had slower response times and stronger RLPFC responses for Recombined vs. Intact pairs, consistent with heightened retrieval monitoring. A group-level conjunction analysis demonstrated strong overlap across vertices between tasks in RLPFC and additional reasoning-related activation. However, the constellation of most strongly active vertices within-participants overlapped weakly between tasks, on average, with pronounced variability across participants. We conclude that relational reasoning and retrieval monitoring may share

a common RLPFC mechanism but that they do not reliably elicit the same neural pattern.

Topic Area: LONG-TERM MEMORY: Episodic

D59 - Tracking Event Boundary Processing in Language: Hierarchical Dynamics of Comprehension and Memory

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Understanding a narrative requires constructing a coherent situation model by segmenting information into discrete events, typically marked by shifts in time, space, or goals. While most research on event segmentation relies on continuous audiovisual stimuli where event boundaries must be inferred, language provides inherently discrete boundaries, yet fewer studies have examined how this process unfolds during the comprehension of written narratives. Most language-based studies focus on behavioral measures, providing limited insight into the real-time neural dynamics underlying event model updating. Here, we combine word-by-word reading times (RTs) with scalp EEG to examine how readers update event representations and how these dynamics influence memory organization. We used narratives with two hierarchical levels: stimuli adapted from Ding & Zacks (2025) comprised ten short stories with a nested structure of fine- and coarse-level events. We hypothesize that each level exhibits distinct behavioral and neural signatures supporting event updating and episodic memory formation. Participants read stories word by word in a self-paced task while EEG was recorded, followed by a distractor and a free recall task. RTs increased at both boundary types, with coarse boundaries showing a post-boundary slowdown relative to fine boundaries, indicating more effortful integration. EEG data mirrored these behavioral effects, revealing a larger late positivity for coarse than for fine boundaries. Finally, fine-level events were more likely to be recalled when reading times were higher at boundary positions, but not coarse-level events. These results emphasize language as a precise framework for investigating the dynamics and structure of event segmentation.

Topic Area: LONG-TERM MEMORY: Episodic

D60 - Schema and Prediction Error in Episodic Memory Encoding: how object–location expectancy in visual scenes influences memory formation

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Prior knowledge generates expectations about where objects typically appear within scenes, which can facilitate memory when confirmed, yet also facilitate memory when violated. The SLIMM framework [1] attributes this to a U-shaped relationship between expectancy and

memory, with dissociable neural contributions of the medial prefrontal cortex (mPFC), supporting schema-congruent information, and the medial temporal lobe (MTL), supporting schema-incongruent information. Building on prior research using immersive virtual-reality [2], we tested these predictions using 2D scene-object images in a series of pre-registered behavioural and fMRI studies. Participants viewed scenes in which a target object occupied a semantically congruent, incongruent or neutral location, and rated their expectancy on a scale from -100 to +100. Their memory was later tested by presenting the object again in different locations across three scenes, with the foil locations matched for congruency. The behavioural data confirmed the predicted U-shape, i.e., better memory for highly congruent and highly incongruent trials than neutral trials. The fMRI data, however, failed to show support for SLIMM's predictions of an interaction between expectancy and subsequent memory within the mPFC and MTL (hippocampus). We discuss these findings in relation to SLIMM and the broader literature on expectancy and memory. [References: 1. Van Kesteren, M.T.R., et al. (2012). Trends in Neurosciences, 35, 211-219. 2. Quent, A., Greve, A. & Henson, R.N. (2022). Psychological Science.]

Topic Area: LONG-TERM MEMORY: Episodic

D61 - Enhanced semantic encoding underlies the memory benefit of the pretesting effect

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Tests can enhance long-term memory even when administered before initial study—a phenomenon known as the pretesting effect. Competing accounts attribute this effect to semantic, attentional, or episodic processes, but its underlying neurocognitive mechanisms remain poorly understood. Here, 35 participants underwent functional magnetic resonance imaging (fMRI) while studying and later recalling weakly associated word pairs. On half of the study trials, participants were prompted to covertly generate a plausible target word based on a cue (e.g., handyman – ?) before viewing the intact pair (e.g., handyman – hammer), whereas on the other half of study trials, there was no prior target word generation. Replicating prior behavioral findings, participants recalled more targets in the pretest condition compared to the study-only condition. Subsequent memory analyses revealed that successful encoding of pretested word pairs, relative to study-only pairs, was associated with greater activation in semantic and language-related regions, including the bilateral temporal pole, middle temporal gyrus, angular gyrus, and insula. Enhanced activation was also observed in prefrontal regions, comprising the orbitofrontal cortex, frontopolar cortex, and middle frontal gyrus. Moreover, across participants, the behavioral advantage for pretested over study-only pairs was positively correlated with the magnitude of activity differences between the two conditions in clusters located in the temporal pole, insula, frontopolar cortex, and orbitofrontal cortex. Together, these findings provide first neuroimaging evidence in support of the semantic account of the pretesting effect, and they

suggest that enhanced semantic encoding is facilitated by prefrontal functions.

Topic Area: LONG-TERM MEMORY: Episodic

D62 - Retinotopic coding by human hippocampus? An evaluation using intracranial electroencephalography.

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By representing both space and ongoing experience, the hippocampus supports memory and spatial learning. Recent functional magnetic resonance imaging (fMRI) studies show contralateral hippocampal responses to visual stimuli, pointing to retinotopic coding as one such form of spatial representation. However, fMRI is an indirect indicator of neural activity and provides low temporal resolution, and so it is unclear which, if any, aspects of neural activity demonstrate retinotopic coding in hippocampus. In visual cortex, prominent alpha oscillations are retinotopically organized; we hypothesized that hippocampal theta would similarly demonstrate retinotopic sensitivity. We tested this hypothesis by examining direct hippocampal recordings from epilepsy patients (N=12) undergoing presurgical monitoring while they completed the Human Connectome Project visual field mapping task (N=98 hippocampal contacts; 40% in left hippocampus). Analyses focused on slow (1-5 Hz) and fast (6-12 Hz) theta activity. Both slow and fast theta power were significantly modulated by visual stimulation (linear-mixed effects model for slow theta: Beta=0.03, 95% CI=[0.02, 0.04], $\chi^2(1)=21.45$ p=0.02, corrected; for fast theta Beta=0.03, 95% CI=[0.02, 0.04], $\chi^2(1)=23.21$, p=0.02, corrected). Few visually sensitive contacts had activity that correlated significantly with stimulus hemifield (5%, p<0.05, corrected). Linear mixed effects modeling failed to identify modulation of theta activity by contralateral visual stimulation. In contrast, behavior during an ongoing change-detection task significantly modulated hippocampal theta (p<0.05), including microsaccades, fixation-cross color changes, and button presses. Thus, hippocampal theta is visually responsive, but concurrent behaviors may be responsible for apparent visuospatial sensitivity.

Topic Area: LONG-TERM MEMORY: Episodic

D63 - No Evidence for a Benefit of Theta Band Visual Entrainment on Scene Recognition Memory

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Previous work has demonstrated that the neural activity in the theta band (3-8Hz) supports memory processes, with evidence suggesting that low theta may be related to successful recognition, while high theta supports interference resolution. Modulating theta activity through non-invasive visual entrainment may also allow us to influence memory. Research investigating theta entrainment to enhance memory has yielded mixed results regarding its effectiveness. Here,

we asked two questions: (1) does visual entrainment improve memory retrieval, compared to a no-flicker control? And (2), does entrainment at 3, 7.5, or 10Hz differentially affect memory? Participants studied 120 scenes while providing indoor/outdoor judgements. Afterwards, participants completed a recognition memory task where they were presented with the 120 studied scenes and 60 novel scenes. During the memory test, scenes were presented with background visual flickers at 3, 7.5, or 10Hz to induce entrainment, along with a no-flicker control condition. In Experiment 1, flicker and no-flicker trials were split across two blocks, with block order counter-balanced, whereas Experiment 2 interleaved all trial types. Across both experiments, we failed to find evidence of an entrainment effect on memory. In the blocked design, entrainment at any frequency lowered performance compared to the no-flicker condition, when the flicker block was second, suggesting that low-frequency entrainment might interfere with recognition when participants are fatigued. Overall, we failed to find evidence that entrainment benefits recognition memory when visual flickers are applied during memory retrieval.

Topic Area: LONG-TERM MEMORY: Episodic

D64 - The Production Effect on Memory is Located at Memory Encoding and Memory Retrieval: An ERP Study

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The Product Effect (PE) is a memory phenomenon where reading words out loud produces superior memory than reading words silently. Research has established distinctiveness as an influence on the PE, citing the distinct elements of speaking as causes for more accurate recollection. This study utilized a remember/know paradigm to observe the PE effect for study and test phase ERPs to determine if encoding during the study phase and retrieval during the test phase are impacted by the PE. Participants were presented with novel nouns to read aloud or silently during the study phase. During the test phase participants were presented with the previously studied and new nouns, identifying each as 'remember,' 'know,' or 'new'. Participants produced higher accuracy in the aloud condition for 'remember' responses compared to words read silently, demonstrating a PE. ERP results demonstrated more positive amplitudes for 'remember' than forgotten responses at the Dm ERP component in the aloud but not the silent condition during the study phase, indicating the PE influenced memory encoding. No observed difference at the FN400 ERP component between aloud and silent conditions suggested familiarity did not influence recognition of studied words. More positive amplitudes for 'remember' responses at the LPC ERP component in the aloud than silent condition during the test phase suggested that the distinct elements of speaking increased memory retrieval and therefore recollection of studied words. These are the first results to confirm the influence of the PE on memory encoding, while also demonstrating the effect of distinctiveness on recollection.

Topic Area: LONG-TERM MEMORY: Episodic

D65 - Structural measurement, lesion distribution, and memory performance across 74 selective medial temporal lobe amnesics

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Damage to the medial temporal lobe (MTL) is frequently found in clinical populations. However, selective hippocampal or MTL cortex (MTLc) damage is not only extremely rare, but very hard to confirm. Nonetheless, neuropsychological findings remain critical to the development and confirmation of theories of the cognitive neuroscience of memory. We describe the neural and behavioural patterns in a population of 74 selective MTL amnesics (age 24-71) and 80 matched healthy controls. Participants underwent high resolution 3T MRI scanning, including T1 and DTI, neuropsychological assessment, and experimental testing of memory, focusing on recollection and familiarity, across four types of stimulus information (words, scenes, objects, faces). Manual volumetry of the medial temporal lobes yielded relatively selective hippocampal ($\approx 10\%$), MTL cortex (entorhinal, ERC, perirhinal PRC, and parahippocampal, PHC with intact hippocampus) ($\approx 30\%$), and global MTL (MTLc plus hippocampal damage) ($\approx 60\%$) patients. Using continuous modelling of regional volumes, ridge regression with subsequent hierarchical regression revealed that across all amnesics, ERC volume was the primary driver of memory performance for all memory tests, while hippocampal volume (particularly head and tail) was the key driver of tests of recall and recollection-based recognition. Categorical analyses demonstrated that hippocampal patients performed normally on the more familiarity-based recognition tasks, while MTLc patients (and global MTL patients) were impaired. As a two-way gateway between MTLc and hippocampus, the ERC is well-placed to support memory independent of task and material. These and other MTL findings are discussed in the context of memory theory and the optimization of neuropsychological studies of amnesia.

Topic Area: LONG-TERM MEMORY: Episodic

D66 - Task incorporation into dreams and memory consolidation

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Sleep supports episodic memory consolidation, but the role of dreaming in this process remains underexplored. This study examines whether dream incorporation reflects consolidation processes and whether targeted memory reactivation (TMR) modulates such

incorporation. A total of 105 healthy young adults ($M = 23.79 \pm 3.02$ years) completed a within-subject sleep study, including one adaptation and two experimental nights and four weeks of dream diaries while wearing a Fitbit. Participants learned 100 (neutral) word–(emotional/neutral) picture pairs in the evening. Memory recall was tested before and after sleep, and again four days later. Sleep was recorded using polysomnography, including a 64-channel EEG. Sleep staging was performed using U-Sleep and verified by a human scorer. During each experimental night, dream reports were collected via up to eight awakenings (four NREM, four REM), and during morning reports. During one of the experimental nights (counterbalanced), TMR was applied by replaying word cues for 15 minutes prior to each awakening. A total of 1,085 lab-based dream reports were collected, along with 2,071 morning and home diary reports. Dream content was rated for task and experiment incorporation by trained raters (all Cohen's $\kappa > 0.4$), supplemented by dictionary-based text analyses. Preliminary findings show that lab-collected dreams exhibit significantly more experiment-related content than home dreams, with similar incorporation rates across NREM and REM awakenings. This Registered Report collected one of the largest datasets to date on dream content and memory, enabling a robust investigation of how dream incorporation relates to targeted and spontaneous memory consolidation.

Topic Area: LONG-TERM MEMORY: Episodic

D67 - Using Naturalistic Neuroimaging to Enhance Knowledge of Sex Differences in Memory Networks

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Males and females exhibit differences in episodic memory, both behaviourally and neurally. For example, females have a general episodic memory advantage, as well as higher connectivity in the posterior default mode network (DMN) and lower connectivity in the anterior DMN compared to men. There are significant advantages to using naturalistic stimuli (such as audiovisual movies) for uncovering memory networks, however, few studies have used such stimuli to investigate network differences in delayed memory recognition between males and females. In this study, 35 older adults (age 55-75, 17 female) encoded six narrative driven, naturalistic scenes. Seven days later, all participants completed a delayed recognition task during fMRI, where they viewed three previously encoded and three novel scenes. To identify differences in functional connectivity during recognition between males and females, we used functional connectivity multivariate pattern analysis (fc-MVPA) with post-hoc seed-based connectivity (SBC) analyses. Fc-MVPA revealed four clusters where functional connectivity differed between males and females for the encoded vs. novel scenes, including the left hippocampus, ventromedial prefrontal cortex, right angular gyrus, and the right cerebellum. SBC from these ROIs showed widespread

between-network differences between males and females. Notably, the left hippocampal ROI showed significantly greater connectivity for males with the DMN than for the females. These results provide evidence of unique differences between males and females in neural connectivity during episodic memory recognition, particularly between the DMN and hippocampus. More broadly, we provide valuable insight into network level sex differences in more true-to-life episodic memory conditions in older adults.

Topic Area: LONG-TERM MEMORY: Episodic

D68 - A Spectral T+A-G+ of Memory

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Spectral analysis of invasive and non-invasive electroencephalographic (EEG) recordings have revealed consistent frequency-specific power modulations that predict successful episodic memory performance. Across a broad range of encoding and retrieval tasks, mnemonic success is marked by a pattern we refer to as spectral T+A-G+, characterized by increased low-theta power (~3-5 Hz; T+), decreased alpha power (~8-10 Hz; A-), and increased gamma power (30+ Hz; G+). Here, we synthesize evidence for T+A-G+ from scalp and intracranial EEG experiments, evaluating its robustness across tasks and contrasts. We review mechanistic accounts linking theta oscillations to hippocampo-cortical coordination, alpha suppression to reduced inhibition, and gamma activity to local computation supporting neural representations. Finally, we consider whether T+A-G+ reflects the activation of memory-specific processes, as opposed to a task-general marker of cognitive effort and engagement. Converging evidence suggests that, although each component of T+A-G+ is involved in task-general cognitive processes, their combined expression emerges most reliably during memory tasks. This supports the view that T+A-G+ represents the joint activation of neurocognitive processes which are critical for episodic memory.

Topic Area: LONG-TERM MEMORY: Episodic

D69 - Ageing is not all bad: Middle-aged memory shows enhanced recognition of semantic information.

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Noticeable failures in recall and recognition memory are experienced long before we reach old age; despite this, little research focuses on middle-age. The source of these failures could reflect early neurodegeneration, of the type found in the elderly (e.g., hippocampal atrophy) or it could reflect other subtle changes in information processing. Here we draw on the established pseudoneglect effect and its reduction across the adult lifespan to ask whether the relationship between attention and memory could explain the middle-aged memory failures experienced by most. Likewise, drawing on evidence that the inferior parietal lobe (IPL) exhibits a similar

hemispheric lateralisation of function related to whether semantic and perceptual memory is retrieved, we compare the relative preservation of semantic and perceptual memory in middle-age and its relation to changes on attention. We tested middle-aged (40-65yrs; N=30) and younger adults (18-30yrs; N=30) on two novel recognition memory tasks that require perceptual (object pictures) and semantic (sentences) pattern separation selectively. Results demonstrate that while pattern-separated memory for perceptual information shows decline in middle-age, pattern-separated memory for semantic information does not. Similarly, we show that middle-aged participants while poorer than younger adults on a speeded perceptual matching task, perform more accurately than younger adults on a speeded semantic matching task, potentially suggesting a more efficient semantic encoding system. These findings will be discussed in the context of a middle-age shift in attention laterality, the role of the IPL, and the implications for ageing research more generally.

Topic Area: LONG-TERM MEMORY: Episodic

D70 - Computational methods can significantly predict humans' scoring of story recall details

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Story recall remains a primary method of assessing episodic memory, but manual scoring of participants' responses can be laborious and time consuming. Computational methods offer an efficient, scalable, automated alternative for recall scoring. We asked whether two computational approaches could match traditional human scoring of story recall. The first approach employed a classical natural language processing (NLP) pipeline using rule-based techniques, including n-gram extraction, named entity recognition, and dependency parsing (Python Natural Language Toolkit). The second approach leveraged the advanced language understanding capabilities of large language models (LLMs). We used the classical NLP method and two LLMs (OpenAI's GPT-4o and Google's Gemini 2.0/2.5) separately to score n = 160 young and n = ~95 older adults' immediate and delayed recall of pairs of stories created by Taler et al. (2021). Responses were classified as veridical (i.e., word-for-word), gist (i.e., general idea), or distorted (i.e., clearly errors). Remarkably, both approaches closely matched the human scoring of veridical recall. The classical NLP pipeline failed to capture gist and distortion scores, whereas the LLMs demonstrated moderate correlations with human ratings on both dimensions. We explored different LLM prompting methods and received similar results each time. Computational methods are approaching human-level performance in scoring memory veridical recall, though they still need improvement in capturing the subtleties of memory errors. Further development of these automated tools will help make cognitive and neuropsychological testing more efficient and accessible, and may be especially useful with large datasets.

Topic Area: LONG-TERM MEMORY: Episodic

D71 - Schema-related memory effects are differentially modulated by age and memory performance

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The effect of schema-congruence on memory has been largely studied in younger adults (YA), where events that are schema-congruent or schema-incongruent are often better remembered than schema-neutral events. How this relationship changes in ageing is less well studied. Across two experiments (E1: N=78; E2: N=156), we investigated how schema-related memory effects are modulated by both participant age and the delay between encoding and retrieval. Participants encoded 'events' comprising a famous person, an object and a location. Schema-congruence was manipulated based on the profession of the famous person (e.g. Adele-Stage-Microphone would be a congruent event). Memory for half of the events was tested immediately and the other half following a delay (E1: 48-hour; E2: 12-hour). Collapsing across experiments, we saw effects of congruency that differed as a function of age and overall memory performance. Low performers showed a congruence advantage, with greater performance in the congruent condition than the neutral and incongruent condition, regardless of age. High-performing YAs showed an incongruence advantage, with greater performance in the incongruent condition than the neutral or congruent condition, however in low-performing older adults (OA) no effects of congruency were seen. Our results show that congruence benefits memory when overall episodic memory performance is low, regardless of age. Incongruence benefits memory when overall performance is high, but only in YAs. This latter finding supports the proposal that schematic prediction error enhances memory for incongruent events, and suggests that these prediction error signals are disrupted in OAs even when episodic memory performance is relatively preserved.

Topic Area: LONG-TERM MEMORY: Episodic

D72 - How Valence and Motivation Interact to Shape Autobiographical Memories

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In the context of affect, research has separately characterized the roles of valence (negative to positive) and motivation (not goal-relevant to goal-relevant) in influencing episodic memory. However, in real life, these two features often intersect; highly goal-relevant memories can be both negative (e.g., survival) and positive (e.g., achievement). Here, we tested whether valence and motivation interact to influence autobiographical memory vividness, which represents the richness of memory retrieval. Participants (N = 36; 16 female; M_age = 31.94, SD_age = 6.08) completed a 4-week online study. In Week 1, they identified significant and mundane personal events that occurred within the prior two weeks. Across the next three weeks, they recollected and rated those same events. Each week, they rated valence (0 negative to 100 positive), motivation (0 not goal-relevant to

100 very goal-relevant), and vividness (0 not vivid to 100 very vivid). Linear mixed-effects models (random effects: participant, week) showed that both valence and goal-relevance significantly interacted to predict vividness ($\beta = .22$, $t = 4.26$, $p < .001$), such that goal-relevance significantly predicted vividness for neutral ($\beta = .24$, $t = 4.34$, $p < .001$) and positive ($\beta = .46$, $t = 6.31$, $p < .001$) memories, but negative memories were rated as vivid regardless of their goal-relevance ($\beta = .02$, $t = .27$, $p = .79$). Autobiographical memory vividness is therefore shaped by both affective value and goal-relevance, revealing joint effects of valence and goal-relevance on vividness.

Topic Area: LONG-TERM MEMORY: Episodic

D73 - Vector-Based Analysis of Competitive Memory Biases in Verbal Recall

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Behavioral studies of episodic memory interference traditionally focus on how similarity between events can reduce the probability of those events being successfully remembered (i.e., forgetting). However, similarity can also produce subtle biases in memory even when events are otherwise successfully remembered (Chanales et al., 2021; Drasher et al., 2022). To date, these biases have been measured using highly controlled stimuli that vary on a single dimension and memory tests that specifically orient subjects to relevant dimensions (e.g., color). To extend the generalizability of these findings, we developed an approach for measuring similarity-induced biases in verbal recall for complex, naturalistic scene images. The premise for our approach is that, using natural language processing, verbal memories can be translated to a high-dimensional space and the relationship between similar memories can then be quantified using vector geometry. In our study (planned $n = 180$), participants will learn associations between 12 face images (cues) and 12 scene images (associates). Scene images are drawn from 6 semantic categories (e.g., libraries), resulting in two images per category. Each subject studies the same 'target' image from each category along with one of 5 possible 'competitor' images (counterbalanced across subjects). After learning, participants are prompted with each face (cue) to recall and verbally describe the associated scene image. The critical goal for this study is to apply vector geometry to the high-dimensional verbal recall space to determine whether target memory is systematically biased toward the competitor (attraction) or away from the competitor (repulsion).

Topic Area: LONG-TERM MEMORY: Episodic

D74 - Boosting the impact of episodic simulations on decisions via semantic scaffolding?

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People can mentally project themselves into the future by imagining possible experiences. Notably, this capacity, episodic simulation, also influences their decisions. Specifically, episodic simulations have been shown to reduce delay discounting, i.e., the tendency to devalue a reward with the delay until its delivery. Episodic simulations are thought to convey this beneficial effect by rendering the future more vivid and tangible. Here, we test the hypothesis that this impact of episodic simulation can be fostered by providing a stronger semantic scaffold for the simulation. Prior research indicates that simulations that are situated in more familiar locations are more vivid. The more familiar locations are thought to provide a stronger semantic scaffold for the construction of the imagined scene. This study examines whether personally more familiar locations facilitate more vivid episodic simulations, and whether these vivid simulations yield greater reductions in delay discounting. In response to activity cues (e.g., going grocery shopping), participants first identified highly familiar and barely familiar locations. They then imagined such activities at these locations before they made monetary choices between smaller, immediate and larger, later rewards. Data collection is still ongoing, but preliminary analyses indicate that participants experience future simulations as more vivid that were situated at more familiar than at less familiar locations. The results further indicate that choices for larger, later rewards are also preceded by more vivid simulations. Understanding how prior knowledge shapes episodic simulations will help elucidate the cognitive mechanisms underlying adaptive planning and self-control.

Topic Area: LONG-TERM MEMORY: Episodic

D75 - Compensatory frontal activity in cancer survivors associated with accurate memory performance but inaccurate metamemory judgments: an ERP study

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Cancer survivors often self-report subjectively greater difficulties with "forgetting" than are found on objective memory metrics. Emerging evidence, including neuroimaging research finding that survivors with comparable recognition memory to controls engage prefrontal regions to a greater extent, suggests that discrepancy between subjective complaints and objective performance may reflect strategic compensation for early attentional deficits at encoding and/or at retrieval. To date, no studies have examined the time course of encoding and retrieval processes in survivors compared to controls. In the present study, we recorded EEG in 23 breast cancer survivors (BCS) and 23 non-cancer controls (NCC) during 6 study/test runs of a

verbal old/new recognition task. For each item, participants made judgments of learning (JOLs) at encoding and retrospective confidence judgments (RCJs) at retrieval. On self-report measures of attention and memory abilities, BCS reported significantly higher subjective impairment than NCC. Despite comparable memory performance and JOLs on the recognition task, BCS showed an underconfidence bias at retrieval compared to NCC. ERPs at encoding found no significant group differences in mid-latency posterior attentional effects (200-300ms), but BCS had significantly greater frontal activity 400-600ms post-stimulus onset for subsequent hits. ERPs at retrieval found that while both groups demonstrated a similar posterior old/new effect (500-700ms), BCS showed greater late positive frontal activity overall during this period. Taken together, these findings suggest compensatory frontal activity during encoding and retrieval may preserve performance despite underlying cancer-related cognitive deficits, but subjective beliefs about memory difficulties may persist even when recognition is accurate, leading to metamemory inaccuracies.

Topic Area: LONG-TERM MEMORY: Episodic

D77 - Learning of motion directions induces rapid and stable changes in the motion-sensitive visual cortex

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Traditionally, neocortical declarative memory formation has been viewed as a slow and hippocampus-dependent process. While it has been demonstrated that engrams can form rapidly in higher-order association cortex, the potential for rapid plasticity of the early visual cortex remains debated. Here, we examine whether memory engrams for basic visual features can develop rapidly in feature-selective visual cortex, with a focus on color and motion direction. Participants (preliminary n=39, planned 80) learned object-feature associations in five encoding-recall repetitions with concurrent 3T fMRI. During encoding, object-color-motion triplets were presented, and participants encoded either object-color (color group) or object-motion associations (motion group). During recall, objects were presented without feature information to isolate memory-related activity in feature-selective cortex. Memory retention was assessed after 24h. Behaviorally, participants demonstrated clear evidence of learning and retention over 24h. During memory recall, bilateral activity in motion-sensitive visual area MST increased specifically in the motion group across the recall repetitions, and these changes remained stable even after 24h. Additionally, repetition-related increases in functional activity within MST were associated with recall performance, highlighting the behavioral relevance of these neural changes. These findings show rapid, long-lasting and behaviorally relevant plasticity of feature-selective visual cortex in response to learning, which aligns well with emerging evidence for a role of early visual cortex in long-term memory. Furthermore, they indicate that the potential for rapid memory formation might be a fundamental property across the cortical

hierarchy. Future diffusion MRI analyses will determine whether functional changes are accompanied by changes in microstructural plasticity.

Topic Area: LONG-TERM MEMORY: Episodic

D78 - Thalamic network organisation across rest and recognition memory

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Thalamic nuclei form distinct cortico-subcortical circuits supporting executive control, motor planning, attention and memory; however, their intrinsic organisation at rest and relevance to episodic memory remain understudied. Using Human Connectome Project data, we conducted two complementary investigations. First, nucleus-resolved rest-ing-state fMRI in 198 young adults quantified functional connectivity among five bilateral thalamic regions: anterior thalamic nuclei (ANt), mediodorsal thalamus (MDt), pulvinar, ventral anterior (VA) and ventral lateral (VL). Seed-based and inter-nuclear analyses identified two modules: a VA-VL executive-motor network (mean $r \approx 0.78$) and an MDt-pulvinar associative-attentional network (mean $r \approx 0.65$), with ANt showing moderate coupling to VA and VL ($r \approx 0.40$). Second, in 166 participants completing a recognition-memory task, recollection (Remember) and familiarity (Know) were contrasted. Whole-brain analyses showed insular and cingulate engagement for both Remember>New and Know>New, with marginal hippocampal peaks under small-volume correction. Critically, Dynamic causal modelling suggested driving inputs to ANt during recollection and to MDt during familiarity; both conditions modulated bidirectional connections among hippocampus, ANt, perirhinal cortex (PRC) and MDT. Together, these results indicate separable thalamic modules at rest and condition-specific recruitment of ANt and MDt as drivers within hippocampal-thalamic-cortical circuitry. This integrated framework positions the thalamus as a hub linking cognitive and motor systems and motivates multimodal, behaviourally targeted analysis.

Topic Area: LONG-TERM MEMORY: Episodic

D79 - Theta-mediated conceptual reinstatement in vmPFC precedes perceptual reinstatement in ventral visual cortex during memory recall

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When recalling past episodes, different features of an experience, such as conceptual meaning and perceptual detail, are reconstructed and reinstated across distributed cortical regions. However, current models of human memory remain unclear how these feature-specific reinstatements unfold over time, and whether they interact hierarchically during memory retrieval. Using magnetoencephalography (MEG) and time-resolved encoding-retrieval cross-phase classification analysis, we compared the time course of conceptual and perceptual reinstatement during cued visual recall. Conceptual information decoding in the ventromedial prefrontal cortex (vmPFC) preceded perceptual information decoding in the ventral visual cortex (VVC), and the two were expressed in distinct frequency bands: theta (4–8 Hz) for conceptual and gamma (30–40 Hz) for perceptual information. Cross-correlation and spectral Granger causality analyses revealed that during reinstatement conceptual information in vmPFC predicted and directed perceptual information in VVC, with theta-band information flow predominantly from vmPFC to VVC. In addition, bottom-up connectivity from VVC to vmPFC was expressed in the alpha band. These findings suggest that memory retrieval proceeds from abstract conceptual reconstruction to the reinstatement of perceptual details, mediated by theta oscillatory communication between prefrontal and sensory areas. We propose a hierarchical interactive model in which vmPFC initiates conceptual activation through theta-band top-down signals, while VVC provides alpha-band feedback for evaluating reconstructed perceptual details.

Topic Area: LONG-TERM MEMORY: Episodic

D80 - Real-time mouse movements reveal decision-making processes between competing goals and predict subsequent memory

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We are constantly faced with conflicting choices in everyday life. This can occur in pursuit of one goal (e.g., choosing compass A or B for a hiking trip), or multiple related goals (e.g., choosing hat A or B for a hiking trip versus a beach trip). However, it remains unclear how people make such decisions and how subsequent memories are impacted. To test this, participants were asked to sort items into one of two goals (e.g., a hat for a hiking trip versus a beach trip). Each item was either compatible with one goal only (unique condition) or both goals (competing condition). Critically, for some items, participants were shown two exemplars (e.g., hats A and B) and asked to make related decisions across the task; participants decided whether these exemplars satisfied the same or different goals. To track moment-by-moment decision-making processes, we recorded participants' mouse movement as they assigned items to goals. Compared to the unique condition, mouse trajectories in the competing condition had longer distances and showed greater pre-decision attraction toward the unselected choice, indicating greater deliberation during decision-making. When later asked to recall the presentation frequency of each item, participants had higher accuracy for items that satisfied

competing goals than those that satisfied one unique goal. Further, greater spatial attraction toward the competing choice during the decision phase predicted better frequency memory later on. Overall, our results reveal that behavioral measures of competition predict separation of memories for competing content associated with different decisions.

Topic Area: LONG-TERM MEMORY: Other

D81 - How does offloading generative processes to ChatGPT impact learning and memory?

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We often use technology to store information externally and reduce the cognitive load required to accomplish tasks, a process known as cognitive offloading. While offloading can improve productivity, it can also impair learning and memory. Famously, global positioning systems (GPS) help us navigate efficiently, but can also hinder spatial learning. Similarly, Large Language Models (LLMs) can improve productivity by generating tailored outputs for a wide range of tasks, whereas self-generating content engages deeper cognitive processes that enhance memory. Nonetheless, given LLMs ability to generate tailored outputs, are generative aspects of human learning still relevant? The present study explores how offloading generative tasks during study to an LLM influences learning outcomes. Specifically, we investigated how offloading mnemonic generation for randomly-generated five-letter acronyms to LLMs influences both recognition and cued-recall memory performance, compared to self-generation of mnemonics using a fully self-paced (Experiment 1) and time-equated design (Experiment 2). On self-generated trials, participants created their own mnemonics, whereas on LLM-generated trials, participants were asked to type out the mnemonic that was generated on-screen by ChatGPT, and were instructed to study each word before moving on to the next trial. We demonstrated that when mnemonic generation was offloaded to an LLM, both recognition and cued-recall performance were significantly impaired in comparison to self-generation, regardless of whether study was self-paced or equal for both trial types. These results underscore the possible trade-offs between efficiency gains from LLMs with the potential cognitive drawbacks of relying on them for tasks that are crucial for learning and memory.

Topic Area: LONG-TERM MEMORY: Other

D82 - Contributions of medial temporal lobe structures to viewpoint-invariant visual object familiarity with and without wakeful rest

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The nature and neural substrates of the mnemonic representations that support human's remarkable ability to rapidly recognize visual objects remains unclear. Recognition memory paradigms rarely address our ease and speed in recognizing individual objects, namely, beyond changes in viewpoint and against highly similar lures. We further ignore whether wakeful rest, supposedly involved in consolidation, plays a role in fast familiarity. Here, we tested the hypotheses that 1) fast familiarity for individual objects is spared in aging or selective hippocampal damage, but impaired after damage to the perirhinal cortex; and 2) short wakeful rest enhance the viewpoint-invariance of mnemonic representations of objects. 59 healthy young and old participants, and 3 patients with either selective hippocampal or perirhinal damage, underwent a speeded recognition memory paradigm, minimizing the diagnosticity of conceptual and perceptual fluency cues: targets and lures belonged to the same subordinate categories, and target viewpoints differed between study and test. Fast familiarity was assessed after a 2-minutes period of either wakeful rest, or spatial navigation preventing cognitive rest. Across these two rest conditions, both healthy elderly participants and patients with hippocampal damage performed successfully, but the patient with perirhinal damage was severely impaired. Wakeful rest uniquely protected the young against false alarms for highly confusable objects. Overall, we thus bring novel evidence supporting the role of the perirhinal cortex in building viewpoint-invariant representations of visual objects, and underline converging evidence that wakeful rest may modulate this mnemonic representation through hippocampus-dependent pathways.

Topic Area: LONG-TERM MEMORY: Other

D83 - Environment and expertise shape spatiotemporal variation in conceptual knowledge

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Conceptual knowledge is often regarded as stable, yet research shows that it is continuously altered by contextual factors. Even within domains of broadly shared knowledge, the accessibility and salience of specific concepts vary with recent experience and environmental exposure. This creates a unique conceptual landscape that affects many aspects of cognition but is difficult to quantify at the level of an individual. To address this challenge, we used ecological data on bird species distributions to map spatiotemporal variation in conceptual knowledge across participants differing in domain expertise and geographical location. In a picture-word interference task (bird names overlaid on photos), reaction times varied with trial congruency (name-photo match vs. mismatch) and were further influenced by participant expertise and the regional abundance of each individual bird species. These results demonstrate that even within a single domain, large

datasets can reveal the fine-grained structure of conceptual knowledge as it is dynamically shaped by exposure to items in one's local environment.

Topic Area: LONG-TERM MEMORY: Semantic

D84 - Categorical Judgments: Examining the Learned Structure Derived from Implicit Statistical Learning

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Implicitly tracking transitional probabilities in our environment, termed statistical learning, facilitates early language acquisition and efficient perceptual processing. Recent work suggests that transitional probabilities may also aid rapid category formation and thereby inform explicit inferences about shared, non-temporal features. After viewing a sequence of items constructed from a random walk along a graph with community structure, participants tend to group items from the same temporal community, particularly when oriented toward some novel, invisible feature that items might share. While this suggests that implicitly learned structure can shape explicit similarity judgements, such behavior could reflect either inferring categories or simply tracking transitional probabilities. As a stronger test of category inference, we had participants learn a different fact about one member from each community before viewing the sequence. Then, rather than grouping pairs of items, we directly asked if the fact applied to other items from the same or different communities. Early results (n = 60) suggested a general bias towards selecting the item from the same temporal community as the relevant trained item, consistent with categorical generalization. However, post-hoc power analyses revealed that the study was underpowered to detect potential effects in this modified task, particularly across individual conditions. To address this limitation, we are collecting data from a new, larger sample (n = 180) to better assess the reliability and magnitude of the observed effects.

Topic Area: LONG-TERM MEMORY: Semantic

D85 - Imagery and meaning: How individual differences in visual imagery affect conceptual knowledge

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Conceptual knowledge is grounded in simulation in neural systems for perception and action. Mental imagery is also thought to rely on simulation in these same systems, yet it remains unclear whether individual differences in imagery experience affect how concepts are represented. This planned study tests whether people with more vivid visual imagery rely more on perceptual simulation during conceptual processing. Participants (target N = 210) will judge whether word pairs are similar in shape (e.g., ruler-bookmark) or color (e.g., crow-coal), while concurrently maintaining either abstract shapes or color gradients in working memory, or performing no secondary task. We

predict that judgments will be selectively disrupted when the working-memory content engages the same perceptual modality as the conceptual feature being judged (e.g., shape judgments will be most disrupted by holding abstract shapes in working memory). We also predict that this feature-specific interference will be stronger for participants with more vivid imagery. Such findings would suggest that vivid imagers depend more on simulation using visual resources to access conceptual knowledge about visual features, highlighting how imagery experience may influence the cognitive and neural bases of meaning.

Topic Area: LONG-TERM MEMORY: Semantic

D86 - Targeted reactivation of motor and declarative memories linked via higher-order associations

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Optimizing learning and memory retention has long been a focus of neuroscience research. One promising intervention is Targeted Memory Reactivation (TMR), in which learned material is paired with sensory cues that are replayed offline during consolidation to trigger memory reactivation (Hu et al., 2020). TMR during sleep has been shown to enhance both declarative (memories of facts and events) and procedural memories (memories of movement-based skills) in young adults; and electroencephalography (EEG) evidence links these effects to modulations of slow oscillations, spindles, and their coupling - mechanisms that are critical for sleep-dependent neuroplasticity (Cairney et al., 2018; Nicolas et al., 2022, 2025). While previous studies have primarily examined the effects of TMR on consolidation within individual memory domains, here, we tested whether associations across domains can be leveraged through TMR to enhance memory consolidation. Using an adapted version of the explicit Serial Reaction Time Task, twenty-four young healthy participants learned both a motor (procedural) and an object (declarative) sequence that were linked or not by higher-order associations. TMR was then administered during post-learning NREM sleep during a 90-minute nap that was monitored using real-time analyses of sleep EEG. In contrast to our expectations, TMR tended to disrupt object memory consolidation but did not indirectly affect the consolidation of the linked motor memory. These findings suggest that higher-order associations between domains may not elicit similar reactivation processes during sleep. Ongoing sleep EEG analyses will characterize the neurophysiological processes underlying direct and indirect TMR.

Topic Area: LONG-TERM MEMORY: Skill Learning

D87 - The Brain Resilience Study: Neural signal complexity from low-resolution EEG reflects cognitive performance in aging

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Aging is accompanied by changes in brain structure and function that are thought to be related to cognitive decline. Neural complexity is an indicator of information processing capacity in brain networks and is associated with cognitive function. In the present study, we investigated the relationship between signal complexity measured using multiscale entropy (MSE) and cognitive performance (MoCA and CANTAB) in older adults. While previous studies have established associations between MSE of EEG signals and cognitive outcomes, these findings have mostly relied on high-density EEG systems. Here, we aim to determine whether similar relationships could be detected using a low-resolution, portable EEG device. We recorded 5 minutes of resting-state EEG in older adults (82 participants; 39 females; ages 52–84 years) using the Muse S (InterAxon) 4-channel system. Data were band-pass filtered, epoched, and artifacts were identified for rejection by local Autoreject. MSE was calculated for each channel and epoch and averaged per participant. Then, it was examined using Partial Least Squares to extract patterns associated with cognition. Participants were differentiated by cognitive scores and revealed a shift toward higher entropy at finer time scales and lower entropy at coarser time scales, with better memory performance ($p < 0.05$), with stronger effects at finer temporal scales. Additionally, the mean-centered PLS showed different MSE between sexes ($p < 0.05$). These findings suggest that EEG signal complexity from low-resolution EEG can provide unique insight into cognitive function across aging and sexes.

Topic Area: METHODS: Electrophysiology

D88 - Age-Dependent Acute Responsiveness to Transcranial Photobiomodulation

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Infrared light enhances the body's natural repair ability. Transcranial Photobiomodulation (tPBM) is a therapeutic technique that illuminates low-power LED near-infrared lights placed around the scalp for stimulating the cerebral cortex areas. The photons absorbed by neuronal mitochondria boost their bioenergetic action and cell recovery. The upregulation of mitochondria is linked to the improvement of cognitive functions and emotional regulation. Recent studies report that kids with ADHD display prominent relief in social relationships and sleep quality after eight consecutive months of daily tPBM therapy administered at home. Our team is to examine whether a subject's age affects his acute responsiveness to tPBM. The hypothesis is that young adults exhibit more positive responses to tPBM than middle-aged adults, possibly due to greater neuroplasticity and better cerebral circulation. Two groups of participants, young

adults aged between 18 and 24 and middle-aged adults aged between 35 and 55, are recruited to complete two randomized tPBM sessions with a 20-minute duration, one active and one sham. Visually evoked event-related potentials are collected prior to and immediately after each of the tPBM sessions. Functional connectivity between every pair of EEG channels is estimated creating an adjacency matrix that signifies network coupling strength. Given the adjacency matrix, graph-theoretical analysis derives network-level measures such as clustering coefficient and network diameter, enabling quantitative comparison of large-scale functional connectivity patterns between two age groups. Our previous studies have demonstrated that the graph-theory-based functional connectivity analysis can capture subtle changes in the brain's large network-level behavior due to interventions.

Topic Area: METHODS: Electrophysiology

D89 - Bridging Brain Structure and Function: Structural-Functional Brain Network Coupling and Frontal Midline Theta Connectivity in Cognitive Abilities

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Structural connectivity (SC) and functional connectivity (FC) of brain networks are key neural features underlying individual differences in general cognitive abilities. Variations in SC may influence cognitive abilities indirectly by shaping FC, with the alignment between SC and FC captured by the SC-FC brain network coupling index. We propose that cognitive abilities emerge from an optimized SC-FC coupling as well as the dynamic regulation of frontal midline theta connectivity in the millisecond range. In this preregistered work in progress (<https://osf.io/52fkr>), we investigate MRI-derived SC-FC coupling and EEG-derived theta connectivity dynamics as two complementary predictors of general cognitive abilities. Our sample includes 215 healthy adults (102 males, 113 females) with a mean age of $M = 27.71$ years ($SD = 6.76$, range 18 – 40) who underwent extensive cognitive ability testing. EEG data during a task-switching cognitive control task were collected in 212 participants. 160 participants also underwent functional MRI measurements during an MRI-adapted version of the same cognitive control task as well as diffusion-weighted measurements. We quantify SC-FC coupling using graph-theoretical brain network communication metrics and apply structural equation modeling to estimate the latent association between the connectivity measures and general cognitive ability, while simultaneously controlling for measurement error. We expect that both SC-FC coupling and theta connectivity dynamics will significantly relate to individual differences in cognitive abilities. Moreover, a strong relationship between these connectivity predictors would suggest that optimized SC-FC coupling facilitates the dynamic modulation of functional connectivity during cognitive control mechanisms.

Topic Area: METHODS: Neuroimaging

D90 - NITRC's Triad of Services: Software, Data, Compute

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The Neuroimaging Tools and Resources Collaboratory (NITRC) is a knowledge environment for MR, PET/SPECT, CT, EEG/MEG, optical imaging, clinical neuroinformatics, computational neuroscience, and imaging genomics tools and resources. NITRC's Resource Registry (NITRC-R) catalogs software, data, databases, and other resources, extending the impact of previously funded neuroimaging contributions. NITRC-R provides efficient access to research tools and resources, categorizing and organizing resources, facilitating interactions between researchers and developers, and promoting better use through enhanced documentation and tutorials. The NITRC Image Repository (NITRC-IR) hosts freely-downloadable data, offering 21 projects, 13,000 subjects, and 20,700 imaging sessions, including International Neuroimaging Data-Sharing Initiative (INDI) datasets and the Open Access Series of Imaging Studies (OASIS) datasets. The NITRC Computational Environment (NITRC-CE) provides cloud-based computational services via Amazon Web Services. Current work includes designing the next generation NITRC-CE to meet current and future needs. Funded by the NIH since 2006, NITRC continues to support research, education, and neuroinformatics efforts.

Topic Area: METHODS: Neuroimaging

D91 - Spatial entropy of brain network landscapes

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We introduce a method for mapping the spatial entropy of functional brain network community structure images in brain space. Entropy maps indicate the extent to which the network communities present in a local area are ordered or disordered. We demonstrate how spatial entropy can be quantified for each voxel in the brain according to the network community affiliations of surrounding voxels. This process results in interpretable maps of brain network entropy. We show that regional entropy decreases in regions associated with the central executive network during 2-back working memory scans relative to resting-state scans. We also show that regional entropy decreases in the auditory cortex during music-listening scans relative to rest. We suggest that these regional entropy reductions reflect self-organization of neural processes in support of functionally localized cognitive tasks. Analyses in this work provide a framework for future analyses of spatial entropy in complex networks that can be mapped to Euclidean space – both within the brain and in other contexts.

Topic Area: METHODS: Neuroimaging

D92 - Iron levels in Deep Grey Matter Structures in Preterm Infants as a Marker for Cognitive Decline following Brain Injury

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Abnormal brain iron accumulation following brain injury in preterm infants is known to lead to poor neurodevelopmental outcomes later in life, highlighting the importance of detecting these changes early in the infant's life. Quantitative susceptibility mapping (QSM), a non-invasive MRI technique, can quantify brain iron levels, allowing for the rapid identification of these iron accumulations. We hypothesized that deep grey matter (DGM) structures served as sites of iron accumulation following brain injury in preterm infants, increasing susceptibility to cognitive disorders. 110 subjects (GA range: 24-32 weeks) underwent MRI scans following brain injury and 57 scans with clear visibility of the ROIs (thalamus and caudate nucleus) were selected for QSM analysis. Veins and brain bleeds interfering with the ROI values were masked out, and the mean chi values (proportional to iron levels) of the ROIs were recorded and interactively compared with gestational age (GA), postmenstrual age (PMA), and the sum of brain injuries (IVH + WM injuries + ventriculomegaly) via a mixed effects linear regression model ($\text{Chi ROI} \sim \text{PMA} + \text{Injuries} + \text{GA} + (1 | \text{Subject})$). While chi values in the caudate nucleus did not significantly interact with injuries ($p > 0.05$), the left thalamus showed significant interactions with injury ($\beta = 0.0007691$, $p = 0.013046$), suggesting that the thalamus may serve as a site of iron accumulation following brain injury in preterm infants, potentially making the thalamus more susceptible to neurodegeneration. These results suggest the potential for thalamic iron levels to serve as a marker for cognitive disorders.

Topic Area: METHODS: Neuroimaging

D93 - Individualized Parcellation Reveals Specificity of Dorsal Attention Network Function in Sustained Attention

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Sustained attention enables stable, goal-directed behavior and fluctuates between optimal "in the zone" and suboptimal "out of the zone" states. Trial-wise reaction time variability (RTV) during continuous performance tasks indexes these attentional states and has been linked to fluctuations between dorsal attention network (DAN)- versus default mode network (DMN)-dominant states. However, these networks are typically treated as monolithic, despite evidence of comprising multiple distinct networks. Although such network distinctions have been demonstrated in cognitive domains including memory and semantic processing, they have not been systematically examined in relation to sustained attention. Here, we

tested whether RTV fluctuations preferentially relate to specific networks within canonical DAN and DMN using individualized mapping. Twenty healthy adults completed two fMRI sessions, each including an 8-minute gradual-onset Continuous Performance Task. Individualized DAN and DMN subnetworks were identified using Multi-Session Hierarchical Bayesian Modeling, and RTV-BOLD associations were quantified using z-scores extracted from general linear model analysis. At the group level, DAN-A showed the highest mean RTV-BOLD correlation, followed by DAN-B, while DMN networks showed near-zero or negative correlations. A one-way repeated measures ANOVA revealed a significant main effect of network ($F(3, 57) = 6.53$, $pH = 0.007$). One-sample t-tests against zero revealed a significant positive RTV-BOLD association in DAN-A ($t(19) = 3.15$, $p = 0.005$), whereas DAN-B and both DMN networks did not differ from zero (all $p > 0.35$). Our results suggest that RTV-indexed attentional fluctuations selectively recruit DAN-A, reflecting inefficient or maladaptive hyper-engagement of the DAN's core sustained goal maintenance component.

Topic Area: METHODS: Neuroimaging

D94 - Exploring behaviour-adaptive and physiology-sensitive stimuli generation in cognitive neuroscience research (Poster abstract for the Sketchpad Series)

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Humans are typically confronted with perceptual input that changes dynamically in response to the environment, and often even adapts directly to the perceiver. Conversely, cognition experiments usually rely on static, perceiver-independent stimuli. To reconcile experimental rigor with ecological validity, recent artificial intelligence tools offer new solutions by enabling the creation of in-situ-adaptive, yet controllable, stimuli. Imagine, for instance, stimuli dynamically adapting to participants' responses (e.g., ad-hoc generated images prompted by affective ratings) or to participants' physiology (e.g., a pleasant melody generated in response to heightened electrodermal activity). As a proof-of-concept, I am illustrating the embedding of text-to-image (Stable Diffusion) and text-to-speech (Bark) transformer models into experimental scripts that then create stimuli adapting in real time to participants' behaviours. Extending previous pilot work, I present two ongoing studies in which participants rate faces or voice sequences that are either (emotionally) intensified or attenuated during the experiment through rating-adaptive, individualised prompt adjustment. This procedure allows for individualised experimental designs and provides insights into how humans process dynamically changing perceptual input, allowing for a closer approximation of real-world conditions. In addition, psychophysiological parameters are recorded using a mobile sensor (EmotiBit) to capture responsiveness to adaptive stimuli and to identify targets for the next methodological step: creating stimuli that are directly physiology-sensitive. While focussing especially on methodological aspects of integrating transformer models, prompted by behavioural response, into experimental scripts, I also outline future steps involving the use of

physiological signals to guide stimulus generation, since both approaches offer immense potential for cognitive (neuroscience) research.

Topic Area: METHODS: Other

D95 - Current Landscape of fMRI and Neurotechnology Infrastructure in Hawai'i: A Comprehensive Overview

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Comprehensive documentation of neuroimaging and neurophysiological equipment is essential for advancing collaborative and regionally representative neuroscience. Yet, the distribution and accessibility of such facilities in Hawai'i is not yet systematically mapped. This gap limits coordination among clinical and academic institutions and obscures the state's capacity for large-scale, multi-site research. To address this, the Hawai'i fMRI and Neurotechnology Infrastructure Mapping Project (Hi-Fi) is establishing a standardized database of neuroimaging and neurophysiological equipment, including MRI, fMRI, EEG, MEG, TMS, rTMS, and fNIR, across the Hawaiian Islands. The current focus is on publicly accessible institutions, providing an initial framework for transparent reporting and future expansion to private entities. Medical and educational organizations housing relevant equipment were identified through publicly available institutional information. Short structured surveys were then distributed to collect detailed data on equipment specifications, field strength, research or clinical usage, accessibility, and willingness to collaborate. Collected data are being synthesized into an open-access report and interactive database summarizing Hawai'i's neurotechnology infrastructure. Preliminary findings highlight both the diversity of available resources and the need for improved visibility across institutions. By consolidating this information, Hi-Fi aims to enhance statewide, national, and international research connectivity, reduce redundancy in equipment acquisition, and promote equitable access to advanced measurement technologies. This initiative represents the first systematic effort to map Hawai'i's neuroimaging and neurophysiological landscape and establishes a foundation for sustainable, collaborative growth in the region's neuroscience capacity and future inclusion of private entities.

Topic Area: METHODS: Other

D96 - The Impact of Combining FES Cycling and rTMS on Corticospinal Excitability in People with Motor Incomplete Spinal Cord Injury

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Spinal cord injury (SCI) can disrupt the function of the corticospinal tract, leading to motor impairments that require targeted rehabilitation

strategies to promote recovery. Neuromodulation approaches, such as repetitive transcranial magnetic stimulation (rTMS) or functional electrical stimulation (FES) cycling have been used to facilitate neuroplasticity. Although both interventions have shown potential benefits individually in this population, no studies have investigated the effectiveness of utilizing rTMS as a primer to FES cycling. In this study we investigated the effects of combining rTMS and FES cycling on corticospinal excitability in individuals with motor incomplete SCI. Participants attended 12 sessions over six-weeks and were randomized to receive either active or sham rTMS prior to FES cycling. Corticospinal excitability was measured using motor evoked potential (MEP) amplitude from the right first dorsal interosseous (FDI) muscle during the first and final session. Of the six participants, four were male and two were female with an average age of 61 ± 6.78 years. Preliminary results showed that the intervention group had a mean MEP amplitude increase of 70.53 ± 191.63 uV while the sham group had a mean decrease of 14.46 ± 45.98 uV over the course of the intervention. This research cites the need for further investigation into combined neuromodulation interventions as a rehabilitation approach. Future work will focus on running a powered trial to determine the effectiveness of combining rTMS with FES cycling in this population.

Topic Area: METHODS: Other

D97 - Gamma Oscillations in QIF based E-I Network

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Gamma-frequency oscillations are essential for cortical information processing, with Pyramidal-Interneuron Network Gamma (PING) emerging through E-I interactions or Interneuron Network Gamma emerging through I-I interactions. Previous Quadratic Integrate-and-Fire (QIF) network models relied on unrealistic inhibitory reversal potentials or mixed current-injection/conductance inputs, limiting biological relevance and analytical clarity. As a result, we developed a mean-field firing rate equations (QIF-FRE) to analyze macroscopic dynamics using exclusively conductance-based external and synaptic inputs with biologically plausible reversal potentials and an all-to-all connected QIF spiking network for verification of microscopic dynamics. Network dynamic was systematically characterized by varying external conductance drive and synaptic coupling strengths. Our model successfully generated 50Hz PING oscillations with realistic parameters. As external excitatory conductance input to excitatory population gradually increased, we observed three distinct dynamical regimes: (1) robust PING oscillations, (2) transition from PING to weak ING, and (3) oscillation quenching via subcritical Hopf bifurcation. Due to intractability to mean-field solution, we also derived analytical solution to single QIF neuron model which revealed that conductance-based inputs create voltage-dependent phase space compression, predicting the critical transition point in network. Additionally, we identified parameter regimes producing atypical synaptic currents due to QIF resetting properties and demonstrated that increasing simultaneously synaptic inhibitory conductance input to

excitatory and inhibitory population normalizes these currents. Our work indicates that conductance-based QIF E-I networks generate biologically plausible gamma oscillations while revealing novel dynamics including input-dependent mechanism transitions and QIF's limitation in modeling plausible neural network dynamics.

Topic Area: OTHER

D98 - Anti-Phase Theta-Gamma Coupling: A Neurodynamic Hypothesis Derived from a Dynamic Self-Model

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The nature of the self remains a central enigma in philosophy and a key frontier in science. This paper develops a novel “Dynamic Self-Model”—the self is an illusion emerging from the rapid alternation between “awareness” (A) and “awareness-of-awareness” (AoA)—inspired by phenomenological insights from Buddhist meditation. As a core component, we define AoA—which cannot be detected under ordinary conditions—as a spontaneous process distinct from effortful “meta-cognition” and attentional “meta-awareness”, thereby advancing it as a prime candidate for the Higher-Order Representation. Among the many possible neural bases for this conceptual model, we propose a parsimonious, falsifiable neurodynamic hypothesis as one promising candidate mechanism: an “anti-phase” theta-gamma coupling, where sensory gamma activity (A) and prefrontal gamma activity (AoA) are driven by opposite phases of the same theta rhythm. This approach recasts the long-standing philosophical enigma of selfhood as a testable question about neural mechanisms. As a preliminary test, we outline a proof-of-concept experiment that compares a simple task baseline with an induced flow state of reduced self-awareness, using high-density MEG with individual structural MRI for source localization. We will quantify theta-gamma (4–8/30–80 Hz) phase-amplitude coupling in prefrontal and sensory ROIs. We predict anti-phase (~180°) coupling with stronger prefrontal gamma at baseline, specifically attenuated in flow, providing neural evidence consistent with the Dynamic Self-Model. Beyond its empirical plausibility, we further argue that this model offers a powerful, unifying explanatory account for several enduring puzzles in consciousness studies, which in turn provides strong theoretical support for the model.

Topic Area: OTHER

D99 - Sensory and Social Deprivation During a 3-day Dark Retreat

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Dark retreat is an ancient contemplative practice in which practitioners enter complete darkness with reduced sensory stimulation for

extended periods, with the goal of gaining spiritual insight through intensive exploration of first-person experience. In Tibetan Buddhist traditions, for example, retreats can last for up to 49 days and aim to catalyze profound inner transformation. Contemporary versions of dark retreat that can be experienced without much contemplative training have recently gained some popularity, typically with a reduced duration of 3-7 days. Such experiences may have potential value for promoting psychological benefits. For example, a treatment known as dark therapy, with 14 hours of darkness each day, was developed for patients with bipolar disorder. However, the phenomenological and neurophysiological effects of dark retreats remain under-researched, and there is little documented evidence on changes in wakefulness, sleep, and dreaming. This study aims to examine sleep architecture and dreaming during 3-day dark retreats in 10 participants. We will compare retreat data with baseline measurements as part of a broader collaboration investigating neural and psychological effects of darkness immersion. Sleep will be examined using a wearable EEG headband including total sleep time, prevalence of different sleep stages, sleep efficiency, and lucid-dreaming frequency. We predict prominent changes in sleep and circadian rhythms. Additionally, we will assess interoceptive processing by evaluating heartbeat-evoked potentials and phenomenological reports. Findings from this investigation could provide useful insights into how extended periods of darkness influence consciousness and the brain during both wakefulness and sleep, potentially guiding future clinical and contemplative applications.

Topic Area: OTHER

D100 - Dreaming of a Better Past: The Role of Dreaming in Modifying Highly Emotional Autobiographical Memories

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Dreaming has been hypothesized to serve a functional role in memory formation and emotional regulation. Dream content often reflects waking concerns and emotional experiences, but the mechanisms underlying this process remain unknown. Here, we investigated how reactivating highly emotional autobiographical memories prior to sleep affects dream content and subsequent emotional appraisals of these memories. Participants (N = 43) completed the Autobiographical Emotional Memory Task (AEMT) prior to bed for three consecutive nights, and were awoken up to two times each night to provide verbal dream reports, with a final report upon awakening for the day. We hypothesized that reactivating negative emotional memories would lead to greater incorporation of memory elements in dream content relative to recalling positive memories, and that dreaming about these memories would reduce emotional reactivity towards them. Statistical analysis of the data collected in this study is ongoing. If our hypotheses are supported, this would provide further evidence that dream content can be experimentally manipulated by reactivating emotional memories prior to sleep, and would highlight an emotional regulatory function of dreaming, whereby incorporation of memory elements into

dreams results in less intense subjective emotional appraisals of the memory post-sleep.

Topic Area: OTHER

D101 - Transcranial Electrical Stimulation in Physiological Sleep: A Review

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Transcranial electrical stimulation (tES) is a safe, non-invasive brain stimulation technique using a weak electrical current to modulate neural activity when people are either awake or asleep. TES is an important tool for potentially improving patient functioning without the use of pharmaceuticals. However, there is limited data on how this method affects sleep in healthy adults. To address this gap, we are conducting a systematic review on the impact of tES on sleep in healthy adults using the Covidence platform for data collection. Since sleep structure changes with age, we focused on studies with adults (18-65 years of age) with no history of psychiatric or non-psychiatric illness to remove the likelihood of any sleep co-morbidities. Additionally, we only included original papers and excluded literature reviews, case studies, guidelines, and protocol. We included studies using various forms of tES: transcranial direct current stimulation, transcranial alternating current stimulation, and transcranial temporal interference stimulation. We excluded studies involving transcranial magnetic stimulation, vagal nerve stimulation, and deep brain stimulation. From an initial list of 1800 abstracts, we determined 52 papers fit our inclusion criteria and did a full-text review to further assess suitability. We are now extracting data on risk of bias, methodology, and sleep-based outcomes from the 29 included studies for a manuscript. For risk of bias, we are using the 2019 revised Cochrane risk-of-bias tool for randomized trials. Two authors review each of the 29 included studies to reduce bias in rating and ensure thorough data extraction.

Topic Area: OTHER

D102 - A music-reward localizer: using fMRI to identify neural responses to musical pleasure

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Pleasurable music engages the brain's reward network, offering a unique window into the neural basis of abstract reward. Characterizing how this network responds to music is key to developing brain-based markers of its therapeutic potential. However, no validated fMRI localizer currently exists to functionally define these music reward-related regions, limiting the development of objective biomarkers for music-based interventions. This study aimed to develop an fMRI localizer that reliably captures neural activity associated with musical

pleasure. Twenty participants underwent fMRI while listening to self-selected pleasurable and emotionally neutral musical excerpts (i.e., elevator music). The paradigm consisted of three runs of four randomized trials, each comprising a 60-s excerpt followed by a 30-s rest period. Behavioral ratings of musical pleasure and physiological measures (electrodermal activity and heart rate) were collected concurrently. Functional data were preprocessed in SPM12. The primary contrast of interest was pleasurable vs. neutral music. Second-level random-effects analyses were conducted using contrast images from each participant. Significant activation was observed in the right ventral striatum and bilaterally in the midbrain (substantia nigra/ventral tegmental area) for pleasurable compared with neutral music, corrected for multiple comparisons using small-volume FWE ($p < 0.05$). This localizer identifies neural activity within key regions of the reward network implicated in musical pleasure and may provide a biomarker of music- and reward-related brain function, supporting its application in music-based interventions.

Topic Area: PERCEPTION & ACTION: Audition

D103 - Rhythm modulates perception and neural tracking of speech in a speech-in-noise task

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Humans are able to tune into a single speaker even when multiple people are speaking, a phenomenon known as the "cocktail-party effect" (Cherry, 1953). Neural entrainment, or phase synchronization, to the quasi-rhythmic quality of the speech envelope has been proposed as a potential underlying mechanism (Selective Entrainment Hypothesis). McAuley and his colleagues (2020) have previously tested this hypothesis using a speech-in-noise perception task where sentences from a target and a background speaker were presented simultaneously. Their results showed that rhythm distortion in the target speech stream significantly decreased speech perception accuracy to the target speech stream whereas rhythm distortion in the background speech stream improved it. The current study aims to 1) replicate the previous behavioral results with a more naturalistic set of stimuli and, 2) to examine a more direct neural entrainment measure using Electroencephalography (EEG). Twenty participants listened to 100 stimuli in each of the 3 conditions (Target Rhythm Distorted, Background Rhythm Distorted, No Distortion). They were instructed to attend to the target sentences and answered questions about them. Behavioral results replicated previous findings that response accuracy was significantly higher in BRD condition than TRD condition. Phase-locking values, a metric indexing neural tracking of speech envelopes, were extracted for both target and background streams. PLVs were significantly higher for target than background streams across all conditions. Further, the difference in PLV between target and background streams was higher in BRD than TRD condition, providing neural entrainment evidence that underlie the behavior patterns.

Topic Area: PERCEPTION & ACTION: Audition

D104 - Sudden Auditory Degradation Elicits Increased Auditory–Frontal Connectivity During Emotional Speech Perception

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Previous research has shown that older adults with hearing loss are less accurate in the recognition of affective auditory stimuli than those with normal hearing. Some studies have also found that these drops in accuracy are accompanied by task-based increases in fronto-temporal connectivity. However, it is unclear whether this increased connectivity only arises following years of hearing loss or whether it may arise suddenly following signal degradation. Using functional Near-Infrared Spectroscopy (fNIRS), the present study investigated the effect of sudden simulated hearing loss in normal hearing young adults. Forty-five participants listened to emotional speech in multitalker babble and judged the expressed emotion. Half of the participants heard the original, unaltered stimuli (NH), while the other half heard stimuli that were modified to simulate hearing loss (SHL). Compared to NH, SHL had worse task performance and increased connectivity between superior temporal gyrus and inferior frontal gyrus (IFG). One interpretation of this difference in connectivity is that the IFG of participants with SHL may have been differentially recruited to support the “filling-in” of missing detail that would support emotion recognition. These findings indicate that neural signatures commonly attributed to long-term hearing loss can emerge immediately following signal degradation.

Topic Area: PERCEPTION & ACTION: Audition

D105 - Musical Preference and Reward Sensitivity Influence Neural Activation During Repeated Listening: An fNIRS Study

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Music is consistently ranked as one of the most rewarding activities. Familiar music is often considered more rewarding such that increased exposure to preferred pieces may produce greater liking. However, the neural mechanisms of musical preferences on reward as a function of familiarity have not been explored. This study used functional near-infrared spectroscopy (fNIRS) in a repeated exposure paradigm to investigate the extent to which familiarity influences the hemodynamic activation of the auditory cortex and portions of the prefrontal cortex for preferred and non-preferred music. Additionally, it examined the hemodynamic activation and self-reported liking for preferred and non-preferred pieces in distinct reward sensitivity groups, as measured by the extended Barcelona Music Reward Questionnaire (eBMRQ). A significant interaction was found between musical preference and repetition, such that overall activation was greater with repeated exposure to preferred music. Additionally, individuals with higher reward sensitivity showed greater overall activation across the brain when listening to preferred music. Together, these results suggest that musical preference and repetition interact to modulate activity across auditory–frontal networks, which was further pronounced in individuals with higher music reward sensitivity. This novel study demonstrates

the dynamic function of musical preferences on the neural mechanisms and functional organization of music reward, indicating a greater need to consider the integral role of individual preferences.

Topic Area: PERCEPTION & ACTION: Audition

D106 - Conversational engagement modulates neural speech tracking in real-time dialogue

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During speech listening, cortical activity shows rhythmic fluctuations that align with the temporal dynamics of the acoustic signal. This neural speech tracking (NST), measurable with EEG, reflects the degree to which connected speech is represented in cortical activity, and is modulated by both stimulus acoustic features and motivational-attentional factors. Here, we examined for the first time whether contextual conversational factors influence neural tracking of speech during truly social, naturalistic interaction. In a dual-EEG (“hyperscanning”) setup, 48 participants (24 unacquainted dyads) held short, free-form conversations on topics they had jointly rated as highly interesting or uninteresting. After each conversation, participants provided a set of ratings that together composed a behavioral index of conversational engagement. Each speaking turn was subsequently delineated from the synchronized audio recordings through careful manual segmentation. NST was computed as the peak Gaussian Copula Mutual Information (GCMi) between the speech envelope and EEG across stimulus-response lags of 0-300 ms. A linear mixed-effects model controlling for speakers’ main vocal acoustic features and the conversational topic showed that listeners’ perceived conversational engagement explained unique variability in the extent of NST in frontal and bilateral temporal regions ($p = 0.019$), with more engaging conversations eliciting stronger NST. This finding shows a cortical encoding advantage for engaging live conversations, highlighting that even early auditory encoding is dynamically shaped by listeners’ motivational engagement, and suggesting that processes previously observed in controlled listening tasks extend to natural, interactive communication.

Topic Area: PERCEPTION & ACTION: Audition

D107 - Audiomotor adaptation remaps spatial-auditory representations

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Humans interact with dynamic environments in which previously familiar movements may yield unexpected outcomes. Sensorimotor adaptation illustrates this process, involving the recalibration of motor commands based on sensory feedback. Although extensively studied in the visual domain, far less is known about audiomotor adaptation.

This research investigated whether audiomotor adaptation in the absence of visual input is sufficient to alter spatial-auditory mappings. Participants with healthy vision and hearing interacted with a 9x9 grid space by moving a computer mouse to learn the mapping between spatial locations and auditory feedback. Each grid produced a unique sound varying in frequency and amplitude. Learning was assessed by asking participants, while blindfolded, to locate target grids after hearing specific sounds. In the subsequent reaching task, participants' cursor movements produced continuous feedback sounds based on the learned spatial-auditory mapping. After a baseline block, a 30° cursor rotation was introduced, creating a mismatch between expected and actual auditory feedback. After the reaching task, grid-sound mappings were tested again. For the reaching task, participants' performance showed increased accuracy, faster movements, and shorter, more linear trajectories across runs, indicating they learned to adapt to auditory feedback. Critically, participants with greater adaptation showed increased errors in the post-grid-sound mapping test compared with the pre-test, suggesting remapping of spatial representations after audiomotor adaptation. These findings demonstrate that sensorimotor adaptation can occur with auditory feedback alone and can reshape spatial-auditory representations in sighted individuals who predominantly rely on vision, supporting the idea that sensorimotor adaptation may operate through modality-general learning mechanisms.

Topic Area: PERCEPTION & ACTION: Audition

D108 - Frequency-Dependent Posterior-Anterior Reorganization of Brain Dynamics Across the Adult Lifespan

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Healthy aging includes not only neural decline but also large-scale functional reorganization across the brain's cortical architecture. A consistent pattern observed across neuroimaging studies is the posterior-to-anterior shift (PASA) in activation and connectivity: activity in posterior regions decreases, while activity in frontal regions increases as we age. This gradient has been interpreted as reflecting a dynamic interplay between deficit and compensation, whereby degradation of posterior processing efficiency prompts greater reliance on anterior control mechanisms to sustain cognition. However, the lack of spectral resolution limits insight into how different neural oscillatory systems contribute to reorganization. Here, we used magnetoencephalography (MEG) to examine frequency-resolved patterns of network segregation and integration across life span. Power-envelope correlations were computed for resting-state MEG data from Cam-CAN (Cambridge Centre for Ageing and Neuroscience) across 619 subjects. We then quantified how patterns of functional segregation and integration vary with age along the anterior-posterior axis. Results revealed a gradient of reorganization: with increasing age, frontal regions became more segregated, exhibiting stronger within-region coupling and reduced cross-regional integration, whereas posterior regions showed the opposite trend,

becoming more integrated and less internally cohesive. These opposing shifts were most pronounced in the beta frequency range (12-24 Hz), which is a rhythm often linked to long-range coordination and top-down control. These findings suggest that the opposing shifts in frontal and posterior organization imply a redistribution of network dynamics, whereby greater local specialization in frontal hubs helps balance reduced coherence in posterior regions in a frequency-dependent manner.

Topic Area: PERCEPTION & ACTION: Development & aging

D109 - Awake Infant fMRI and Deep Neural Network Models Reveal Hierarchical Development of Object Feature Tuning in the Ventral Visual Stream

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When an adult views an object, the ventral visual stream (VVS) encodes features across spatial scales, from fine details to global shape, and a range of complexities, from low-level perceptual features to conceptual properties. Due to methodological challenges, when and how object feature tuning emerges during development remains unknown. Behavioral studies indicate that young infants attend to low-level visual features, but cannot reveal which features are represented along the VVS. Through the Foundations of Cognition Project, we therefore conducted the largest cross-sectional and first longitudinal awake infant fMRI study to date, acquiring object responses at 2-months (n=113) and 9-months (n=51), and from adults (n=17). To probe feature tuning, deep neural networks (DNNs) were trained on objects blurred at varying levels, suppressing fine detail and yielding models with graded sensitivity to features across spatial scales. Representational similarity analysis was used to characterise group-level responses along the developing VVS and compare them to model responses across blur levels. For each comparison, the model layer whose representations best matched the brain response was selected, capturing the appropriate level of complexity. By 2-months, V1 responses resembled adult-like tuning. In contrast, later VVS regions remained immature through 9-months, demonstrating a hierarchical trajectory of development. Across development, V1 responses were best modelled by intermediate layers, consistent with previous work suggesting that V1 is sensitive to more complex features in addition to low-level ones. That such complexity appears to be present by 2-months indicates surprisingly sophisticated early

sensory representations and motivates further work to probe their content.

Topic Area: PERCEPTION & ACTION: Development & aging

D110 - To Move or to Use: Task Goals Drive Kinematic Differences in Object-Directed Action

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Motor planning is a fundamental cognitive function providing flexibility to manipulate objects according to task goals. For example, when moving a spoon into a cabinet, numerous parts of the object can be grasped. But when the goal is to eat soup with a spoon, the object must be grasped in a manner that anticipates its subsequent use. Here, we developed a markerless hand posture tracking system using the OpenCV and MediaPipe libraries to measure speed when initiating and executing movements, and grip aperture precision (distance between thumb and index finger) as 16 neurotypical participants grasped objects and placed them into a nearby container directly, or after performing use actions. Half of the participants completed 4 blocks of grasp-to-move trials, followed by 4 blocks of grasp-to-use trials (and vice versa for the other half). Participants wore occlusion glasses to block visual processing and prevent motor planning before an auditory cue was presented, at which point the lenses became transparent and participants executed the action. This allowed us to test how task goals modulate action kinematic features while holding stimuli constant. We tested two hypotheses: (H1) Grasping-to-use actions require more precise grip aperture than grasping-to-move; and (H2) Grasping-to-use actions are performed more slowly than grasping-to-move actions. Analyses comparing differences in these variables as a function of task goals support both hypotheses. Our findings indicate that motor planning processes modulate kinematic features of grasping actions, and demonstrate the feasibility of markerless hand posture tracking as a tool to study cognitive processing.

Topic Area: PERCEPTION & ACTION: Motor control

D111 - Mapping Lesions in Action: Voxel-based Lesion-Activity Mapping

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Understanding how focal brain damage disrupts cognitive and neural function is a central challenge in cognitive neuroscience. At the 2025 CNS meeting, a symposium on voxel-based lesion-symptom mapping (VLSM) highlighted what VLSM can and cannot reveal about brain-behavior relations. A key issue raised was the need for methods to test how lesions alter neural processing in functionally connected areas distal to the site of injury. Here, we introduce Voxel-based Lesion-Activity Mapping (VLAM), a new approach relating lesion topography to task-evoked neural responses. We validated VLAM using a functional MRI (fMRI) dataset collected from 109 pre-operative brain tumor patients with left-hemisphere lesions. We tested the hypothesis that lesions to parietal areas supporting object-directed grasping (left anterior intraparietal sulcus) and use (left supramarginal gyrus) will disrupt neural responses for manipulable objects in left ventral temporal cortex (VTC). VLAM analyses supported this hypothesis: Participants with lesions in these left parietal areas exhibited weaker neural responses for manipulable objects in the left VTC. Control analyses showed that parietal lesions did not affect responses to place stimuli in the left VTC, indicating a domain-specific parietal attenuation in left VTC. These findings reveal that category-specific neural responses for manipulable objects in VTC emerge, in part, via inputs from parietal regions that support object-direction action. More broadly, we establish VLAM as a new method for investigating how lesions alter neural responses in distal, functionally connected areas.

Topic Area: PERCEPTION & ACTION: Motor control

D112 - Understanding the Effect of Manipulating Task Importance on Implicit Sequence Learning

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Implicit learning within the broader context of skill learning is theorized to depend on the statistical extraction of regularities during repeated practice. A persistent challenge lies in identifying how implicit knowledge representations are affected by potentially overlapping motivational contexts. For example, how changes in motivation or task difficulty occur in different learning environments. Here we explored how implicit motor learning is modulated by motivational contexts using a within-subjects design of the Serial Interception Sequence Learning (SISL) task. In the SISL paradigm, participants make precisely timed responses to moving visual cues that covertly follow a 12-item repeating sequence. Participants were instructed that after a training period they would be able to earn points towards a set goal. At test, points were earned by accurately responding to cues in alternating blocks with High and Low stakes conditions. In Low stakes blocks, participants were told they could earn or lose only a small

number of points, whereas in High stakes blocks they could earn or lose ten times as many points, emphasized by a visual background change. After 144 sequence repetitions, all participants showed reliable sequence-specific learning. Survey results indicated that participants rated the High stakes blocks as significantly more important than Low stakes blocks. However, there were no observable differences in knowledge expression between stakes conditions. Perceived importance through task motivation may not have sufficiently influenced implicit learning, or this may indicate that the SISL task targets implicit learning processes that are unaffected by motivational instruction.

Topic Area: PERCEPTION & ACTION: Motor control

D113 - Crossing the arms impairs vibrotactile frequency perception by degrading sensory evidence: Evaluation with a Drift Diffusion Model.

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The present study explores the interaction between egocentric and external reference frames in non-spatial processing, specifically vibrotactile frequency perception. While previous studies primarily investigated the impact of reference frames on spatial judgments, such as in temporal order judgment with arm crossing (Yamamoto & Kitazawa, 2001), their effects on non-spatial processing, including texture and frequency perception, have been largely unexplored. Tactile frequency perception is known to exhibit an assimilation effect, wherein perceived frequency shifts towards that of a distracting stimulus, even when individuals attempt to ignore it (Kahrimanovic et al., 2009; Kuroki et al., 2017). This effect is pronounced when stimuli are synchronized. Here, we investigated the combined influence of stimulus simultaneity and arm-crossing on tactile frequency perception. In the experiment, vibrotactile stimuli were presented to the left and right index fingers, and participants identified which finger received the higher frequency. Stimuli were delivered either sequentially or simultaneously, with arms either uncrossed or crossed. Behavioral results revealed that non-spatial vibrotactile frequency perception was impaired not only by the absence of simultaneity but also by arm-crossing. To examine the underlying decision-making process, we applied the Drift Diffusion Model (DDM) to response time and accuracy data. The modeling revealed that the drift rate—a parameter reflecting the quality of sensory evidence—was significantly reduced in the arm-crossed condition compared to the uncrossed condition. These results suggest that non-spatial tactile perception is influenced by spatial information, and that reference frames affect not only spatial localization but also early sensory evidence accumulation in non-spatial perceptual decisions.

Topic Area: PERCEPTION & ACTION: Other

D114 - Semantic priming modulates the strength and direction of the Kanizsa illusion

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Visual illusions are often considered key examples for cognitive impenetrability, as they are held not to be affected by non-perceptual processes. We revisit this claim in five preregistered experiments focused on the Kanizsa illusion, where a nonexistent shape is experienced due to filling-in of illusory contours. Three Pac-Man-like shapes inducing the Kanizsa illusion of a triangle were preceded by a prime that was either semantically related to the Pac-Man characters or not. We hypothesized that the semantic prime would promote a non-holistic interpretation of the Kanizsa inducers as individual Pac-Man characters, thus biasing participants against perceiving the illusion. In Experiment 1, the semantic prime was a picture of a Pac-Man maze. In Experiments 3 and 4, it was the word 'Pac-Man'. As expected, a difference between the prime groups was found, with fewer detections of the Kanizsa triangle shape when participants were semantically primed with Pac-Man related stimuli. To show that the effect does not stem from mere attentional engagement by a meaningful prime, a non-Pac-Man related semantic prime was used in experiment 2, and no difference between the groups was found. Finally, in Experiment 5, we showed the opposite effect, with semantic priming of the illusory shape ('Triangle') enhancing the probability of seeing the Kanizsa illusion. Taken together, the results suggest that semantic priming can affect the probability of experiencing the Kanizsa illusion, thus supporting claims of cognitive penetrability.

Topic Area: PERCEPTION & ACTION: Vision

D115 - Faster Alpha Oscillations and Aperiodic Activity Predict Narrower Temporal Binding Windows in ADHD profiles

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Temporal integration enables the visual system to accumulate sensory evidence over time, ensuring perceptual stability despite uncertainty. Neural oscillations in the alpha band (8–13 Hz) have been proposed to define the temporal window of integration, yet their role and relationship with temporal perception atypicalities observed in neurodevelopmental conditions such as attention deficit hyperactivity disorder (ADHD) remain unexplored. We developed a continuous-stream visual temporal integration task in which neurotypical participants (n = 83) viewed two orthogonal Gabor patches ($\pm 45^\circ$) alternating at different durations in counterphase for one second and reported whether they were perceived as fused (integration) or separate (segregation). Resting-state EEG was recorded in eyes-closed and eyes-open conditions to estimate individual alpha frequency (IAF) and aperiodic neural activity, which were linked to temporal binding performance and self-reported ADHD traits. Behaviourally, higher ADHD traits were associated with narrower temporal binding windows and finer temporal resolution. Temporal judgments were also influenced by perceptual history: individuals with

lower ADHD traits showed stronger serial dependence toward prior integration responses, whereas those with higher traits relied less on previous experience. EEG–behavior correlations revealed that faster IAFs predicted lower temporal thresholds, and steeper aperiodic slopes (i.e., lower neural noise) were linked to greater perceptual precision. Importantly, faster IAFs were observed in individuals with higher ADHD traits, potentially explaining their narrower temporal integration window. These findings reveal a multilevel mechanism in which oscillatory and aperiodic neural dynamics jointly shape temporal integration, elucidating how individual differences in neural dynamics underlie atypical temporal perception in ADHD.

Topic Area: PERCEPTION & ACTION: Vision

D116 - The impact of gait complexity on visual information processing

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Walking is in many situations a highly automated skill that requires only minor cognitive resources. Whenever the walking surface becomes uneven, locomotion can turn into complex behavior that has to be cognitively controlled. In this case, other cognitive tasks will be affected by increased cognitive-motor interference (CMI). So far there is only few research for visual processing on this topic due to restricted experimental opportunities. Experimental approaches require either outdoor measurements of mobile EEG or virtual environments in which gait complexity can be manipulated. We tested peripheral visual stimulus detection under varying walking conditions while measuring mobile EEG. The treadmill either run flat or was tilting in various complexities. No main effect of gait complexity was found in a first experiment, but both for response accuracy and late ERP components a decrease of peripheral performance decline was observed, indicating a widening of attention when walking becomes more complex. In a follow up experiment (pilot phase), we increased the amplitude of tilting to amplify the impact of gait complexity. Here we see a stronger effect of gait complexity, primarily with respect to response times. Most interestingly, responses became faster with flat walking if compared to standing but were on the same level with standing when walking was more complex. So far, the experiments show a complex interaction between walking demands and visual processing, pending on available resources but also the type of information that has to be processed.

Topic Area: PERCEPTION & ACTION: Vision

D117 - Visual Spatial Frequency Modulates the Polarity of Early ERP Components

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The spatial frequency of visual stimuli is known to modulate various aspects of early visual processing. However, stimulation protocols do not typically account for the fact that visual stimulation results in early

ERPs with a reversed polarity between the upper and lower visual field. Intermixing spatial frequency and spatial field can lead to ambiguity when reporting ERP polarities. Here, we used a rapid-serial presentation experiment while recording EEG from 12 participants who were presented with 42 unique checker-board stimuli that varied in the number of their radial and angular cycles. By designing stimuli with radial and angular cycles, we were able to account for the influence of spatial frequency and spatial field on early ERP components. Our results show that the polarity of the P1/N1 ERP components in early visual cortex is modulated by spatial frequency, with higher spatial frequencies exhibiting stronger positive ERP responses around 100ms post-stimulus onset, while lower spatial frequencies elicited a stronger negative response at 100ms. In addition, we were able to accurately decode the spatial frequency of stimuli using time-resolved EEG decoding analysis, suggesting that early ERPs represent the specific spatial frequencies of stimuli. These findings highlight the potential for utilising the appropriate spatial frequency of stimuli to elicit stronger responses in early visual cortex.

Topic Area: PERCEPTION & ACTION: Vision

D118 - Arousal Reshapes Perceptual Representations

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The locus coeruleus (LC) releases norepinephrine in a phasic burst during arousing events, a pattern that often enhances behavioral outcomes by improving both accuracy and response time. Prevailing theories attribute these benefits to the sharpening of neural responses; however, such models merely amplify or suppress existing signals, leaving the structure of information unchanged. We propose instead that arousal serves to modulate spatial interactions through lateral inhibition, thereby inducing representational shifts and facilitating perceptual distinctiveness. To test this account, we formalized existing LC-based arousal theories within a CNN–drift diffusion pipeline and validated the outputs using human behavioral data from a novel ultra-rapid categorization study. The introduction of lateral inhibition significantly improved human–model alignment, whereas traditional signal-based models not only failed to replicate behavior but also significantly reduced accuracy. Analysis of network dynamics revealed that alterations in representational space were significantly correlated with increases in human alignment and enhanced the informativeness of individual units. These findings imply that the effects of arousal depend critically on local interactions, operating through representational changes rather than signal amplification alone.

Topic Area: PERCEPTION & ACTION: Vision

D119 - Diurnal variation in alpha oscillations and aperiodic components of patient ECoG

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Neural activity in the cerebral cortex shows both rhythmic oscillations and 1/f aperiodic components. Alpha-band (8–13 Hz) activity is dominantly observed over the occipital cortex, and numerous studies have reported its association with cognitive functions such as vision and attention. The slope of the EEG aperiodic component has been suggested to reflect the excitation/inhibition (E/I) balance. Some cognitive performances are known to fluctuate across the day, with peaks around 10:00–11:00 or 17:00–20:00. Time-varying dynamics of alpha oscillations and aperiodic components may involve such diurnal fluctuation in cognitive functions. In this study, we analyzed long-term, multichannel electrocorticogram (ECoG) recordings from ten epilepsy patients with chronically implanted intracranial electrodes. We quantitatively investigated the diurnal variations in the alpha oscillation frequency and the slope of the 1/f component. The alpha peak frequency over occipital regions, defined as the frequency yielding maximal occipital alpha power, exhibited a clear diurnal rhythm: it gradually increased during the day and peaked around 19:00–21:00, while some patients showed an additional peak around 9:00–15:00. In contrast, the slope of the 1/f components showed multiphasic fluctuation patterns, with peaks around 9:00, 20:00, and possibly 13:00 across many electrodes and patients. These results demonstrate that both periodic and aperiodic components of human intracranial neural activity exhibit diurnal fluctuations. They also suggest that considering such daily rhythms will be important for future cognitive experiments, neural state estimation, and clinical applications. Furthermore, the observed neural fluctuations may be associated with diurnal variations in cognitive performance, warranting further investigation of this relationship.

Topic Area: PERCEPTION & ACTION: Vision

D120 - Grasping unseen physical properties of objects: The role of the ventral visual pathway in object-directed action

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Many daily activities require object-directed actions that involve reaching to grasp an object that is manipulated to achieve a goal. Even before grasping an object, visual cues affect the form of grasp. Consider two cups filled with water, one made of styrofoam and one made of glass. Upon observing each, our brains automatically and implicitly process the difference in material properties to determine that a glass cup requires a stronger grip force than one made from styrofoam. Thus, perceptual inferences about what objects are made of and their associated weight, an unobserved physical property, are

necessary for functional interactions. This study examined the role of the ventral visual pathway in translating visual cues into functionally appropriate object-directed actions. Specifically, it tested the use of surface texture cues to drive inferences about material properties and the internal weight distribution of an object. In Study 1, subjects completed a localizer task in which they viewed images from different categories (e.g., faces, tools, words) during fMRI scanning. In Study 2, subjects made center of mass estimations on small manipulable objects while in the scanner. Results demonstrated that voxels in the collateral sulcus preferring small manipulable objects show functional overlap with voxels that process surface texture and material properties. Additionally, our findings show that the neural response observed in the collateral sulcus is modulated by the complexity of the center of mass inference. These findings support the view that the collateral sulcus supports perceptual inferences about material properties and weight distribution of graspable objects.

Topic Area: PERCEPTION & ACTION: Vision

D121 - When How You Measure Time Matters

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Research on human time perception has relied primarily on two paradigms to estimate perceived duration. In the comparison paradigm, observers judge whether a test interval is longer or shorter than a standard, allowing derivation of a point of subjective equality (PSE). In the reproduction paradigm, observers reproduce perceived duration by pressing and holding a response button. Although both paradigms are widely used to study temporal distortions, they have rarely been evaluated side-by-side using identical stimuli. There is an inconsistency in the literature concerning temporal dilation induced by dynamic, size-changing stimuli. Comparison paradigm studies have reported a strong asymmetry, with looming disks producing substantial dilation and receding disks producing weak or no dilation. In contrast, reproduction studies, including our under-review work, have reported comparable dilation for both looming and receding stimuli. In the present study, observers viewed identical looming, receding, and static disk stimuli and completed both comparison and reproduction tasks within the same experimental framework. In the comparison task, we failed to fully reproduce the previously reported looming–receding asymmetry, observing only modest differences between stimulus types. In the reproduction task, both looming and receding stimuli produced large and comparable temporal dilation relative to static controls, with substantially larger effect sizes (looming: $d = 1.20$; receding: $d = 1.38$) than those observed in the comparison task (looming: $d = 0.43$; receding: $d = 0.18$). These findings indicate that the magnitude and apparent symmetry of temporal dilation depend strongly on the measurement paradigm, suggesting differential contributions of perceptual and motor timing mechanisms.

Topic Area: PERCEPTION & ACTION: Vision

D122 - BrainTrace: cortical encoding of visual acuity under myopic blur

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Myopic defocus degrades visual acuity and is thought to play a causal role in axial eye growth, yet its cortical consequences remain incompletely characterized. Electrophysiological studies of blur have largely relied on visual evoked potential amplitude changes, providing limited insight into how optical noise alters neural encoding. Here, we introduce a fast periodic visual stimulation (FPVS) protocol combined with EEG to objectively track how myopic blur alters the cortical encoding of angular visual acuity. Adults ($n = 10$) with corrected-to-normal vision viewed rapid sequences of size-matched Landolt C optotypes and annuli presented in a 2:1 base:oddball ratio, such that discrimination of the Landolt C gap selectively elicited neural responses at the oddball frequency and its harmonics. Optical blur was simulated by convolving stimuli with point-spread functions derived from Zernike polynomials corresponding to myopic defocus levels of 0 diopters (D), -1 D, and -3 D (negative control). Neural entrainment was quantified over occipital channels using signal-to-noise ratio and Z-score analyses at the group level. Entrainment at the base frequency remained robust across all blur levels, confirming reliable visual stimulation, while Z-scores decreased with increasing blur. In contrast, oddball-frequency entrainment were significant for 0 D and -1 D blur, indicating successful neural discrimination of the Landolt C gap, but were absent in the -3 D condition, when the Landolt C and annulus were perceptually indistinguishable. Critically, Z-scores at the oddball frequency decreased with increasing blur over occipital cortex. This protocol provides separable neural indices of stimulus visibility and feature discriminability, allowing to parse how optical blur and other forms of external sensory noise limit visual encoding. Overall, it offers a rapid, objective neural marker of angular visual acuity under sensory degradation.

Topic Area: PERCEPTION & ACTION: Vision

D123 - Toward Translational Mechanisms of Learned Helplessness: Linking Behavior, Computation, and Neural Modulation

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Motivational deficits are a hallmark of depression, yet their underlying mechanisms remain unclear. Within the Research Domain Criteria (RDoC) framework, learned helplessness (LH) provides a model for these impairments, displaying passivity even when control is possible. Such passivity may arise from an overactive Pavlovian system that biases behavior toward punishment-averse inaction (Pavlovian bias). Or it could be due to weakened drive to act (action bias) which would also manifest as reduced choice stochasticity—reflecting

diminished exploration and increased behavioral rigidity – under uncertainty. We tested these hypotheses using a modified Levine task to induce helplessness through solvable (control) or unsolvable (experimental) conditions. Participants ($N = 112$; 74 retained: 35 control, 39 experimental) completed an orthogonalized Go/No-Go (o-GNG) task before and after induction, dissociating Pavlovian and instrumental components. Behavioral indices and hierarchical Bayesian modeling (HBayesDM) parameters quantified latent constructs of action bias, Pavlovian bias, and choice stochasticity. Modeling supported the action bias hypothesis: we observed a significant reduction in action bias (pre: 1.55, post: 0.61; HDI (post-pre) = [-1.8, -0.1]) and choice stochasticity (pre: 0.14, post: 0.04; HDI (post-pre) = [-0.2, -0.02]) following helplessness induction, indicating diminished drive to act and reduced exploration. Furthermore, experimental group participants with elevated depressive symptoms (PHQ-9 ≥ 8 ; $n = 14$) showed nearly double the decline in action bias. On the other hand, Pavlovian bias remained stable. These findings highlight reduced action vigor and exploration as key computational features linking helplessness to depressive symptomatology and highlight a potential target for dACC–dlPFC modulation.

Topic Area: THINKING: Decision making

D124 - A Mechanical Analogy for the Observed Oscillations in Choice Behavior of a Population Facing a Time-Varying Reward

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Here we report on different behavioural strategies that emerge in a population when confronted with time varying rewards. Our investigation uses a two-lever choice task to study decision-making in which participants must repeatedly choose between an immediate, but variable reward, or a constant but delayed one. The reward on the immediate reward goes inversely with its selection frequency. For rats carrying out this task, we find two behavioural groups: patient rats who choose to wait for the constant reward, and impatient rats who prefer immediate, and overall, less rewards. Analysis of the choices from each group shows that their decisions oscillate back and forth over time in a regular pattern. Stochastic simulations of this task using a reinforcement learning (RL) framework reproduce experimental observations. Using a mean-field approximation we show that the RL equations for the population dynamics can be approximated by a set of ODEs, which for the given task map to that of a damped harmonic oscillator. This mechanical analogy shows how oscillations in decision preferences occur at characteristic frequencies determined by how strongly the individual values reward, akin to the spring stiffness, and their learning rate, that is analogous to the inverse mass. There is a biasing force that moves the equilibrium toward either waiting or impatience. The spring analogy indicates that there are intrinsic limits to how rapidly agents can adjust their preferences while maintaining stable decision dynamics

Topic Area: THINKING: Decision making

D125 - Effects of Psilocybin Treatment on Cognitive Effort Avoidance in Major Depressive Disorder and Co-Occurring Alcohol Use Disorder

Ceyda Sayali¹, Eli Weisman¹, Frederick Barrett¹; ¹ Johns Hopkins University School of Medicine

Psilocybin has shown preliminary safety and efficacy in treating Major Depressive Disorder (MDD) and Alcohol Use Disorder (AUD), yet the mechanisms underlying its therapeutic effects remain unclear. While psychedelics acutely impair cognitive control performance, post-acute improvements have been observed. Importantly, cognitive control is not a unitary construct—it includes both the capacity to perform and the motivation to engage in cognitively demanding tasks. In this study, we examine whether psilocybin influences cognitive effort avoidance, a transdiagnostic feature across psychiatric conditions. This ongoing double-blind study evaluates the effects of a 25 mg dose of psilocybin on cognitive effort motivation in individuals with co-occurring MDD and AUD (MDD-AUD). We hypothesized that psilocybin would increase motivation for cognitive control post-acutely, reflected in greater selection of high-effort tasks, and that these changes would relate to symptom improvements. Participants were drawn from a placebo-controlled trial of psilocybin-assisted therapy for MDD-AUD. Cognitive effort motivation was measured using a task-switching paradigm embedded in a parametric Demand Selection Task at baseline and one week post-dosing. Depression symptoms were assessed at the same time points using the 9-item Patient Health Questionnaire (PHQ-9). Preliminary results indicate that greater reductions in PHQ-9 scores were associated with more frequent selection of high-effort tasks, despite no change in task performance. These preliminary findings suggest that psilocybin may reduce cognitive effort avoidance in individuals with MDD-AUD, potentially enhancing motivation for goal-directed behavior critical to recovery from both depression and addiction.

Topic Area: THINKING: Decision making

D126 - Similar factors predict cognitive effort preferences when working for rewards vs. avoiding losses

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In everyday life, we must work for rewards while avoiding often-unpredictable losses. For example, we need to attend to multiple options when choosing an investment to avoid losing money. Human research suggests that cognitive ability explains whether people choose high-effort, high-reward choices when effort demands remain static, together with perceived stress and problem-solving preferences when demands shift. However, these experiments have typically examined effort expended for rewards rather than to avoid losses. As stress can enhance loss sensitivity, we wanted to determine whether these factors still predict effort choices when framed in terms of gains

vs. losses. Here, we used a visual short-term memory task to examine factors predicting high vs. low effort choices for varying reward or loss levels. On each trial, undergraduate participants (nHigh Effort = 191, nLow Effort = 70, NFemale = 209, NMale = 47, MAge = 20.55, RangeAge = 17-48) chose to deploy more effort for a higher reward, or less effort for a smaller reward. On win trials, failures result in not earning points; on loss trials, failures result in losing points. Between blocks, either the outcome amount on low-effort trials or effort requirements for high-effort trials increased. We found that visual short-term memory ability, chronic stress levels, and everyday effort preferences predicted more high-effort choices on both win and loss trials, with no difference between win and loss trials in the outcome amount motivating effort switches. These results show that similar motivational factors underpin trade-offs in reward-seeking and loss-avoidance given shifting effort demands.

Topic Area: THINKING: Decision making

D127 - Mindfulness Increases Resting State EEG Gamma Power in Mild Cognitive Impairment

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Introduction: Mild cognitive impairment (MCI) due to Alzheimer's disease (AD) features compromised default mode network (DMN) strength and connectivity¹. While mindfulness may increase DMN activity in MCI², the neural mechanisms and state-versus-trait changes in network activity remain unclear. We hypothesized that mindfulness would increase resting-state gamma power, a marker of DMN integrity³, reflecting beneficial neuroplasticity in MCI. Methods: MCI participants were randomized to 8-week mindfulness training (N=8) or waitlist control (N=11). EEG was collected at baseline and post-intervention during rest and 30-minute meditation in both groups. Frontocentral gamma power spectral density (30-45 Hz) was analyzed using group × time × task interactions. Results: The mindfulness group significantly increased gamma at rest post-intervention (p=0.003), while waitlist controls showed no changes (p>0.2). Frontocentral gamma was significantly lower during meditation versus rest at both timepoints (p<0.02), consistent with state-dependent DMN disengagement. The mindfulness group showed stable gamma during meditation across timepoints (p=0.46). A three-way interaction (group × time × task) approached significance (p=0.053), confirming this differential pattern. Conclusion: Mindfulness selectively strengthened resting-state DMN activity as indexed by increased gamma power, while preserving DMN disengagement during meditation. This dissociation suggests mindfulness enhances baseline DMN integrity

in MCI without disrupting adaptive network flexibility, indicating potentially beneficial neuroplasticity despite compromised network function. These findings support mindfulness as a targeted intervention for DMN dysfunction in cognitive impairment.

Topic Area: THINKING: Development & aging

D128 - A pleasant surprise: perplexity from large language models assesses divergent thinking

Yuhua Yu¹ (yuhua@arizona.edu), Quentin Raffaelli², Simone Luchini³, Roger E. Beaty³, Jessica R. Andrews-Hanna¹; ¹Department of Psychology, University of Arizona, ²Department of Psychology, University of Calgary, ³Department of Psychology, Pennsylvania State University

Divergent thinking (DT) is central to human innovation and creativity, yet its assessment remains largely constrained by lab-based tasks and a focus on final products, overlooking the rich information embedded in the thought process itself. We introduce perplexity—a computational measure of surprise derived from large language models – as a theoretically grounded DT measure that can be flexibly applied to verbal data in both process- and product-oriented contexts. Study 1 links the perplexity in participants' verbalized thought processes — during both goal-directed divergent thinking and unprompted stream of consciousness—with individuals' DT performance. We show that a higher level of surprising content (higher perplexity) predicts greater DT capacity. Study 2 focuses on creative products, validating perplexity as an automated measure of originality in solutions to open-ended, real-world problems. Together, these findings establish perplexity as a unified metric that bridges theories of creative cognition with naturalistic, verbal data. By providing a scalable measurement of DT via both participants' thought processes and creative products, our approach opens new avenues for scalable research on DT across diverse contexts.

Topic Area: THINKING: Other

D129 - Narratives Have a Persisting Influence on the Tempo of the Brain

Samira Tavassoli¹ (stavass1@jh.edu), Evelyn Allen¹, Joshua Seewald¹, Janice Chen¹; ¹Johns Hopkins University

The media we consume can shape our thoughts and patterns of brain activity. As people observe scene shifts during naturalistic audiovisual input, their cortical activity patterns shift, too (Geerligs et al., 2022; Tseng & Poppenk, 2020; Baldassano et al., 2017). But to what extent does the influence of media on brain dynamics persist beyond the end of the stimulus? In our study, we investigated how the pace of a narrative can affect the pace of cortical pattern shifts even after it concludes. While undergoing fMRI scanning, participants (n = 19) listened to seven fictional stories, each of which was followed by a 1-minute (awake) rest period. We then quantified participants' cortical pattern shifts and shift rates (the amount of change in multivariate patterns per minute) in each parcel during the listening and rest

periods. We found that during the listening period, semantic shifts in each story (assessed via human judgments) temporally aligned with cortical pattern shifts in the default mode network (perm-p $\leq$ 0.01 for all stories). Moreover, cortical shift rates during listening were significantly positively correlated with cortical shift rates during the subsequent rest period for parcels in the default mode (perm-p < 0.02), auditory (perm-p < 0.02), limbic (perm-p < 0.005) and ventral attention networks (perm-p < 0.03), but not the visual, somatomotor, or temporoparietal networks (all perm-ps > 0.05). These results suggest that media can leave a lasting imprint on the intrinsic tempo of the brain, potentially shaping how we process future information.

Topic Area: THINKING: Other

Poster Session E

Monday, March 9, 2026, 2:30 – 4:30 pm, Fairview/Kitsilano Ballrooms

E1 - Neurophysiology of the Ventral Attention Network: Modulating Vigilance Performance with tACS

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Sustained attention relies on coordinated oscillatory activity within the right-hemisphere ventral attention network (VAN), comprising the temporoparietal junction (TPJ) and inferior frontal gyrus (IFG). Prolonged vigilance tasks tax this system, leading to performance decline and cognitive fatigue. We hypothesize that theta-band synchronization (~5 Hz) within the VAN supports sustained attention and that transcranial alternating current stimulation (tACS) at this frequency would enhance performance metrics, particularly reaction speed, during an auditory spatial attention task. Experiment 1 used EEG to identify the dominant coherence frequency between TPJ and IFG during a 30-minute vigilance task. Coherence in the theta band decreased with time-on-task, suggesting fatigue-related desynchronization; the peak frequency was 5 Hz. Experiment 2 applies 5 Hz tACS targeting the VAN during a buzz-shuffle auditory localization task. Participants were randomly assigned to a sham group (N = 16) and a 5Hz tACS stimulation group (N = 17) and performed the same 38-minute auditory spatial attention task. Preliminary results showed a significant group difference in reaction time, with faster responses under stimulation (p < .001), but no significant difference in accuracy (p = .498). Data collection is ongoing to expand our sample and evaluate the robustness and magnitude of current effects. Together, these studies indicate that 5 Hz oscillations coordinate VAN activity during sustained attention and that external modulation at this frequency can enhance performance. These findings advance understanding of the neural mechanisms underlying vigilance and support the potential of theta-band tACS for mitigating fatigue-related impairments and performance declines.

Topic Area: ATTENTION: Auditory

E2 - "Using EEG to Predict Dementia Risk and Cognitive Resilience in Elderly Patients Undergoing Surgery."

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Thomas Jackson³, Ali Mazaheri^{1,2}; ¹University of Birmingham|

School of Psychology, ²Centre for Human Brain Health, ³University of Birmingham| Inflammation and Ageing

Elective surgeries are common in older adults due to age-related health conditions, yet these procedures often lead to cognitive decline and reduced quality of life. Disruptions in attention networks, particularly the alerting network, have been linked to post-surgical cognitive decline, including delirium and memory impairments. This study examined how task-related EEG changes, specifically alpha modulation during the Attention Network Task (ANT), relate to post-operative cognitive outcomes, alongside inflammatory profiles that may contribute to vulnerability. Pre-surgical EEG recordings were collected during the ANT, which measures alerting, orienting, and executive control. The analysis focused on alpha suppression within the alerting network, as this EEG signature has been shown to predict post-operative cognitive outcomes. Inflammatory markers were assessed to explore their relationship with attention network function and clinical outcomes. We observed that greater alpha suppression in the alerting network was associated with better cognitive resilience following surgery, whereas reduced suppression corresponded with higher incidence of cognitive decline, including delirium and memory deficits. Elevated inflammatory markers were also linked to disrupted alpha suppression, highlighting a potential interaction between inflammation and attention networks in shaping cognitive outcomes. These findings confirm the predictive value of alpha suppression in the alerting network and underscore the role of inflammatory profiles in modulating vulnerability. By integrating EEG-based task measures with inflammatory markers and clinical data, this work demonstrates a comprehensive approach to identifying older patients at risk of cognitive impairment and supporting targeted strategies to improve recovery.

Topic Area: ATTENTION: Development & aging

E3 - Shape from shading as a marker of lateralization changes across the lifespan

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Shape from shading refers to the ability to judge whether a surface appears convex or concave based on shading information relative to an assumed light source. Observers typically assume that the light source is positioned above and to the left. This left bias is thought to reflect right-hemisphere dominance in processing shape from shading. Furthermore, while younger adults tend to show a strong left bias, older adults have on average a reduced left bias, which has been associated with decreased lateralization during aging. However, it remains unclear when this shift begins to emerge across adulthood. In the current study, we investigated the pattern of shape-from-shading

bias across the adult lifespan, from 18 to 91 years of age. Participants completed a shape-from-shading task in which they judged whether shaded shapes appeared convex or concave. We replicated the previously observed difference between younger and older adults. Some older participants had a left bias, while others had a central or even right bias. In contrast, younger adults had a left bias. Importantly, the reduced left bias in older age resulted from a continuous change across adulthood. This pattern suggests that age-related changes in shape-from-shading perception reflect a gradual decline in hemispheric lateralization. Shape-from-shading may therefore serve as a reliable longitudinal tool for tracking lateralization changes across the lifespan.

Topic Area: ATTENTION: Development & aging

E4 - Frontoparietal functional connectivity underlies top-down control impairments in patients with mild cognitive impairment

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Patients with mild cognitive impairment (MCI) show reduced top-down control, the ability to ignore task-irrelevant information. It is unclear whether this reduction corresponds with decreased brain connectivity. We aimed to determine whether and how differences in functional connectivity, or the correlated activity between brain areas, explain differences in top-down control in MCI. Twenty-six patients with MCI (mean age: 71.2 ± 8.9 years; 10 females) and 29 age-matched healthy older adults (mean age: 68.2 ± 4.6 years; 9 females) underwent neuropsychological assessment to confirm diagnosis and cognitive status. We used resting-state functional magnetic resonance imaging at 3T to analyze functional connectivity. Top-down control was estimated with a theory of visual attention (TVA)-based verbal partial-report task (parameter α ; higher α indicates poorer control). We identified visual and attention-relevant functional brain networks and tested for differences between patients and controls while controlling for age and sex. Patients with MCI showed lower functional connectivity in the left frontoparietal (FPN) and visual network (VN). Patients also had worse top-down control than healthy controls ($p = 0.031$). The FPN, but not the VN, significantly correlated with top-down control across participants ($r = -0.39$, $p = 0.003$) and in the patient group ($p = -0.48$, $p = 0.014$). Moreover, FPN connectivity mediated the relationship between MCI and top-down control. These results indicate that lower FPN connectivity explains worse attentional control in MCI. Top-down control might explain memory decline in patients with MCI; longitudinal data are needed to establish prognostic value.

Topic Area: ATTENTION: Development & aging

E5 - Effects of aging on multisensory attentional control and its association with executive capacity

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Attentional control is essential for goal-directed behavior and requires active suppression of distractors. Alpha oscillations (8–14 Hz) have been proposed as a neural mechanism of functional inhibition during multisensory (audiovisual) attention tasks, indirectly enhancing processing of task-relevant information and optimizing behavioral performance. However, it remains unclear whether aging modulates anticipatory alpha suppression in multisensory tasks, and if this neural mechanism is associated with executive capacity. The present study examined temporal and topographical dynamics of anticipatory alpha activity (8–14 Hz) and event-related potentials of the congruence effect (ERPce) evoked by simultaneous visual and auditory syllables during a crossmodal attention task in cognitively preserved young and older adults. Anticipatory alpha modulation was computed by subtracting alpha power during auditory from visual attention, and the ERPce by subtracting incongruent from congruent trials. Non-parametric permutation tests were performed over occipito-parietal and fronto-central channels during -0.4 to 0 s for alpha, and -200 to 1100 ms for ERPce. Older adults showed reduced alpha modulation across attended modalities and a larger behavioral congruence effect during auditory attention, accompanied by lower auditory sensitivity (d') and an enhanced late positive component (P800ce). The P800ce amplitude was associated with poorer performance on neuropsychological tasks of inhibitory control. Also, reduced frontal alpha suppression correlated with increased P800ce amplitude, indicating that diminished anticipatory suppression of irrelevant information relates to less efficient attentional filtering. Together, these findings indicate an aging-related reduction in the ability to suppress distracting sensory information under multisensory attention contexts, which also impacts executive efficiency.

Topic Area: ATTENTION: Multisensory

E6 - Effects of auditory and vibrotactile stimulations on EEG markers of vigilance following sleep deprivation

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Sleep deprivation impairs the ability to maintain vigilance, especially in monotonous tasks such as long-distance driving, thereby increasing the risk of accidents. To counter these effects, sensory stimulations have been explored as transient means to enhance vigilance, but the relative efficacy of different modalities remains unclear. The aim of our study was to examine the transient effects of auditory and vibrotactile stimulations of different lengths on the recovery of vigilance following the onset of a hypovigilant episode. For this purpose, fifty-two participants underwent one night of total sleep deprivation. Equipped

with electroencephalographic (EEG) recording and a stimulation wristband, participants performed a two-hour monotonous driving task on a simulator. When a hypovigilant episode was detected (based on EEG), one of five conditions was triggered: either a short (8s) or long (20s) vibrotactile stimulation, a short or long auditory stimulation or no stimulation at all, with each participant experiencing all five conditions. EEG activity was analyzed using relative power spectral density (PSD) over 80 seconds following each condition, as a reduction in alpha power (8–14 Hz) is typically associated with increased vigilance. Linear mixed-model analyses revealed significantly lower alpha power following all stimulation conditions compared to the no-stimulation condition, with no significant differences between the different modalities or durations of stimulation. These results suggest that vibrotactile and auditory stimulations can enhance vigilance levels following hypovigilant episodes, with potential applications in real-world settings. Future analyses will investigate how these findings are related to driving performance.

Topic Area: ATTENTION: Other

E7 - High-resolution diffusion tensor imaging of the cerebellum and brainstem in Type I Chiari Malformation: Associations with attention and pain

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Background. Chiari Malformation Type I (CMI) is a congenital neurological condition in which the cerebellar tonsils are displaced into the spinal canal. Common symptoms include pain, motor disturbances, cognitive dysfunction, and anxious-depressive symptomatology. Our prior research has revealed elevated fractional anisotropy (FA) in CMI patients compared to matched controls using whole-brain diffusion tensor imaging (DTI). Higher FA coincided with worse attention performance, even after controlling for chronic pain. In the present study, we utilize high-resolution, partial brain DTI to replicate our previous findings and better characterize affected white matter tracts proximal to the cervico-medullary junction. Methods. High-resolution diffusion weighted images (DWI), attention performance data, and symptomatology data were analyzed from 18 CMI patients and matched healthy controls. DWI were processed using an FSL diffusion toolbox pipeline, using the DTIFIT, Tract-Based Spatial Statistics, Randomise, and GLM tools. Results. CMI patients exhibited significantly higher FA in the three cerebellar peduncles and medial lemniscus compared to controls after controlling for attention performance and self-reported pain symptoms. Elevated FA in these regions correlated with attention and pain measures, wherein higher FA was associated with worse attention performance and higher self-reported pain and disability symptoms. Conclusion. Our findings align with prior observations of increased FA in CMI, though the underlying mechanisms remain debated. While greater FA in CMI could reflect

increased compression of white matter pathways proximal to the cervico-medullary junction, we postulate that elevated FA may instead be the consequence of central pain sensitization and a disrupted neuroinflammatory process in CMI patients.

Topic Area: ATTENTION: Other

E8 - Exploring the Cognitive Role of the Coupling Between Alpha Power and Autonomic Rhythms During Task Performance

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A recent framework proposes that the brain and body form a dynamic system that modulates coupling mechanisms to optimize adaptation to changing environments. Previous studies have shown that alpha power relates to attention fluctuations during task performance, while others demonstrate alpha power coupling with phases of autonomic nervous system (ANS) rhythms—gastric activity, heart rate variability (HRV), and respiration—during the resting state, each reported in separate investigations. However, trivariate relationships among alpha power, ANS rhythms, and attention fluctuations remain unexplored. Given that alpha oscillations comprise multiple components across brain regions, this study aims to clarify which alpha components couple with ANS rhythms and associate with attention fluctuations, using magnetoencephalography (MEG) for high spatial resolution. MEG, respiration, electrogastrogram (EGG), and electrocardiogram (ECG) were recorded during six 5-minute oddball task blocks. Two block types—visual and auditory—were included, in which visual or auditory stimuli were presented at 3Hz. Participants were instructed to continuously attend to them and respond to infrequent target stimuli. We examined alpha-ANS coupling by calculating the modulation index between alpha power and ANS phases across MEG sensors. Strongest effects (Cohen's d) were observed in right-temporal sensors for alpha-EGG coupling and in parietal sensors for alpha-high-frequency HRV and alpha-respiration coupling during task performance, consistent with prior alpha-ANS findings during the resting state. Furthermore, these sensors also exhibited higher alpha power preceding missed targets compared to hits, suggesting that alpha components coupled with ANS rhythms may contribute to attention fluctuations during cognitive task performance.

Topic Area: ATTENTION: Other

E9 - Decoding Scalp EEG Signatures of Attentional Switching Using Machine Learning

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The ability to switch between external and internal attention is critical for everyday life. Despite its prevalence and wide-ranging impact on cognitive functions, the value of using electrophysiological features to decode these types of attentional switches remains underexplored. To address this, we recorded scalp EEG from 37 participants while they performed an attentional switching task requiring them to switch

between attending externally to tones or internally to their thoughts. We then used machine learning models to detect the direction of these switches (i.e., switching to external versus switching to internal attention). For these analyses, we extracted block-level spectral features across four canonical frequency bands (theta, alpha, beta and gamma) from 63 electrodes using the means and the standard deviations of brain activity across the three second period of switching, resulting in a total of 504 features for each participant. To enhance classification performance, we selected the fifteen most informative features using the random forest algorithm across participants. These features served as inputs into several classification models. The model with superior performance was the 5-fold within-subject support vector machine classification model, which achieved a Matthew's Correlation Coefficient of 0.62. The most informative EEG features consisted of beta and gamma band activity over prefrontal, frontocentral, and centro-parietal regions, which consistently emerged across multiple iterations of feature selection. These results suggest EEG features can be used to predict switching between external and internal attention at above chance levels, highlighting their potential value for real-time prediction in future studies.

Topic Area: ATTENTION: Other

E10 - Excitatory and inhibitory imbalance in migraine shown by altered oscillatory alpha activity

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Migraine is a neurological disorder linked to photophobia and differences in visual task performance between attacks. Additionally, people with migraine aura commonly experience visual disturbances, such as scintillation and scotoma, preceding attack onset. A possible mechanism for such phenomena is excitatory and inhibitory (E/I) imbalance reflected in altered electrophysiological measures. Here, we assessed E/I via top-down (TD) mechanisms in the visuospatial attentional system involving both engagement (excitation) to an attended and suppression (inhibition) of the unattended visual hemifield. This was indexed by alpha-band oscillations (~8-14 Hz), reflecting desynchronised (decreasing) and synchronised (increasing) activity over posterior sites contralateral and ipsilateral to the attended hemifield, respectively. We measured posterior EEG activity of people with (n=17) and without migraine (n=16) during a spatially-cued endogenous attentional task with and without bilateral task-irrelevant gratings (Cruz et al., 2025; JNeurosci). Neutral spatial cue trials were included, acting as alternative baseline correction method in addition to pre-cue baseline, to control for temporal and spatial orienting of attention during target anticipation. Multilevel modelling showed a non-significant trend for poorer behavioural performance in migraineurs. EEG data showed controls having typical lateralised alpha power decreasing over contralateral and spatial orienting related increase over ipsilateral posterior areas. However, migraineurs showed stronger alpha power decrease in a bilateral manner and weaker

spatial orienting related alpha power increase compared to controls. The absence of behavioural group effects alongside indication of E/I imbalance via alpha band oscillations among migraineurs warrant further investigation into the oscillatory components in the migraine brain.

Topic Area: ATTENTION: Spatial

E11 - Electrophysiological evidence for the voluntary prevention of salience-driven distraction in humans

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For decades, researchers have sought to determine whether humans can voluntarily resist attention capture by a salient visual distractor. The latest research indicates that when individuals must search for a target in every stimulus array over hundreds of trials, they cannot prevent salience-driven distraction on demand but do so automatically by implicit learning. Using electrophysiological markers of attentional selection (N2pc) and suppression (PD), we investigated whether people can voluntarily prevent salience-driven distraction when they know in advance that search is not required for the upcoming display. On each trial, a 100-ms cue display was followed by a 700–1100-ms blank interval and then a 750-ms array of 16 blue bars. The cue display contained a shape (circle or square) that indicated whether a response was required to indicate presence of an orientation singleton in the subsequent “target” display. Trials that required a response (go trials) and trials that required no response (no-go trials) were equally likely and randomly intermixed. We found that although the singleton elicited the N2pc on go trials, the same singleton elicited the PD on no-go trials. Importantly, preparatory activity that was observed over the anterior scalp in the cue-target interval predicted participants’ reaction times and amplitudes of their N1, N2pc, and singleton detection positivity (SDP) on go trials and their PD on no-go trials. These results demonstrate that people can voluntarily ignore salient distractors by proactively disengaging from search. We surmise that this inhibitory control stems from an executive-control network in frontal brain regions.

Topic Area: ATTENTION: Spatial

E12 - Hemispheric laterality of the putamen predicts pseudoneglect

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Healthy individuals tend to exhibit a subtle leftward attentional bias, a phenomenon termed pseudoneglect. While this bias is thought to reflect a right-hemisphere dominance when allocating spatial attention, the contribution of subcortical structures remains poorly

understood. Although lesion and neuroimaging studies in clinical populations have implicated asymmetries in the basal ganglia and thalamus to dysfunction in spatial attention, it remains unclear whether naturally occurring subcortical asymmetries in healthy individuals predict behavioural biases in spatial attention. In this study, we investigated whether volumetric asymmetries in subcortical structures are associated with biases in spatial attention in a non-clinical population. This was achieved by using the landmark task to assess spatial biases, alongside acquiring T1-weighted MRI data from 44 healthy participants. The subcortical regions were segmented using the FIRST algorithm to estimate the volumetric asymmetry of specific regions. We found that variability in pseudoneglect was predicted by the degree of leftward lateralisation of putamen volume, indicating that the putamen contributes to the magnitude of spatial attention biases. This also suggests that the left putamen may support right-hemisphere neocortical dominance through the indirect pathway. These findings bridge anatomical and behavioural measures, highlighting the functional relevance of subcortical asymmetry in shaping attentional processes in the healthy brain. Our findings pave the way for early diagnosis of neurological disorders associated with subcortical atrophies including Parkinson’s Disease and dementia.

Topic Area: ATTENTION: Spatial

E13 - Calm TMR: Extending Targeted Memory Reactivation for Calmness and Well-Being in At-Home Sleep

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Traditional Targeted Memory Reactivation (TMR) has focused primarily on mnemonic consolidation. This project extends the framework beyond memory enhancement toward inducing calmness and positive affect during sleep through an approach called Calm TMR. The key question is whether a calm state conditioned with auditory cues during wake can be reactivated during slow-wave sleep to promote physiological relaxation and emotional balance. To move beyond laboratory constraints, we designed an at-home TMR protocol allowing participants to sleep naturally in their home environment. Data were collected from 68 participants, with 4 excluded. Technically, this work builds on a Galaxy-Watch–based TMR app, which we expanded into a flexible platform supporting customizable cues, adjustable duration, volume range control, and adaptive sound attenuation based on arousal. The system enables real-time cue delivery directly from the watch, providing an accessible, wearable framework for everyday TMR research. Subjective sleep quality and dream affect were measured using a sleep-quality assessment and daily sleep diaries, while physiological data from a Galaxy Watch and Muse EEG headband captured sleep stage, heart rate, and movement patterns. Calm TMR is expected to enhance sleep efficiency, deepen slow-wave sleep, and foster calmer, more positive sleep experiences. By seeking to promote calm and restorative sleep, Calm TMR has the potential to

improve daytime functioning and overall well-being, bridging cognitive neuroscience with practical applications for daily life.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

E14 - Emotional Arousal is Mediated by a Sense of Presence Elicited by Three-Dimensional Virtual Stimuli

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In simulated environments, 'presence' is the sensation of immersion that is thought to indicate that experiences in these environments may be similar to real ones. It is related to the perceptual realism of objects and experiences, including those that evoke emotion. However, there is limited research that explicitly targets the relationship between presence and how effectively virtual stimuli can elicit emotional responses. The current study explores whether the strength of presence elicited by virtual objects mediates their emotional impact. Participants were presented with both static two-dimensional (low-presence) and rotating three-dimensional objects (mixed presence; objects shown as videos), and were required to rate the emotional arousal, valence, and realism of each one. Stimuli for both conditions consisted of 30 objects collected from the Unity Asset Store and Sketchfab, with each object being shown for 20 seconds. Results show that higher ratings of realism were found for rotating compared to static objects, with this increased immersion related to the level of emotional arousal they elicit. This suggests that perceptions of realism may evoke more intense emotional responses, even when not presented in true immersive virtual environments (i.e., virtual reality systems). Further, this work highlights the potential of three-dimensional, or virtual paradigms, when designing studies of affective response, as they may provide higher fidelity and a more naturalistic response pattern compared to traditional two-dimensional stimulus presentations.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

E15 - The Impact of Mild Traumatic Brain Injury on Emotion Regulation

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Mild traumatic brain injury (mTBI), commonly referred to as a concussion, has been associated with difficulties in emotion regulation, which includes both explicit (conscious awareness) and implicit (unconscious awareness) processes. Difficulties in emotion regulation may contribute to real-world challenges such as interpersonal conflict, increased emotional reactivity, and reduced coping to daily stressors. This study investigated how mTBI affects both forms of emotion regulation and whether impairments extend to executive functioning domains such as working memory and attentional control. We collected a preliminary sample of 56 participants (28 with a history of mTBI and 28 without). Participants

completed explicit (cognitive reappraisal) and implicit (emotion dot probe) emotion regulation tasks, along with five executive functioning tasks measuring attention control and working memory. Preliminary analyses were conducted on a trial-by-trial ratings of positive and negative affect across each condition within the cognitive reappraisal task. Results indicated no main effect of group and no interaction effect, however, there was a significant main effect of condition. This suggests that, irrespective of group, participants demonstrated the ability to reappraise negative images effectively. Given the preliminary nature of these findings, the results indicate that participants were able to successfully regulate their emotions by both down-regulating negative affect and up-regulating positive affect. Overall, future analyses will further examine how mTBI affects conscious and unconscious emotion regulation and the cognitive mechanisms underlying these emotional challenges.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

E16 - The Impact of Emotional Salience on Sound localization in Realistic Virtual Environments

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The impact of emotion on spatial processing is well established in the visual domain yet lagging in the auditory system. Evidence suggests emotional sounds may be localized more rapidly and accurately than neutral sounds. However, most studies lack ecological validity, presenting sounds through headphones or limited source locations (e.g. front versus back). The present study aimed to determine the effect of emotional salience on sound localization within a naturalistic auditory environment. Sounds were presented in an Audiodome, a spherical speaker array enabling the creation of realistic soundscapes. The stimuli used were negative (e.g., screams) and neutral (e.g., footsteps) auditory stimuli matched on low-level acoustic features from the International Affective Digitized Sounds. Blindfolded participants localized sounds among 24 speaker locations using digitally tracked finger pointing. The initial response occurred during sound presentation and a second followed a brief delay to measure location memory. Reaction time and accuracy were the outcome measures. Participants exhibited significantly greater accuracy for stimuli presented left of fixation relative to the right and stimuli localized during the first timepoint versus the second. A significant main effect of emotion was observed for RT and accuracy in the absence of any interactions. This effect was characterized by significantly faster, but less precise localization of emotional relative to neutral stimuli. Emotion, side of presentation and timepoint plays a significant role in our sound localization abilities. These findings suggest a potential speed-accuracy trade-off in the localization of emotional sounds, prioritizing more rapid reactions to emotional stimuli at the cost of precision.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

E17 - Sticky Situations and Sticky Thoughts: Investigating Stress, Coping, and Thoughts

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Our thoughts are influenced by the context of our daily lives, especially when we experience stressful events. Thoughts that are difficult to disengage from and occur outside of our control, also known as sticky thoughts, are often related to these stressors. Importantly, the strategies that individuals employ to cope with their stress might make them more likely to think about the stressor rather than their task at hand, which may modulate their experience of sticky thoughts. We therefore examined how individual differences in coping strategy usage predict stickiness of thoughts after a stress-inducing task. Participants first completed the Brief-COPE scale, capturing how often they use certain coping strategies. Next, they wrote about a recent stressful event in their life. Afterwards, they completed a simple attention task while answering intermittent probes asking how sticky their thoughts were. Heart rate variability (HRV) was measured at baseline, post-writing task, and at the end of the session to assess physiological stress level. Preliminary analyses found that individuals who used more problem-focused and less emotion-focused coping strategies reported more sticky thoughts after the writing task, suggesting that problem-focused copers might be more likely to continue thinking about the stressful event. Furthermore, individuals who had more sticky thoughts had higher baseline HRV, indicative of better stress resilience, suggesting that these sticky thoughts may be adaptive in certain situations. Future work clarifying how different types of thoughts relate to coping strategy use may inform interventions that help people become more successful at coping with stress.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

E18 - Deep Learning–Derived Facial EMG Signatures of Cognitive Workload in Immersive Virtual Reality

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Introduction: Virtual Reality (VR) offers immersive, controlled environments ideal for probing cognitive–emotional states, while facial electromyography (fEMG) enables unobstructed affect sensing in head-mounted displays. We propose a Convolutional Neural Network–Temporal Convolutional Network (CNN-TCN) framework to decode facial expressions and workload from fEMG in VR. Methods: Twelve participants (6F; 40.6±8.9 years) completed emotional, cognitive, physical, and dual-demand VR scenes using the National Research Council Canada's bWell platform. fEMG was recorded with the emteqPRO™ mask. A calibration session, where participants were asked to make intentional expressions (smile, frown, surprise, neutral)

was used to train a CNN–TCN model applied to experimental scenes. Preprocessing included tagging, normalization, and sliding-window segmentation. Mixed-effects models related predicted expression features to perceived workload (from the NASA-TLX). Results: Self-reports confirmed distinct workload/mood profiles across scenes ($\chi^2(4)=10.93$, $p=0.027$). Across leave-one-participant-out folds, the model showed robust generalization (test macro-F1≈0.88±0.13; ROC-AUC≈0.95±0.06). Training curves exhibited rapid loss reduction and F1 stabilization, indicating effective optimization without overfitting. PCA of 81 features revealed two latent dimensions: global expression dynamics (PCA1, 24.5% variance) and frown-related tension (PCA2, 17.1%). Mixed-effects models showed reduced expressiveness under cognitive load ($\beta=-3.93$, $p=0.005$) and elevated frown-tension in emotional scenes ($\beta=2.34$, $p=0.031$). Feature-level models demonstrated scene-specific associations with workload: frown metrics tracked mental demand, surprise/eyebrow dynamics tracked frustration and temporal demand, non-neutral dominance tracked physical load, and smile-related dynamics increased under dual demand. These patterns were consistent with FACS interpretations. Conclusion: CNN–TCN-based fEMG decoding yields robust, interpretable markers of affect and workload in VR, scene-independent assessment and reducing reliance on self-report.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

E19 - Encoding Emotion Differently: Investigating ERP Correlates of Emotional Memory in Anxiety and Depression

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Emotional words are thought to exhibit a memory advantage over neutral material. However, it remains unclear whether emotional content primarily influences neural processes supporting memory encoding, retrieval, or both under incidental learning conditions, and how anxiety and depression affect these mechanisms. This study examined how emotional word valence modulates behavioural recognition performance and event-related potentials (ERPs) during incidental encoding and retrieval, and whether anxiety and depressive symptoms alter these effects. Twenty-six young adults completed an incidental memory task while electroencephalography was recorded. During encoding, participants classified words as emotional or non-emotional, followed by a delayed recognition test. ERPs indexing attentional processing (P2), semantic integration (N400), and later-stage memory processing (early and late LPP) were analysed. Positive words were remembered less accurately than neutral ($p=.022$) and negative words ($p=.011$). Anxiety and depressive symptoms were not associated with recognition accuracy. Exploratory subgroup analyses showed reduced recognition of positive words in the moderate anxiety group ($p=.046$) and in the severe depression group relative to negative words ($p=.021$). Emotionally valenced words elicited larger P2 amplitudes and more negative N400 amplitudes during encoding, and larger early and late LPP amplitudes during retrieval ($p's < .05$). Higher anxiety was associated with larger late LPP amplitudes at retrieval

across conditions ($p < .05$). Emotional content modulated neural processing across multiple stages despite the absence of a behavioural memory advantage. Anxiety influenced later-stage neural activity during retrieval without affecting recognition accuracy, indicating that emotion and anxiety alter how information is processed rather than whether it is remembered.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

E20 - Phasic REM TMR reduces subjective valence and physiological arousal for highly negative items

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The Sleep to Forget, Sleep to Remember (SFSR) hypothesis posits that sleep—particularly REM sleep—supports emotional memory processing by decoupling affect from memory content. This study investigated how Targeted Memory Reactivation (TMR) during REM sleep influences emotional reactivity, physiological responses, and memory performance. Twenty-five participants viewed short negative videos before sleep, rated their emotional valence, and underwent ECG recording. During REM sleep, closed-loop TMR was applied to half of the video cues, time-locked to eye movements. Participants repeated valence ratings and a sequential memory task the following morning, and again one and two weeks later. Linear mixed-effects models showed a baseline valence $\times$ TMR interaction with a normalizing effect: more negatively rated items became more positive, while less negative items became more negative after TMR ($b = -0.05$, CI [-0.09, -0.02], $p = .004$). A significant TMR $\times$ N3*REM interaction ($b = -0.05$, CI [-0.09, -0.01], $p = .016$) indicated that a higher N3*REM product enhanced heart rate deceleration (HRD) for TMR items, whereas a lower N3*REM product reduced HRD, suggesting that both sleep stages modulate the physiological impact of TMR. Participants in the cued condition showed superior memory performance compared to uncued ($b = 0.45$, CI [0.17, 0.74], $p = .002$), and higher baseline valence predicted better memory ($b = 0.23$, CI [0.02, 0.43], $p = .031$). These results indicate that REM-locked TMR affects emotional memory processing and autonomic responses, contingent on baseline affect, and sleep architecture.

Topic Area: EMOTION & SOCIAL: Emotional responding

E21 - Dissociable Associations Between Stimulus Realism, Valence, and Arousal for Positive and Negative Stimuli

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Human research in affective cognitive neuroscience rests on the assumption that emotion-inducing stimuli used in the lab are ecologically valid. However, there is growing acknowledgment of the potential dissimilar nature of lab-based and real-life experiences of emotion. One emerging factor of interest is whether participants

perceive the stimuli as real (e.g., of an actual event) or as fiction (a movie or simulation). Although some evidence suggests that real stimuli evoke stronger emotional responses, the results are equivocal. To address this question, we had participants ($N = 101$) watch short video clips sourced from YouTube, TikTok, etc., depicting positive, negative, and neutral content, and provided valence, arousal, realism, and amusement ratings for each. We observed dissociable associations between realism, subjective arousal, and valence ratings for positive versus negative stimuli. For positive stimuli, valence and realism were positively correlated, but arousal and realism were not. In contrast, for negative stimuli, arousal and realism were positively correlated, but valence and realism were not. Collectively, the results raise the possibility of a nonlinear relationship between perceived realism and subjective experiences of emotion, especially when considering positive and negative stimuli separately. They also highlight a need for further work addressing the factors that contribute to differences in emotional experiences in real life versus fictional contexts.

Topic Area: EMOTION & SOCIAL: Emotional responding

E22 - Dynamics of Respiration-Coupled Neural Activity in REM Sleep for Emotional Memory Learning

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REM sleep provides a key window for emotional memory processing. Although respiration and emotional memory exhibit reciprocal regulation, how they interact during REM sleep remains unclear. This study investigates how respiration modulates brain activity during REM sleep and how such lung-brain coupling further influences emotional learning during REM sleep. Thirty-three participants completed a pre-sleep encoding task, REM target memory reactivation (TMR), and post-TMR tests. During the pre-sleep task, participants performed word-sound-picture pairing and sequence encoding tasks, with positive real words followed by pseudowords to establish an emotional valence context for pseudowords. During late-night REM sleep, TMR was applied to reactivate the positive sequences alongside novel pseudowords to induce emotional valence learning of pseudowords during sleep. Upon awakening, participants completed affective judgment tasks with pseudowords to assess the emotional learning effects, and how respiratory effects on TMR-induced REM emotional learning were examined via respiratory-EEG cross-frequency coupling. Results showed that participants exhibited positive learning during REM sleep, with significant implicit preferences toward positive pseudowords relative to neutral pseudowords ($t = -3.167$, $p < 0.01$, Cohen's $d = -0.551$). Additionally, drift-diffusion analyses revealed that positive pseudowords exhibited faster information accumulation rates ($v_{\text{Neu}} - v_{\text{Pos}}$, $\text{Meandiff} = -0.612$, 95% HDI [-0.930, -0.276]). Preliminary respiratory analyses revealed that inhalation elicits stronger brain activity than exhalation. Moreover, the respiratory phase exerted a significant modulatory effect on brain activity during REM sleep, particularly in the delta and theta bands (MI:

F(3,42.6)=16.8, $p < 0.001$). Thus, emotional memory learning occurs during REM sleep, where the respiratory phase modulates brain activity. Future analyses will explore body-brain mechanisms underlying the learning.

Topic Area: EMOTION & SOCIAL: Other

E23 - Cerebello-meso-frontal activity is linked to anhedonia and avolition in early psychosis

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The cerebellum is emerging as a critical substrate in disorders like schizophrenia. Given the cerebellum's direct projections to the ventral tegmental area (VTA), and upstream to the frontal lobe, we investigated whether psychophysiological interactions (PPI) between each deep cerebellar nucleus (DCN), the VTA, and dissociable frontal targets (i.e., rostro-middle frontal gyrus [rMFG] and medial orbitofrontal cortex [mOFC]) may be associated with anhedonia and avolition in psychosis. We predicted that the strength of the PPI between cerebrocerebellar (dentate) DCN, VTA, and rMFG target would be associated with worse avolition. Conversely, we hypothesized that PPI between the spinocerebellar DCN (fastigial/interposed), VTA, and mOFC would be associated with anhedonia. We predicted this functional DCN dissociation since the cerebrocerebellum is more cognitive while the spinocerebellum is more affective. PPI analysis was run on fMRI data from patients from the Human Connectome Project for Early Psychosis. Strength of the PPI was characterized as the beta of the interaction term between the DCN and VTA regressed onto the frontal target of interest. After controlling for demographics, handedness, and medication exposure, PPI between the right dentate, VTA, and rMFG was associated with avolition on the PANSS ($\beta = -6.22$, $p = .013$); PPI between the left interposed, right VTA and mOFC was associated with consummatory pleasure items on the CAINS ($\beta = 20.61$, $p = .046$); and the PPI between the left fastigial, right VTA and mOFC was associated with the motivation and pleasure items on the CAINS ($\beta = -97.45$, $p = .0098$). These results provide preliminary evidence for symptom-circuits associations in psychosis.

Topic Area: EMOTION & SOCIAL: Other

E24 - Individual differences in early attentional orienting to approach- and avoidance-related stimuli

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Frontal alpha asymmetry (FAA), the difference in alpha power across the right and left hemispheres (RH, LH), is a marker of emotion/motivation. The present study examined relationships among self-reported approach and avoidance motivation, FAA, and event-related potentials (ERPs) to emotionally salient animal faces. Twenty-seven undergraduates (mean age = 19.48 years) completed the

Behavioral Inhibition and Activation Scales (BIS/BAS) and resting EEG was recorded. Participants then viewed images of snakes, snarling dogs, puppies, and kittens, indicating whether they would approach or avoid each stimulus. Preliminary results revealed that a frontal ERP negativity (N2, a marker of attention) was more negative for snakes and snarling dogs. Regression analyses showed that higher BAS scores were associated with larger (more negative) N2 amplitudes during approach trials ($\beta = -.48$, $p = .016$). Resting FAA, however, did not significantly predict N2 activity within our experiment. Much like the approach trials, BAS again predicted N2 amplitude in the avoid trials ($\beta = -.43$, $p = .043$), while BIS and FAA were not significant predictors. These results suggest that individuals reporting stronger approach motivation show greater early attentional engagement with motivationally relevant cues, whereas resting FAA appears less closely tied to this neural response. Although FAA has been described as a both stable trait and a dynamic state marker of approach-avoidance motivations, the findings garnered from our preliminary analyses hint that ERPs may capture more state-like aspects of motivational processing. Future work with larger samples and additional EEG indices will help clarify these relationships.

Topic Area: EMOTION & SOCIAL: Other

E25 - How Eye Contact Shapes Neural Dynamics of Face Memory

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The human face is arguably the most frequent visual stimulus we encounter, with eye gaze direction providing crucial social cues. Direct gaze (DG) captures attention more effectively than averted gaze (AG) and, essentially, enhances memory encoding and retrieval. The neural correlates underlying the link of memory enhancement and gaze direction remain unclear. One possible mechanism is that DG elicits holistic processing, fostering the formation of distinct, relational memory representations, consequently leading to a more accurate retrieval. To test this, we designed a magnetoencephalography (MEG) - adapted continuous recognition task, presenting neutral emotion faces with DG and left- or right- AG. Healthy adults (18-35 years) judged whether a test face matched the previously encoded probe face. The test face could be either identical (Match), the same identity with different gaze direction (Gaze Mismatch), or a different identity with a same gaze direction (ID Mismatch). Rapid Invisible Frequency Tagging (RIFT) at 68.5 Hz was applied to the eye region during Probe presentation to entrain rhythmic neural activity and localize the neural sources of the DG- versus AG-tagged signal. Pilot behavioural data from seven adults indicate that presenting the probe face with DG improves recognition in the ID Mismatch condition, but impairs recognition in Gaze Mismatch condition, with no effect in the Match condition. The MEG analyses so far reveal a trend in gaze-related differences during encoding and recognition, engaging networks associated with gaze and memory processing. We expect our findings

to advance understanding of memory systems involved in face and gaze processing.

Topic Area: EMOTION & SOCIAL: Person perception

E26 - AI Faces the Criteria for Being Real; A Behavioral and Pupillary Reactivity Study.

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Technological advances in artificial intelligence (AI) are challenging our perceptions of real vs. artificial, extending to facial affect. Generative AI is increasingly capable of creating images based on emotion prompts (Sivasathiya, 2024); one study found that AI facial images passed the uncanny valley test and were deemed to be truly human (Reuten, 2018). However, little systematic work has validated the emotional quality of AI-generated images. Sixty undergraduates (mostly female) completed a happy and sad face-viewing paradigm, exposed to 12 real faces (FACES) and 12 AI-generated faces (the latter piloted in 14 undergraduates). Each face was randomly presented in full-screen color and outcomes measures included pupillary reactivity (IMotions) and judgements of valence and approachability (sliding 100-point Likert). After eliminating the first 2 trials as practice, preliminary 2x2 ANOVAs did not reveal pupillary differences between the real and AI faces for happy and sad affect ($p>0.05$). Similarly, no behavioral differences were revealed between real and AI faces ($p>0.05$), with all happy faces being recorded as more positively-valenced and approachable compared to sad ($p<0.05$). Overall, real and AI-generated faces showed expected judgement ratings, aligning with both the valence and approach-withdrawal hypotheses. The lack of physiological differences in cognitive engagement (pupil reactivity) between the 2 face types indicates similar affective analyses. Overall, current AI can generate facial images that accurately depict emotional qualities, at least for happy and sad faces. Future work must investigate other basic and learned emotions. AI-generated images may accurately depict basic emotions but fall short for self-referential and/or mixed emotions.

Topic Area: EMOTION & SOCIAL: Person perception

E27 - Frequency-based modulation of internal-external attention switch costs

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Daily life requires us to frequently switch between attending to information from external (perceptual) and internal (memory) sources. Recent research has documented that such transitions between external and internal attention modes incur a switch cost, but many aspects of this mode switch cost are presently not understood. Here we probed a fundamental question regarding this cost, namely, whether the cognitive processes reflected in the mode switch cost are malleable; specifically, whether they would display adaptation effects to time-varying switch demands. We developed a novel mode

switching task using real-world objects. Experiment 1 involved an equal number of attention mode repetition and switch trials, and the results replicated the basic mode switch cost observed in prior studies. Experiment 2 systematically varied the proportion of mode switches between 25% and 75% across two samples. In line with prior studies in the domain of cued task-switching, we predicted that a greater frequency of switches would result in people adapting their processing strategies to facilitate attention mode switching. In line with this prediction, we found that mode switch costs were significantly reduced in the condition with frequent compared to rare switch demands. These findings provide the first evidence that individuals can modulate their readiness to switch between external and internal attention modes in line with varying contextual demands.

Topic Area: EXECUTIVE PROCESSES: Goal maintenance & switching

E29 - Something's Gotta Give: Reward-Induced Effort Modulations in Task Switching Reveals a Trade-Off Between Cognitive Flexibility and Stability

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Everyday behaviour requires balancing two control modes: cognitive stability, for maintaining task goals in the face of distraction, and cognitive flexibility, for switching efficiently between task sets. According to one influential proposal, these opposing modes effectively trade off with one another: increased flexibility comes at the cost of reduced stability, and vice-versa. However, empirical support for a tradeoff has been equivocal. Here, we examine whether a flexibility-stability trade-off emerges under reward-induced effort modulation, that is, when higher anticipated reward increases mental effort, potentially necessitating prioritization of one control mode over the other. Across two experiments ($N = 62$ and $N = 61$), participants completed a task-switching paradigm with cued reward magnitude (1 vs. 10 cents) and block duration (short vs. long). The task was designed to simultaneously measure both control modes. We tracked flexibility and stability using two validated behavioural indices: switch costs, the reaction time (RT) increase on switch vs. repeat trials, and incongruence costs, the RT difference between incongruent and congruent trials. We observed that higher reward incentives increased flexibility (reduced switch costs) but decreased stability (increased incongruence costs), suggesting a reward-induced trade-off. In Experiment 1, this trade-off further unfolded across within-subject, moment-to-moment adjustments in control across blocks, and between-subject differences in individuals' general tendency toward stability. These findings provide evidence for a reward-driven trade-off, where higher incentives promote flexibility at the cost of stability. We provide rare empirical support that intensifying control engagement through reward may necessitate selective prioritization, yielding a trade-off between cognitive flexibility and stability.

Topic Area: EXECUTIVE PROCESSES: Goal maintenance & switching

E30 - Auditory Network Integration and Neural Representations Collapse Under General Anesthesia: Evidence from Intracranial EEG and Self-Supervised Learning

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Auditory entrainment—the synchronization of neural dynamics with semi-rhythmic sound—is a fundamental mechanism for perceiving and predicting temporal patterns in speech and music. General anesthesia provides a powerful model for investigating how this sensory processing relates to consciousness, yet the precise mechanisms of disruption remain unclear. We hypothesized that propofol-induced unresponsiveness reflects a selective disruption of higher-order auditory areas (dorsal auditory-motor stream), leading to a collapse of large-scale network integration and information representation. We tested this using stereoelectroencephalography (sEEG) in thirteen drug-resistant epileptic patients during a rhythmic auditory paradigm in both awake and anesthetized states. We found that during the awake state, auditory processing engaged a widespread, spatially organized network radiating from the primary auditory cortex. Under anesthesia, this network collapsed into focal activity, and this spatial organization was significantly attenuated. Furthermore, neural activity in the awake state propagated in an organized anterior-posterior direction, which was abolished under anesthesia, indicating a failure of large-scale communication. To assess the functional consequence, we trained CEBRA, a self-supervised learning algorithm, using high-dimensional sEEG neural signals and stimulus envelopes. The decoding performance was high in the awake state ($R^2=0.85$) but failed catastrophically under anesthesia ($R^2=-0.18$). These results reveal a cascade of neural failure: anesthesia fragments the auditory network, dismantles the information flow in time, and ultimately erases the neural representation of the external world. These findings provide a mechanistic account of how sensory representations collapse during unconsciousness, offering new insights into the fundamental network dynamics required to support conscious perception.

Topic Area: EXECUTIVE PROCESSES: Monitoring & inhibitory control

E31 - Does Food-Related Inhibitory Control Differ by Eating Tendencies? Evidence from an Event-Related Potential Study

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Food-related inhibitory control, or the ability to withhold eating palatable, high-calorie foods, plays a key role in diet and weight regulation. Individuals with poor eating tendencies, particularly restrained (overly limiting intake), emotional (eating in response to emotions), or external (eating when food is present) eaters, often show weaker inhibitory control. Testing neural indices of food-related inhibitory control in these individuals would clarify how cognitive functioning across different eating tendencies contributes to both positive and negative diet-related behaviors. Across four studies, 297 participants (M age = 25.80, SD= 7.46; 65% female) completed a high-calorie go/no-go task while EEG data were recorded. Participants responded with a button press to low-calorie food images (go trials) and withheld responses to high-calorie food images (no-go trials). Inhibitory control was indexed by frontocentral N2 and P3 event-related potentials (ERPs). Restrained, emotional, external, and disinhibition (combined emotional and external) eating tendencies were quantified using the Dutch Eating Behavior Questionnaire (DEBQ). Pearson correlations revealed no significant associations between N2 or P3 difference amplitudes (no-go minus go trial amplitude) and any eating tendencies ($p>.16$). Similarly, N2 and P3 difference amplitudes did not differ between successful (high restraint, low disinhibition) and unsuccessful (high restraint, high disinhibition) restrained eaters ($p>.33$). Results suggest that neural markers of inhibitory control toward high-calorie foods do not vary by levels of restrained, emotional, external, or disinhibition eating. Future research should test how neural indices of other cognitive mechanisms, such as attention or reward processing, might differ by eating tendencies and the associated impact on diet.

Topic Area: EXECUTIVE PROCESSES: Monitoring & inhibitory control

E32 - Aperiodic Neural Activity as a Marker of Excitation/Inhibition Balance in Children with Tourette Syndrome

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Tourette Syndrome (TS) is characterized by motor disinhibition, which may reflect altered cortical excitation and inhibition (E/I) balance in frontal and motor regions. Evidence shows that individuals with TS exhibit flatter aperiodic (1/f) spectral slopes compared to controls, suggesting elevated cortical excitability and neural noise across development. However, whether E/I balance changes with behavioral

therapy, and how it develops in children with TS remains poorly understood. We are investigating aperiodic EEG activity before and after Comprehensive Behavioral Intervention for Tics (CBIT) in children (target N: 20, current N: 2, ages 10-14) with TS. CBIT involves 8 weekly sessions of awareness training, competing response practice, and managing tic triggers to strengthen inhibitory control over tics. Data is collected using 64-channel EEG. Preprocessing includes artifact removal, noise correction, and time-locked coding of tics. Aperiodic activity is extracted using SpecParam, and preliminary analyses focus on the aperiodic exponent as an index of cortical E/I balance. We hypothesize that lower exponents at baseline will indicate elevated cortical excitability, and that increases in the exponents following CBIT will reflect improved inhibitory control and a shift towards balanced E/I dynamics. While results are preliminary, this work aims to establish aperiodic activity as a non-invasive marker of cortical excitability in TS and to test whether behavioral therapy can modulate E/I balance. Understanding these dynamics as a mechanism of tic reduction may guide future interventions, including behavioral, pharmacological, or neuromodulatory approaches, ultimately improving individualized care for youth with TS.

Topic Area: EXECUTIVE PROCESSES: Monitoring & inhibitory control

E33 - Human intracranial recordings reveal neural representations of pursuit and avoidance states in a naturalistic paradigm

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Reward pursuit and threat avoidance are fundamental components of behavior, but they have not yet been studied in humans using invasive recording and naturalistic paradigms. We defined pursuit and avoidance as behavioral states and identified their neural correlates using human intracranial electrophysiology from three reward- and threat-related regions: amygdala, anterior cingulate (ACC), and orbitofrontal cortex (OFC). We recorded local field potentials from neurosurgical patients while they pursued "prey" and avoided "predators" in a video-game-like task. We defined pursuit (PRS) epochs based on player trajectories closer to the player-to-prey angle than the predator-to-player angle, with avoidance (AVD) epochs closer to the latter. Hilbert analytic amplitude (HAA) was extracted from gamma (30-150 Hz), beta (13-29 Hz), and theta/alpha (4-12.5 Hz) bands, then aligned to PRS/AVD onset. Each timepoint from -500ms to +500ms was analyzed via linear mixed effects model with permutation testing, yielding time windows with significantly different band power between PRS and AVD. ACC and amygdala displayed transient gamma peaks during and preceding AVD (relative to PRS). Gamma power in amygdala also decreased/rebounded within 50ms of AVD onset. OFC gamma and beta were consistently higher throughout the transition to AVD, briefly dropping at onset. Beta power in OFC and

amygdala decreased simultaneously at 300-400ms in AVD, with theta/alpha in all three regions decreasing after 250ms. These differences, aligned to behavior rather than external cues, point to distinct neural states underlying naturalistic pursuit/avoidance in humans. Shared time courses between ACC, amygdala and OFC further suggest network collaboration in orchestrating these essential behaviors.

Topic Area: EXECUTIVE PROCESSES: Monitoring & inhibitory control

E34 - The immediate effects of cognitive intervention during treadmill running on balance and gait performance in male and female basketball players

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Basketball involves diverse movement skills and varying intensities, requiring players to rapidly accelerate, decelerate, stop and change direction to perform jumping, shooting, and passing. Given that basketball athletes routinely face simultaneous physical and cognitive demands during play, this study aims to examine the immediate effects of cognitive and physical interventions on static balance and gait performance in basketball players. This study recruited six female basketball players (age 20.7 ± 1.6 years) and six male basketball players (age 20.0 ± 0.9 years). The testing protocol included a 20 minutes high-intensity interval (HIIT) running intervention with cognitive dual tasks. Balance and cognitive performance were assessed by using BESS and CANTAB, respectively. To examine the interaction between time (pre- and post-intervention) and group (male and female), a two-way mixed-design ANOVA was conducted with significance level set at $\alpha = 0.05$. After HIIT running with cognitive dual tasks, the executive function in terms of Mean Latency to First Choice ($p < 0.001$) became better in both male and female groups, while Mean Latency to Correct was improved only in the female players ($p = 0.001$). There is no difference in balance test between sex. Taken together, the results suggest that while acute high-intensity exercise coupled with cognitive engagement may transiently enhance certain executive functions, it may concurrently deteriorate motor control and balance. These findings highlight the importance of task specificity and sex-related factors when designing combined cognitive-motor interventions or training protocols.

Topic Area: EXECUTIVE PROCESSES: Monitoring & inhibitory control

E35 - Changes in the Blind and the Deaf are Not Limited to Sensory Cortices

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Changes in the visual cortices of the blind and the auditory cortices in the deaf have been of massive neuroscientific interest. Across a number of tasks, we found that changes in these populations are not limited to their deprived sensory cortices and involve very widespread regions that include the cognitive control-related frontoparietal and the default mode regions. We had blind, and deaf participants, both of whom acquired these conditions congenitally or early in life, execute two cognitive control tasks (auditory/visual working memory updating and tactile decision making), both of which had easy and hard blocks). A group of sighted and hearing control participants, as well as a group of children born to deaf parents and using sign language as their first language, were also tested. We found that activations in control-related frontoparietal regions to control demands were almost absent in deaf participants. In neither of the two tasks did deaf participants show control-related activation in their frontoparietal regions. Accompanying these muted activations were the muted deactivations in the default mode regions. In the blind, frontoparietal activations and default mode deactivations were comparable to those in the sighted except for the bilateral temporoparietal junctions. These regions deactivated more to control demands in the blind, and this was the case in both of the demanding tasks we tested. Blindness and deafness are not just accompanied by changes in their respective sensory cortices but also involve changes in other brain networks. Scientific and Technological Research Council of Turkey (TÜBİTAK) grant 121K902.

Topic Area: EXECUTIVE PROCESSES: Other

E36 - Cognitive profiles of addictive behaviors: Evidence from work addiction, gaming disorder, and cannabis use disorder

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Cognitive impairments have been widely reported across both substance-related and behavioral addictions; however, it remains unclear to what extent different addictive behaviors share common cognitive profiles. Direct, profile-based comparisons across addictions are still scarce. Addressing this gap, the present study examines

cognitive profiles across addictive behaviors compared to non-addicted individuals, focusing on work addiction (WA), Gaming Disorder (GD), and Cannabis Use Disorder (CUD). In a sample of 245 participants, risk for WA, GD, and CUD was assessed via self-report questionnaires, while executive functions were measured using Go/No-Go (inhibitory control), Counting Span, Digit Span, n-back (working memory) and Card Sorting tasks (cognitive flexibility). Latent profile analysis identified four addiction profiles: Low Addiction (LA), WA-focused, GD-focused, and CUD-focused. BHC and R3STEP analyses revealed profile-specific cognitive differences. The WA profile showed poorer cognitive flexibility than the LA profile and poorer inhibitory control than the CUD profile. Working memory deficits were most pronounced in the GD profile, which performed worse in simple working memory than both the LA and WA profiles, and worse in complex working memory than the LA profile. Overall, distinct cognitive profiles emerged across addiction types, suggesting that WA is more closely related to reduced cognitive flexibility, while GD is characterized by working memory deficits. This pattern underscores both shared and disorder-specific cognitive mechanisms, contributing to a nuanced understanding of behavioral and substance-related addictions. Funding: The study was supported by the Hungarian National Research, Development and Innovation Office (Grant number: FK134807).

Topic Area: EXECUTIVE PROCESSES: Other

E37 - Sequential vs. Simultaneous Encoding and Spatial vs. Temporal Retro-Cueing: Dissociating Working Memory Access Mechanisms

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A current debate in working memory research concerns whether spatial and temporal information processing rely on shared or distinct neural mechanisms. Traditional models propose separate systems with spatial processing engaging parietal networks and temporal processing recruiting frontal regions. However, recent evidence suggests both may be encoded through a unified sequence generator mechanism. Retro-cueing paradigms provide an ideal tool to test these competing hypotheses by examining whether accessing information through spatial versus symbolic cues engages different attentional control mechanisms. Four experiments examined whether stimulus presentation format (sequential vs. simultaneous letter arrays) and retro-cue type (spatial vs. symbolic) engage shared neural mechanisms. Two behavioral experiments (n=30 each) tested sequential versus simultaneous presentations with no-cue, single-cue, and dual-cue trials. Two complementary EEG experiments (n=30 each) employed multivariate pattern analysis to decode cue type and validity, plus cross-experiment decoding to examine presentation format effects and time-frequency analysis testing alpha synchronization and theta-gamma coupling mechanisms. Behavioral experiments reveal equivalent retro-cue benefits for both presentation formats, with improved response times but no accuracy differences

and no interaction between stimulus presentation and cue type, suggesting shared prioritization mechanisms. Ongoing EEG analyses will test whether valid spatial and symbolic cues engage similar attentional mechanisms, whether cross-experiment decoding reveals format-specific neural signatures, whether alpha oscillations show differential suppression patterns, and whether theta-alpha coupling demonstrates similar cross-frequency interactions supporting unified mechanisms versus distinct coupling patterns supporting separate systems.

Topic Area: EXECUTIVE PROCESSES: Working memory

E38 - Active removal of information from working memory invokes the concerted recruitment of distributed neocortical regions

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The ability to actively remove irrelevant items from working memory storage is essential for goal-directed behavior. However, the mechanisms underlying active removal of information remain largely unknown. Importantly, exerting control over attentional selection of a memorized stimulus requires information about this specific selection. Our recent work provides evidence that this information is represented in the form of selection-specific activity in parietal and temporal regions. Here, we employ fMRI and MVPA to identify selection-specific activity across the cortex through a multimodal retro-cued n-Back discrimination task. Subjects were tasked with memorizing an item, either visual or auditory, until a colored retro-cue indicated if that item should be remembered or forgotten. Thus, while prior work investigated which process underlies the selection between two items, the current study focuses on the fate of a singular item. Selection suppressed the representation of the to-be-forgotten item in visual and parietal cortex, as indicated by reduced item-specific decodability. To identify areas that carry selection-specific information, whether an item should be actively removed from working memory, we performed a whole-brain searchlight analysis (cvMANOVA for 'remember' versus 'forget') for the period following the cue onset. We find a wide array of frontal and parietal brain regions holding this information, including precentral and lateral prefrontal cortex as well posterior and medial parietal regions, across both stimulus modalities. These results highlight that active removal of working memory contents occurs in both sensory and non-sensory cortical regions and reveal a generalized, modality-independent mechanism for cognitive control of information stored in working memory.

Topic Area: EXECUTIVE PROCESSES: Working memory

E39 - Visuospatial working memory is cortically enabled through veridical, categorical and semantic representations

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Visual stimuli are frequently prone to categorical biases that impact their recall during working memory. How do these systematic errors originate in the brain? Previous work suggests that a single visual stimulus can elicit multiple representations throughout the cortex, and that these differ in content and format. The cortex might then harbour both continuous and categorical neural representations, with the latter likely presenting a neural correlate of the categorical biases evident in behavior. We collected fMRI data from 40 participants during an orientation working memory task. We assessed the nature of orientation representations using multivariate encoding modelling. Additionally, we cross-decoded between orientation and congruent verbal and location stimuli. Our results show that orientation representations across the cortex are organized along a gradient of abstraction, with more veridical representations in sensory areas, and more abstract, categorical codes in anterior areas. The cross-decoding analyses suggest the presence of a common neural code between orientations and simpler visuospatial stimuli (i.e., locations), as well as between orientations and semantic stimuli. Thus, these results suggest that neural representations include categorical, semantic, and spatial formats, simultaneously held throughout the cortex to maintain visual stimuli in a robust fashion. Our findings support a distributed account of working memory storage featuring multiple representational formats. These range from continuous to categorical, including visuospatial simplifications and semantic depictions of the original stimulus.

Topic Area: EXECUTIVE PROCESSES: Working memory

E40 - Catching Alpha in the Act: A Closed-Loop EEG Paradigm

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Numerous studies observed that pre-stimulus activity, such as pre-stimulus alpha power, shapes neural processing and post-stimulus behavioral outcomes. Pre-stimulus frontal alpha-band power at encoding has been linked to enhanced subsequent memory performance, potentially reflecting cortical deactivation of the Default Mode Network. Closed-loop paradigms optimize trials by only presenting stimuli after participants reach a targeted alpha state, allowing more insight into the causality of pre-stimulus alpha dynamics. Here, participants engaged in an object-memory task where this approach was used to control alpha state during object encoding and thereby modulate memory success. Individualized alpha-power distributions were collected during a practice task to define High and Low alpha thresholds corresponding to the upper and lower eighteenth percentiles, respectively. High and Low trials were randomized so that

each stimulus presentation was contingent on alpha power within the pre-stimulus interval (–1000 to 0 ms), reaching the predetermined threshold within a mean of 2.4 seconds. Event-related spectral perturbations around each encoding event were extracted from the triggering frontal electrode, F3, and trials were sorted by whether the presented object was subsequently Remembered or Forgotten. Pre-stimulus alpha power was significantly greater on High versus Low trials ($p < 0.001$), confirming success of the closed-loop design. Nevertheless, we observed no significant difference in subsequent memory for items triggered by high versus low alpha power. Analyses examining the impact of these states on memory performance are ongoing. These findings validate a closed-loop, frontal alpha-triggered approach for elucidating the cognitive effects of spontaneously varying endogenous neural states.

Topic Area: EXECUTIVE PROCESSES: Working memory

E41 - Neural mechanisms for syntactic ambiguity in young bilinguals

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Understanding syntactically ambiguous sentences requires the integration of multiple cues and significant cognitive control (CC). Because of children's developing CC systems, they often struggle interpreting ambiguous sentences. Some research suggests bilingualism can lead to adaptations in the CC brain network through managing two active languages. Yet the neural mechanisms linking bilingual experience, syntactic ambiguity resolution and CC-related brain development remain poorly understood. This study investigates how bilingualism and age shape brain networks supporting ambiguity resolution. English–Hawaiian bilinguals and English monolinguals (adults and children, 5–10 yrs), perform two auditory ambiguity tasks during fMRI scanning: (1) judging whether an action matches a garden-path sentence, and (2) selecting which of two images matches a sentence containing a prepositional phrase ambiguity. We compare ambiguous vs unambiguous conditions (tasks 1/2), and pre-critical word activation to post-critical word activation (task 1) to investigate the mechanism each group uses to resolve the sentence. Preliminary analyses indicate adult bilinguals engage fronto-parietal and subcortical control networks, whereas monolinguals utilize temporal regions, reflecting more reliance on sensory processes, for ambiguity resolution. Data collection is ongoing for the children, but when comparing bilingual and monolingual 8–10-year-olds, bilinguals show more focal recruitment of fronto-temporal regions, like IFG, and reduced reliance on posterior areas compared to monolinguals, reflecting a more adult-like pattern of CC network activation than monolinguals. These findings support the view that bilingual experience can alter neural systems underlying syntactic ambiguity resolution and highlight the value of studying English–Hawaiian bilinguals to expand bilingual research to understudied language groups.

Topic Area: LANGUAGE: Development & aging

E42 - Investigating language network development in autism using movie fMRI

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Language impairments impacting academic and social outcomes are commonly found in autistic children. Traditional fMRI language paradigms are often challenging for autistic children, limiting data quality and interpretability due to sensory and attention demands. Movie-based fMRI offers a naturalistic and engaging alternative that improves compliance and captures language processing in real-world contexts. We developed a movie-based paradigm using Despicable Me and The Present clips, labelled as 'talking' and 'no talking,' to study language network development in children aged 7 to 17. During talking scenes, combined data from the Montreal Neurological Institute and the Healthy Brain Network show robust activation of language regions, including the inferior frontal gyrus, superior temporal gyrus, and supplementary motor area. During no-talking scenes, increased occipital and fusiform activation is shown. These findings demonstrate that the paradigm is a reliable and ecologically valid method for studying language processing in both groups. The next phase of this work applies precision mapping to quantify individual variability in network extent, lateralization, and connectivity. This approach will test whether language network organization in autism reflects atypical group-level patterns or increased inter-individual heterogeneity. By integrating behavioural measures of language and social communication, these analyses will identify whether neural variability predicts symptom profiles or functional outcomes. Preliminary 7T movie fMRI data further demonstrate the feasibility of precision mapping at higher spatial resolution. Together, this work advances an individualized and naturalistic framework for understanding heterogeneity in autism, bridging traditional group comparisons with precision neuroscience approaches capturing meaningful differences in the neural underpinnings of language.

Topic Area: LANGUAGE: Development & aging

E43 - Separable cognitive mechanisms for word learning and perceptual learning of novel speech

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Perceptual learning and word learning are key adaptive processes in speech comprehension. However, little is known about how they interact when both are potentially appropriate. For instance, should the pseudoword /lɛdər/ be interpreted as an accented form of 'letter' or a new word, 'ledder'? In two online studies and one M/EEG study, semantically constraining sentence contexts guided participants towards inferring a pseudoword's meaning (i.e., word learning; "Every morning, Sophie drank a cup of... /pəbu:f/") or correcting an accented familiar word's surface form (i.e., perceptual learning; "The

sailors found their way north using a... /kʌmpəf/"). Study 1 (N=108) demonstrated that participants can engage both learning processes in one task, and the extent of learning depends on the relative number of unique trained items (type frequency) and item repetitions (token frequency). Study 2 (N=180) showed that with suitable type and token frequencies, perceptual and word learning persist for at least 12 hours, and that perceptual learning and word learning performance are uncorrelated. In Study 3 (N=32), simultaneous M/EEG recordings were collected as participants listened to words and pseudowords before, during, and after training to induce perceptual learning and word learning. Sensor-level analyses revealed late-arising lexically-sensitive spatio-temporal activity clusters pre-training that diverged post-training depending on the type of learning applied for specific items. Ongoing analyses are exploring how learning emerges during training and localizing the source generators of the effects. Results provide evidence that perceptual learning and word learning can be induced with a single paradigm yet are distinct cognitive and neural processes.

Topic Area: LANGUAGE: Lexicon

E44 - Does neural synchronization accelerate communicative interaction?

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The transition between speakers in conversation (called turn-taking) is remarkably fast. Speakers only need about 200 ms to take the turn. This speed may be afforded by the synchronization of neural activity with acoustic modulations already before the turn boundary. Specifically, narrow-band activity below 8 Hz has been found to synchronize with rhythmic modulations in speech acoustics, thus aiding temporal prediction. Previously, we found rhythmic modulations before turn boundaries and with higher subjective rhythmicity ratings to accelerate turn-taking. To confirm that neural synchronization is at the basis of this effect, we are conducting an MEG study that simulates turn-taking via virtual game interactions with life-like avatars. We hypothesize that sentences with stronger rhythmic modulations increase neural synchronization, accelerating turn taking response times. This would support a role of neural synchronization in anticipating turn boundaries and accelerating communicative interaction. Data collection for this study is currently underway and expected to be complete by December of 2025.

Topic Area: LANGUAGE: Other

E45 - The effect of lexical ambiguity on memory: An EEG study

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Processing lexically ambiguous words involves the transient activation of all meanings known to the comprehender. While behavioural and event-related potential studies have mapped out the time course of this process, the neural oscillations underpinning the activation and later inhibition of multiple word meanings remain unstudied. It is similarly unclear how the activation of multiple meanings affects subsequent memory for language input. We used electroencephalography (EEG; n = 42) to investigate which neural oscillations supported processing of high ambiguity (multiple meanings), low ambiguity (one primary meaning) and incongruent (semantically anomalous) words in sentential contexts. We focused on theta and alpha/beta oscillations, which have been implicated in lexical-semantic processing, lexical access and memory encoding. We hypothesised that increased theta and decreased alpha/beta power would be linked to better memory and support the processing of high ambiguity and incongruent words, with the latter placing higher demands on lexical access processes than low ambiguity words. Behavioural analyses showed better memory for low ambiguity and incongruent compared to high ambiguity words, suggesting that activating multiple meanings negatively affects memory for the encountered word. Contrary to our hypotheses, we found no effects in the theta band. Instead, alpha/beta desynchronisation supported the processing of lexically ambiguous and incongruent endings, potentially by inhibiting alternative meanings. Overall, our findings suggest that the activation of multiple meanings during the processing of ambiguous words affects subsequent memory for the encountered word forms, and point to an important role for alpha/beta oscillations in the processing of lexically ambiguous and semantically incongruent information.

Topic Area: LANGUAGE: Other

E46 - Linguistic event-related potentials as predictors of implicit and explicit memory

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Two event-related potentials (ERPs), the N400 and P600, have received significant attention in the neurolinguistic literature due to their ties to semantic and syntactic processing, respectively. However, recent evidence suggests that these ERPs may also relate to learning more generally, with the N400 associated with implicit memory and the P600 linked to explicit memory. Importantly, these relations have not yet been tested in a combined study, despite the need for clearer delineation of the effects. The current experiment aims to replicate and delve deeper into the N400's connection to implicit memory, and the P600's association with explicit memory, using a combined paradigm. Participants (N = 40) are first exposed to sentences containing either a semantically expected or unexpected target noun whilst their electroencephalogram (EEG) is recorded. Next, implicit memory for the target nouns is measured via a perceptual identification task, and

explicit memory is tested with an old/new recognition task. ERP amplitudes to target nouns during sentence reading will be related to subsequent memory for the nouns on a trial-by-trial basis using linear mixed-effects models. Data collection is still underway, but we expect to replicate the associations between the N400 and implicit memory, and the P600 and explicit memory. This research will shed light on how these language-related ERPs drive memory encoding in the moment, highlighting their functional significance as broader learning signals.

Topic Area: LANGUAGE: Other

E47 - What underlies differences in emotional expression in L1 and L2? Examining the lexical properties of narratives

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Bilingual speakers are often reported to express emotion less intensely in their L2 than their L1 (Pavlenko, 2005), yet the mechanisms underlying this attenuation remain poorly understood. The present study examines potential linguistic contributors to this difference. English monolinguals (N=70) and bilingual (N=71) participants (self-reported L2 English) produced English descriptions of silent emotional video clips from the Database of Emotional Videos from Ottawa (DEVO: Ack Baraly et al., 2020). Independent human raters (N=305) each rated a subset of transcripts for emotional expressivity on a -1 (negative) to 1 (positive) scale. Monolingual transcripts were rated as more emotionally expressive than bilingual transcripts, but only for negative videos. Examination of transcripts revealed that monolinguals produced longer descriptions than bilinguals overall. The emotionality of words was captured using the NRC Emotion Lexicon (Mohammad & Turney, 2013), which provides crowdsourced emotionality ratings for 14,182 English words. Collapsed across language groups, the density of words considered emotional predicted human coders' expressivity ratings: increased use of emotionally charged words was associated with more extreme ratings. This held for both positive and negative transcripts. Comparisons between language groups revealed that monolinguals produced a greater density of emotionally charged words than bilinguals, aligning with human expressivity ratings. These results suggest that judgments of emotion are influenced by the density of emotionally valenced words and that this may contribute to differences in L1 and L2 emotion expressivity. Future analyses will explore why this language group difference holds only for negative emotion and examine contributions of additional lexical characteristics.

Topic Area: LANGUAGE: Other

E48 - Dynamic Neural Reorganization Underlying Speech Disambiguation

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Prior exposure to a clean speech often enhances understanding when that speech is later heard in noise. We examined how clean exposure alters behavior, fMRI multivoxel patterns, and functional connectivity for Mandarin sentences masked at -12 dB SNR. In the scanner, each sentence appeared sequentially as Pre-Noisy, Clean, and then Post-Noisy across six runs with 24 sentences, and 21 participants reported comprehension on every trial. Behaviors improved significantly, with Clean higher than Pre and Post higher than Pre. Univariate effects spanned language regions, including superior and middle temporal gyri (STG/MTG), supramarginal gyrus (SMG), angular gyrus (AG), inferior frontal gyrus (IFG), precentral gyrus (PreCG), and dorsolateral prefrontal cortex (DLPFC). Support vector machine-based multivoxel pattern analysis (MVPA-SVM) decoded Pre, Clean, and Post above chance across STG, MTG, SMG, AG, IFG, PreCG, and DLPFC. Representational similarity analysis (RSA) showed that cross-condition alignment shifted after clean exposure, with Post-to-Clean exceeding Pre-to-Clean in STG, MTG, SMG, and IFG. A t-distributed stochastic neighbor embedding (t-SNE) revealed that, in STG/MTG, the Clean condition clusters at the center, Post-Noisy surrounds that center, and Pre-Noisy lies farther out; in IFG, each sentence forms its own cluster, with Clean and Post-Noisy close together and Pre-Noisy more distant. Functional connectivity decreased between temporal and sensorimotor/visuospatial regions in Clean compared with Pre, and increased between IFG and parietal/sensorimotor regions in Post compared with Clean. This pattern suggests that clean exposure creates a stable reference representation in the temporal cortex. When noise returns, a lateral IFG-parietal-sensorimotor circuit reconstructs the degraded input.

Topic Area: LANGUAGE: Semantic

E50 - Deceptive Cadences: Investigation of the P600 in sentences and musical phrases within musicians and non-musicians

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Music and language engage similar cognitive processes within the brain, and both are rule-governed, hierarchical structures. Musical expertise improves auditory and motor regions of the brain, but language capacity is not modulated by musical expertise. In event-related potential (ERP) studies, the P600 ERP component is considered an indicator for the processing of syntactic incongruities in sentences. The P600 has also been found during the processing of chord progressions in musicians. The current study investigated the extent that the P600 from musicians and non-musicians can be compared during musical and syntactic processing. Participants were grouped using the Goldsmiths Musical Sophistication Test (Gold-MSI) which subjectively measured participants' relationship with music, and the Musical Ear Test (MET), an objective, perceptual measure of musicianship using melodic and rhythmic phrases. Musicians, as

classified based on their scores on the Gold-MSI, performed significantly better on the MET than non-musicians. Participants listened to sentences that were either grammatically correct or incorrect, as well as consonant or dissonant musical phrases. The P600 for language stimuli replicated previous findings of more positive P600 amplitudes for syntactically incorrect sentences as compared to syntactically correct sentences in both groups. The P600 for musical stimuli was more positive in the musician group when listening to dissonant phrases compared to consonant phrases, while non-musicians demonstrated smaller P600 responses to dissonant musical stimuli compared to musicians. These results may contribute to an argument that music processing is innate within all humans, given that music follows similar rule-governing patterns to language once expertise is equated.

Topic Area: LANGUAGE: Syntax

E51 - The Brain Resilience Study: Structural Connectivity Network Features Relate to Cognitive, Sleep and Sex Differences in Older Adults.

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Brain health outcomes in aging vary widely across individuals. The Brain Resilience Study aims to identify factors that modulate individual differences in resilience and decline in aging by examining risk factors, alongside cognitive and neurobiological variables. In this study, we examined sex differences in how sleep and cognition relate to structural network features in older adults. Multimodal data were collected from 62 participants (52% males; age=68.1±8.4 years) and included structural imaging (T1w, diffusion MRI), and sleep and cognitive assessments. Structural connectivity was estimated and used to examine network segregation, including local clustering and modularity. Sleep and cognitive measures included scores from the Montreal Cognitive Assessment, Pittsburgh Sleep Quality Index (PSQI), Paired Associates Learning task, and Mnemonic Similarity Task. Age and sex were also included for analysis. Behavioural partial least squares analyses examined sex differences in the relationship between network segregation and cognition. Significant latent variables indicated that older adults with lower cognitive performance exhibited higher modularity and lower clustering within visual and attention networks, consistent with reported sensory network changes in ageing (Khalilian et al., 2024). Post-hoc analyses with age and PSQI scores indicated that modularity and clustering were associated with older age and worse sleep quality for female but not male participants. Our findings suggest an interplay between sex, brain structure, and modifiable lifestyle factors such as sleep that influences cognitive function. This work offers insight into the determinants of brain resilience and provides a framework for developing personalized strategies to preserve or enhance cognitive function in older adults.

Topic Area: LONG-TERM MEMORY: Development & aging

E52 - The Origins of Memorability in Infancy

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Some images are consistently more memorable than others, independent of context or prior experience, implying that memorability reflects shared properties of visual processing. While adults show reliable neural signatures of memorability in high-level visual cortex and medial temporal regions, it remains unknown whether this sensitivity depends on visual experience or emerges from the brain's early architecture. Two-month-old infants (n=125 scans), who have had limited visual experience, and adults (n=16) viewed short naturalistic videos during awake fMRI. Framewise memorability scores were predicted using ResMem, a deep neural network trained to predict human memorability. Both infants and adults exhibited activity in ventral visual and medial temporal regions in response to framewise memorability. ROI analyses confirmed the presence of adult-like activity of memorability-sensitive networks in infants. Infants additionally recruited medial and subcortical areas, including the amygdala and hippocampal body and tail, suggesting early involvement of memory-related structures. Memorability effects persisted after controlling for low-level visual features such as attentional saliency and visual entropy. These findings indicate that neural sensitivity to memorability emerges within the first months of life, before extensive visual experience or conscious recall. Memorability appears to reflect an intrinsic organizational principle of the developing visual system, bridging perception and memory from the earliest stages.

Topic Area: LONG-TERM MEMORY: Development & aging

E53 - The impacts of aging on hippocampal place cell sequences during movement and replay

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Age gradually degrades memory function, often leading to changes in behaviors that rely on these memories. The hippocampus is a brain region central to memory processes. Prior work suggests that compressed sequences of spatially-tuned hippocampal cell (place cell) firing play an important role in memory consolidation, recall, and memory-based decision-making. These occur during movement (referred to as theta sequences) as well as during immobility (referred to as hippocampal replay). However, it remains unclear how these

neural sequences change throughout the aging process and whether they contribute to behavioral changes. In this study, we collected electrophysiological recordings from the CA1 subregion of the hippocampus in young (4-9m) and aged (28-32m) rats while they performed a complex memory-guided spatial task. Here we compare the recorded hippocampal activity between the young and aged subjects and evaluate how the neural patterns correlate with the subjects' performance on the task. Decoded sequences of place cell firing exhibited differences during both movement and immobility that correlate with age. These results shed light on how age-related changes in hippocampal patterns of neural activity may contribute to memory impairment in advanced age.

Topic Area: LONG-TERM MEMORY: Development & aging

E54 - Does Theta Synchronicity of Sensory Information Enhance Associative Memory? Replicating the Theta-Induced Memory Enhancement Effect

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The binding of information from different sensory sources is critical for associative memory. Previous animal research suggested that the timing of theta oscillations in the hippocampus is crucial for long-term potentiation, which underlies associative memory. Studies with humans showed correlations between theta oscillations in the medial temporal lobe and episodic memory. Clouter et al. (2017) directly investigated this link by modulating the intensity of the luminance and the sound of the video clips so that they 'flickered' at certain frequencies and with varying synchronicity between the visual and auditory streams. Better memory was observed for the synchronous theta (4Hz) flickering compared with no-flicker, asynchronous theta, or synchronous alpha and delta flickering. This effect –the theta-induced memory enhancement (TIME) effect – is consistent with the importance of theta synchronicity for long-term potentiation. Electroencephalography data showed that synchronicity was achieved in neuronal oscillations. The theoretical importance, large effect size, and applicability to enhance real-world memory mean that replicating the TIME effect would be highly valuable. The present study aimed to replicate the key differences among synchronous theta, asynchronous theta, synchronous delta, and no-flicker conditions while addressing alternative explanations. Across two experiments (one registered report, one preregistered), we find no evidence of improved memory for theta synchronicity in any of the comparisons. MEG data from the first experiment suggested that the modulation manipulations worked as intended. We discuss explanations for the null results and provide a meta-analysis of TIME. Based on these findings, we suggest a reinterpretation of TIME to accommodate these non-replications.

Topic Area: LONG-TERM MEMORY: Episodic

E55 - Association Between Anterior Hippocampal Gyrification and Episodic Memory Performance in Neurotypical Young Adults

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The hippocampus is critical for episodic memory. The relationship between its structural variability and individual differences in episodic memory performance among neurotypical young adults, however, remains unclear. Previous studies have not consistently found associations between hippocampal volume and episodic memory or other aspects of hippocampally-dependent behavioural performance in this population. Here, we moved beyond traditional volumetric approaches and tested whether more fine-grained morphometric features, particularly gyrification, are related to behavioural performance on hippocampal-dependent tasks in neurotypical young adults. To obtain measures of these features, we used HippUnfold, a deep learning-based segmentation tool to model the hippocampus as a folded cortical ribbon, which is of particular importance for capturing variability in folding patterns in the hippocampal head. We focused on a large-scale public dataset that includes high-resolution T2-weighted MRI scans and behavioral measures on multiple hippocampal-dependent tasks, including episodic memory as measured by the Autobiographical Interview. Volumetric and surface-based morphometric measures were obtained in 93 participants (55 female). The surface-based analysis of hippocampal gyrification revealed two significant clusters in the right anterior hippocampus: one positively and the other negatively correlated with the episodic detail scores. The ratio of gyrification values between these clusters was also significantly associated with episodic memory performance, highlighting a potentially reciprocal structural pattern. Together, these results highlight the utility of surface-based measures of hippocampal morphology for relating variability in structural features other than volume to episodic memory in neurotypical young adults.

Topic Area: LONG-TERM MEMORY: Episodic

E56 - Targeted Memory Reactivation During Sleep Disrupts the Temporal Structure of Episodic Memories

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The temporal structure of episodic memory is both constructive and malleable, dynamically shaped by experience. Notably, emotional salience not only enhances retention but may also disrupt the temporal coherence of memories. Sleep consolidation, through hippocampal-neocortical replay, likely underlies these effects. Using targeted memory reactivation (TMR), we causally tested how sleep reactivation organizes the temporal order of emotional versus neutral episodes. Thirty-eight participants completed a within-subject design. They studied 32 six-image episodes (aversive: neutral-to-negative transition; neutral: all neutral), each paired with distinct auditory cues for the first and second halves. After encoding and baseline

affective/temporal tests, closed-loop TMR during N3 sleep reactivated second-half cues for half of the episodes, time-locked to slow-oscillation up-phases. Emotional and temporal memory were reassessed the next morning and one week later. We found that aversive episodes showed higher temporal precision and inflated perceived distances between events relative to neutral episodes; these differences increased after sleep. TMR produced a double dissociation: item recognition improved for both aversive and neutral episodes, while temporal-order accuracy declined. The disruption was segment-specific, limited to cued (second-half) segments and not the early neutral parts, implicating relatively independent processing across episode segments. EEG showed that TMR-evoked theta and sigma power tracked these behavioral effects. Collectively, these results indicate that sleep inflates perceived inter-event distances in aversive episodes. Critically, TMR strengthens item memory but reduces temporal fidelity. Thus, externally driven reactivation during sleep can disrupt the episodic timeline while prioritizing item-level strength.

Topic Area: LONG-TERM MEMORY: Episodic

E57 - Linguistic Scaffolds Shape the Reconstruction of Visual Memories

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Language shapes not only how we perceive the world but also how we reconstruct our experiences in memory. To understand how linguistic scaffolds contribute to episodic memory recall, we examined the neural representations of two basic visual features, color and location, that differ in their verbalizability. In our fMRI experiment, participants encoded everyday objects presented in arbitrary colors and spatial locations while attending to either color or location. During retrieval, they recalled the cued feature, rated its vividness, and reported its value along a continuous scale. Both features were sampled from continuous parameter spaces, enabling detailed mapping of feature-specific neural representations. We constructed linguistic-categorical models for color from behavioral naming data, where similarity between hues was determined by shared color labelling across participants, and for location using eight common spatial terms. Veridical visual models for both features were determined by the angular distance between two hues or spatial locations on the 360° feature wheel. Representational similarity analysis (RSA) revealed that during color encoding, veridical visual representations dominated in the lateral occipital and posterior fusiform cortices, with no regions showing significant linguistic-categorical representation. During color retrieval, however, significant linguistic-categorical representations emerged in the lingual gyrus, posterior fusiform and lateral occipital cortex, showing a “flip” in color representation format. In contrast, location representations remained consistently visual across encoding and retrieval, strongest in early visual and posterior cortices. These findings suggest that when visual information can be richly verbalized,

memory retrieval engages linguistic scaffolds, supporting the reconstruction of experience through language-based representations.

Topic Area: LONG-TERM MEMORY: Episodic

E58 - A computational model of the episodic memory impairment in schizophrenia

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Individuals with schizophrenia show poorer performance than healthy comparisons with word-list free recall, remembering fewer words and reporting those words with impaired temporal organization. We evaluated which cognitive mechanisms may be critically involved in this deficit within the framework of the Context Maintenance and Retrieval (CMR) model of memory search. We used a behavioral dataset of 179 patients and 184 healthy comparison participants performing the Screen for Cognitive Impairment in Psychiatry (SCIP) free-recall task, focusing on trial 1 immediate free recall data. After demonstrating that CMR captures performance differences between the groups on several benchmark analyses, we constructed a family of models in which individual model parameters were allowed to vary between groups, to determine whether each parameter contributes meaningfully to explaining group-level behavioral differences. Two model parameters were primarily responsible for group differences, a recall termination parameter, and a parameter controlling the fidelity of retrieved contextual information. In a final set of analyses, we used CMR to create a classifier to predict disease status from task performance, and used a leave-one-subject-out design to demonstrate above-chance 61% correct classification. This work demonstrates that the CMR model provides a useful framework for understanding the cognitive mechanisms underlying memory search performance deficits in patients with schizophrenia, and shows promise for the development of computational models of memory in the identification and characterization of psychopathologies.

Topic Area: LONG-TERM MEMORY: Episodic

E59 - The recollection deficit in amnesia is critically linked to the confusion of temporal context of items in memory

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Introduction: According to the two-process model, recognition memory relies on recollection and familiarity. While amnesia is typically associated with impaired recollection and preserved familiarity, some amnesic individuals display disorientation and excessive false recognitions, suggesting both reduced recollection and aberrantly increased familiarity. Impaired orientation has been shown to reflect a failure to distinguish the temporal context of items encoded in memory. Methods: Seventeen individuals with amnesia (oriented or disoriented) and 20 healthy controls completed two recognition memory sessions.

Each session included two runs of 120 images, eight of which were repeated five times. The second run comprised: (a) items repeated within that run (targets2), (b) items repeated within the first run (targets1), (c) nonrepeated items from the first run (distracters1), and (d) new items (distracters2). In the exclusion condition, participants identified as “old” only items repeated within the second run. In the inclusion condition, they also identified items previously presented in the first run. Results: Healthy controls and oriented amnesics showed reduced “old” responses to targets1 and distracters1 in the exclusion versus inclusion condition. In contrast, disoriented amnesics produced similar rates of false recognitions in the exclusion condition as hits in the inclusion condition. Process estimates indicated impaired recollection in both amnesic groups, with disoriented patients performing significantly worse than oriented ones. Familiarity remained comparable across groups. Conclusions: Recollection is significantly impaired in amnesia, whereas familiarity appears preserved. Disorientation further exacerbates recollection deficits, implying that temporal context confusion may constitute an additional factor influencing recollection-based memory processes.

Topic Area: LONG-TERM MEMORY: Episodic

E60 - Testing the Causal Role of the Posterior Medial Network in Episodic Memory Specificity

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A key aspect of episodic memory is its specificity or the precision with which information is remembered – a process that is supported by the posterior medial (PM) network including the hippocampus and angular gyrus (AG). Although PM network interactions are associated with memory specificity, their causal role remains unclear. Prior work showed that stimulating the AG reduced hippocampal activity and hippocampal-AG functional connectivity, corresponding to worse performance on simulation and divergent thinking tasks. The present study tested whether AG stimulation alters PM network interactions and episodic memory specificity, as well as their relation to subjective memory vividness. Participants completed two sessions in which they encoded object-scene pairs, memorizing the object’s location within each scene. After encoding, they received continuous theta-burst stimulation (cTBS) over the left AG or a control site (vertex). The AG site was chosen based on its functional connectivity with the hippocampus. Immediately after cTBS, participants completed a scanned retrieval in which they rated memory vividness and reconstructed the object-scene pairs. We hypothesized that AG cTBS would reduce hippocampal activity and hippocampal-AG connectivity, and behaviorally, decrease memory specificity and subjective vividness. Behaviorally, AG stimulation did not significantly affect memory specificity or subjective vividness. Ongoing fMRI analyses will examine whether AG stimulation modulates PM network activity and connectivity, and whether these neural changes relate to individual

differences in retrieval performance. This work will help clarify the causal contributions of the PM network interactions to episodic memory and advance understanding of how targeted neurostimulation can probe memory-related brain networks.

Topic Area: LONG-TERM MEMORY: Episodic

E61 - The Effects of Stress on Memory in Latino Populations

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Introduction: Latinos face unique minority identity-related stressors and higher incidence of Alzheimer’s disease (AD) than non-Latino Whites (NLW). Additionally, stress is often associated with worse memory. Our experiences often contain overlapping features; thus, interference across experiences may lead to difficulties remembering unique events. The ability to reduce interference across similar experiences relies on hippocampal pattern separation computations. Mnemonic discrimination tasks (MDT) have shown to be a behavioral correlate of hippocampal pattern separation and are sensitive to age-related cognitive decline. However, prior studies have examined predominantly NLW participants. In the current study, we investigated how stress in Latinos and non-Latinos was associated with memory performance in young adults using a MDT. Methods: We collected data from 106 participants (ages 18-35), including foreign-born Latinos (N = 26), US-born Latinos (N = 26), non-Latinos (N = 26), and Latinos living in Mexico (N = 28). Participants completed a novel MDT that included stimuli generalizable across cultures. We measured general recognition and lure discrimination, a behavioral correlate of hippocampal pattern separation. We measured stress through physiological and self-report measures. Results: We found that Latino participants showed worse memory (d’ and LDI) and higher levels of subjective stress compared to non-Latinos. In particular, foreign-born Latinos showed negative associations between stress and memory, where higher stress predicted worse memory. Conclusion: We found that Latinos experienced greater stress and worse memory, particularly for detailed information. This study addresses health disparities and increasing awareness of cross-cultural differences in cognition.

Topic Area: LONG-TERM MEMORY: Episodic

E62 - Tempo-Evoked Arousal: Distortions of Temporal Memory and Temporal Expansion

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Arousing events hold privilege within our memory; however, the precise nature of this privilege is not clear. A key component of event memory is the ability to successfully recall the order in which details occurred, leading researchers to investigate how arousal impacts temporal order memory during arousing and non-arousing events. While this work has shown that events which are inherently arousing

are recalled with more accurate temporal memory, it is unclear if this pattern holds when arousal is not inherent within an event. To address this question, we conducted a within-subjects behavioural experiment in which participants encoded four videos depicting neutral events that were paired with either highly arousing or non-arousing musical excerpts. After a short delay, participants were shown pairs of still images from the movies and were asked to make a temporal order judgment (which image came first?), as well as duration estimation (how much time between?). Participants were less accurate on the temporal order judgement task for images from events encoded with arousing music. Music also impacts the duration estimation task, such as arousing music led to temporal expansion distortions compared to low arousing music. This expansion of time was also found when estimates of the entire event were compared across arousal conditions. We interpret these results as indicating that when arousal is not inherent to an event, it can have a harmful effect on memory, contrasting existing literature that promotes an arousal benefit to memory when arousal is engrained in the encoding of an event.

Topic Area: LONG-TERM MEMORY: Episodic

E63 - Hippocampal–Auditory Activation During Music Listening in Anesthetized States

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Can the human brain still differentiate meaningful auditory stimuli during anesthesia—a state traditionally regarded as incapable of supporting high-level cognition? We explored this question by examining hippocampal and auditory cortical responses to music in patients undergoing intracranial monitoring for epilepsy surgery under propofol-induced anesthesia. Prior to surgery, each patient selected several familiar and favorite songs, along with unfamiliar but stylistically matched control pieces. During electrode implantation, local field potentials were recorded from hippocampal and superior temporal regions as patients passively heard these musical excerpts. Preliminary analyses (5 of 15 patients) revealed preserved auditory responses in the superior temporal gyrus and potential indications of enhanced ultra-slow (0.3–0.7 Hz) oscillatory activity in the hippocampus when patients heard familiar or self-selected music. These preliminary patterns—reminiscent of oscillations linked to musical and linguistic phrase processing—may suggest that memory-related networks remain partly active even in anesthetized states. However, further analyses are underway to validate these effects and to determine their reliability across participants and regions. If

confirmed, such findings could support a model in which residual auditory–hippocampal coupling encodes temporal structure and familiarity in the absence of awareness, offering new insights into brain states during anesthesia and potential mechanisms underlying music-evoked “awakening” phenomena in coma or minimally conscious patients.

Topic Area: LONG-TERM MEMORY: Episodic

E64 - The impact of classic psychedelic use on sleep architecture and false memory formation

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Classic psychedelics such as psilocybin and LSD primarily function as 5-HT_{2A} receptor agonists, enhancing synaptic plasticity and altering conscious experience. Increasing evidence suggests their potential therapeutic value in treating mental health disorders, including depression. However, little is known about their long-term effects on cognition and sleep. This study examined whether regular psychedelic users differ from non-users in false memory formation and sleep architecture. Eleven psychedelic users and eleven non-users completed questionnaires assessing mood and sleep quality, followed by a Deese–Roediger–McDermott (DRM) false memory task. Participants encoded lists of semantically related words (e.g., bed, nap, rest), then took a 2-hour nap under polysomnographic monitoring. Upon awakening, they performed a recognition task including critical lure words (e.g., “sleep”) that were semantically related but not previously presented. No differences were found in total sleep time, Stage 2+3 duration, sleep spindle density, or spindle amplitude. However, psychedelic users exhibited lower spindle frequency (11.62 ± 0.48 Hz) compared to controls (12.39 ± 0.69 Hz), $t(20) = 3.01$, $p = 0.007$. Regarding memory, users showed lower d' scores ($t(20) = -2.10$, $p = 0.049$), suggesting greater susceptibility to false memory formation. Exploratory analyses within the user group revealed correlations between d' scores and BDI-II and AIS questionnaire results. Overall, these findings indicate that psychedelic users may differ from non-users in specific aspects of sleep physiology and memory performance. These results highlight the need for further investigation into how chronic psychedelic use may alter sleep-related oscillatory activity and influence memory processes.

Topic Area: LONG-TERM MEMORY: Episodic

E65 - Reactivating memory, replicating science: Insights from the ongoing ManyBeds study of sleep-dependent learning

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Targeted memory reactivation (TMR) proposes that re-exposing sensory cues associated with prior learning during sleep can

strengthen memory consolidation. In a seminal study, Rudoy et al. (2009) found that auditory cues presented during slow-wave sleep selectively reduced forgetting for cued image-location pairs, suggesting that sleep-dependent reactivation can help stabilize specific memories. However, the true magnitude and robustness of this effect remain uncertain, as meta-analytic estimates indicate that previously reported effects may be considerably smaller than initially assumed. To address this open question, the ManyBeds project unites more than 13 laboratories across Asia, Europe, and North America in a coordinated, preregistered replication effort. Using standardized behavioral, electrophysiological, and questionnaire protocols, the consortium will collect data from over 600 participants to derive the most precise and transparent estimate of the TMR effect to date. Data collection is currently underway, with participating sites contributing datasets across all continents. A split-half design divides the data into exploratory and confirmatory halves, enabling a many-analysts approach in which independent teams preregister, exchange, and validate their analyses on withheld data. By combining large-scale collaboration with rigorous Open Science practices, ManyBeds will not only assess the reliability of TMR during sleep but also illuminate how analytical and theoretical flexibility influence replicability in cognitive neuroscience. The project aims to establish a benchmark for reproducible, collaborative experimental science in human sleep research and to demonstrate how open, theory-driven, and cooperative science can advance confidence in neuroscientific findings.

Topic Area: LONG-TERM MEMORY: Episodic

E66 - From error to exploration: Curiosity and Prediction error interact to promote lasting learning

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The ability to update prior knowledge is crucial for maintaining an accurate representation of our world. While such an updating process is thought to rely on mechanisms triggered by prediction errors (PE), recent work suggests that motivational states overlaid on the experience may also be a critical determinant of robust memory updates. Using a trivia quiz paradigm where adult participants were presented with commonly held misbeliefs and obscure facts, we investigated the effects of prediction errors and curiosity on memory updating. Consistent with prior findings, we observed greater likelihood of memory updating i) following a large PE ($p < .001$), and ii) during states of high curiosity ($p < .001$). Crucially, each of these factors play complementary effects such that high PEs were particularly beneficial during states of low curiosity, and conversely, the effect of curiosity was greatest during low PEs ($p = .02$). In addition to memory updating, high PE and curiosity was also associated with an increased desire for additional information ($p < .001$). This increase in information-seeking behavior also led to more persistent memory updates that remained robust in a delayed memory test even after

controlling for the contributions of PE and curiosity ($p = .01$). These findings suggest that fostering a state of curiosity before exposure to errors can facilitate knowledge updating and encourage deeper engagement with the content. Taken together, our results highlight curiosity and prediction errors as complementary mechanisms that work in concert to support robust knowledge updating.

Topic Area: LONG-TERM MEMORY: Episodic

E67 - Emotion as a factor of episodic content to predict vividness of memories

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Typically, emotion is not analyzed as a component of a remembered event but rather investigated as a global influence on memory. This study will investigate how emotion, as a component of memory, contributes to the vividness of an episodic memory and whether the level of detail in memory for emotional content leads other elements, such as spatial information, to contribute less to feelings of vividness relative to neutral memories. Participants will be presented with a theme word, acting as a retrieval cue. Paired with the word will be a picture of an object, a location, and a face displaying an emotion. Participants will be tested for the gist and the details of each element of memory and asked questions about vividness. We hypothesize that reported vividness will correlate with the gist of memory for neutral elements, such as the encoded object and location. However, when participants have a detailed memory of the emotion, it may serve as a retrieval cue, increasing feelings of vividness as a result of being prioritized over other elements. This project may shift the way emotion is considered in memory, and the approach of studying emotion as a component of a memory with similar properties to other elements (e.g. objects, people, places) may open new avenues to explore and fully understand episodic memory.

Topic Area: LONG-TERM MEMORY: Episodic

E68 - Retrieving conceptual details of distinct autobiographical memories enhances representational overlap within the anterior hippocampus

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The hippocampus responds to changes in how memories, including autobiographical memories, are retrieved. Current models propose a functional distinction along the hippocampal long axis, such that the anterior hippocampus supports coarse and holistic representations and the posterior hippocampus supports fine-grained discriminative representations. Complementary research suggests that the anterior hippocampus also contributes to integrating and connecting information on a conceptual level. Together, these findings lead to the hypothesis that autobiographical memories retrieved conceptually will show greater representational similarity in the anterior hippocampus

compared to memories retrieved with non-conceptual (e.g., perceptual) focus. To test this hypothesis, we applied representational similarity analysis (RSA) to an existing fMRI dataset in which participants retrieved 36 autobiographical memories under three conditions: focusing on conceptual details ($n = 12$), perceptual details ($n = 12$), or freely recalling the memory (baseline, $n = 12$). Compared to baseline, conceptually recalled memories showed greater similarity in the left anterior hippocampus ($p = .039$, $d = 0.43$) and right posterior hippocampus ($p = .019$, $d = 0.49$). This effect was not observed for perceptually recalled memories, suggesting distinct representational dynamics along the hippocampal axis depending on retrieval focus. These findings indicate that retrieval focus shapes representational overlap along the hippocampal axis, and that conceptual processing in particular increases shared representational structure across distinct autobiographical memories. Our results highlight specialization along the hippocampal long axis and indicate that conceptual processing may promote retrieval of similar broad knowledge networks, enabling personal meaning structures to extend across otherwise distinct memories.

Topic Area: LONG-TERM MEMORY: Episodic

E69 - Under what circumstances does wakeful rest promote episodic memory consolidation?

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New episodic memories are stabilized and strengthened during post-learning consolidation. Whereas most research indicates that systems memory consolidation primarily moves forward during sleep, other research suggests that wakeful rest (WR), quiet wakefulness with minimal sensory encoding, may also facilitate memory consolidation. However, the circumstances under which WR may optimally promote memory consolidation are not well understood. In this experiment, participants ($N = 95$) completed two consecutive blocks. During both blocks, participants watched a 5-min video and completed an immediate memory test before taking a 15-minute break monitored with electroencephalography (EEG). During the break, participants engaged in either WR by sitting quietly or active wakefulness (AW) by playing a computer game; counterbalanced across blocks. Participants then completed a mind-wandering questionnaire to determine how attention was allocated during the break followed by a delayed memory test for the video. Half of the participants took multiple-choice memory tests, and the other half took free recall tests. Preliminary results indicate that memory declined across both the WR and AW breaks when participants completed multiple-choice but not free recall tests. Furthermore, attention was more internally focused during the WR than during the AW break, and as time spent internally focused increased, memory retention across the break increased. Additional analyses will examine how aspects of EEG, including slow-oscillatory (.5 – 1.5 Hz) and alpha (8 – 12 Hz) activity, may relate to memory change across the break. These results will help illuminate

the conditions and mechanisms through which WR meaningfully contributes to episodic memory consolidation.

Topic Area: LONG-TERM MEMORY: Episodic

E70 - Age-related Differences in Familiarity and Recollection-Based Memory: Cognitive Patterns and Neural Mechanisms Across the Lifespan

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Recognition can be supported by recollection, familiarity, or both. Recollection, which involves recalling the study context declines as we age, while familiarity is relatively spared across the lifespan. The neural mechanisms underlying this age-related dissociation remain unclear. Evidence highlights hemispheric specialisation for memory content within the inferior parietal lobes, suggesting that age-related memory may be supported by a reorganization of brain lateralization emerging in midlife. A cohort of 78 cognitively healthy participants (aged 25-70, median = 55) completed three experimental tests: Familiarity-Only Rating Task (FORT), isolating familiarity with no emphasis on recollection; and two forced-choice recognition tests, one corresponding and one non-corresponding, using highly similar foils, predominantly engaging familiarity and recollection, respectively for face, scene, object, and word information. Participants completed standardized neuropsychological assessments of general memory function and underwent high-resolution T1-weighted and diffusion MRI. Voxel-based analysis of diffusion weighted maps revealed brain regions associated with recognition memory across the adult lifespan, including the right mediodorsal thalamus for familiarity, and the left fusiform gyrus and right caudate nucleus for recollection. Importantly, the integrity of right-lateralised fusiform, as indexed by radial diffusivity, specifically supported familiarity performance for scenes, objects and words in middle-aged adults. Furthermore, the efficient processing of semantically rich materials (e.g., objects and words) moderated the relationship between derived cortical volume patterns and general memory ability, suggesting that semantic processing efficiency may act as a cognitive reserve against age-related memory decline. These findings highlight distinct age-dependent neural mechanisms and suggest compensatory reorganization helps sustain recognition performance in later adulthood.

Topic Area: LONG-TERM MEMORY: Episodic

E71 - Adjusting The Lens Of Encoding: How An Implicit Encoding Context Shapes the Details Recalled In Event Memory

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The context of encoding is known to impact memory. For event memories, like those we experience in daily life, encoding manipulations are known to change the types of details that are

recalled upon retrieval. While prior work has examined the impact of explicit encoding manipulations on event memory retrieval, less work has examined the way an implicit encoding context can inform later memory. In the current study, we address this knowledge gap by assessing the impact of providing different types of background knowledge (conceptual or perceptual information) prior to an event on subsequent detail recall. In a between-subjects design, 64 participants first listened to audio descriptions of the general premise of a TV series (WKRP in Cincinnati) that were described with either conceptual or perceptual details. Next, participants watched a 5 minute video excerpt from one episode of the series. Then after a short 5 minute delay, and a longer 24 hours delay, participants recalled the video in detail. These recollections were scored for the presence of central details, those related to the unfolding story, as well as peripheral details that described more specific information. Peripheral details were subcategorized as event, conceptual and perceptual. Results revealed limited group differences for central details, but stronger differences in the relative proportion and type of peripheral details across conditions and retrieval timepoints. The results suggest that implicitly altering how prior knowledge is represented at encoding will change the way a related event is perceived and recalled from memory.

Topic Area: LONG-TERM MEMORY: Episodic

E72 - A matter of detail – material-specific structural changes after studying different kinds of learning material

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Every time we learn a new skill or store an experience in memory, our brain undergoes functional and structural changes. Advances in neuroimaging, such as diffusion-weighted MRI (DW-MRI), allow to non-invasively track microstructural changes by analyzing the motion of water molecules within human brain tissue. Using these methods, recent studies have demonstrated that repeated encoding and retrieval of an object–location association task leads to the rapid formation of a physical memory trace in the parietal cortex. Notably, this trace fulfills all criteria for a memory engram within just 90 minutes post-learning, highlighting the dynamic and rapid nature of memory formation. Whether microstructural memory traces differ depending on learned information remains an unanswered question. In this study, 79 participants completed an object-location learning task with repeated encoding and retrieval of image pairs depicting either objects (n=40) or scenes (n=39). DW-MRI was measured immediately after the learning task until up to 60 minutes later. We found a region in the posterior parietal cortex that was active during memory encoding and retrieval, and showed a decrease in mean diffusivity (MD), a DW-MRI marker indicating microstructural plasticity already one hour after learning. A whole-brain searchlight decoding analysis revealed that microstructural changes in this area were informative about the specific content of the previous learning material (objects vs. scenes). Our results suggest that a material-specific memory engram is rapidly

formed in the posterior parietal cortex, which persists in a dormant state after the learning experience has ended.

Topic Area: LONG-TERM MEMORY: Episodic

E73 - Can memory for a narrative be unfolded after compression?

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Memories are not exact records of experience. Rather, they are constructions that are shaped by conditions during encoding and retrieval, as well as one's goals. While some memories are highly detailed, others are coarse, summary-level representations. In this study, we tested whether “compressing” memory of a story into a summary impaired later detailed recall. After encoding 3 stories, participants either recounted the story in great detail, summarized the story (Compression), or received no specific instructions (Control). On Day 2, all participants recounted the three stories in as much detail as possible. After recall, participants also completed a sentence recognition test to assess memory specificity. Our key question is whether Day 2 recall performance differs as a function of Day 1 encoding condition (Detail, Compression, or Control). We hypothesized that summarizing what you've read compresses memory in a way that makes the unmentioned details more likely to be forgotten during later recall. Preliminary analyses indicate that detailed recall on Day 1 facilitates detailed recall on Day 2, while summarizing on Day 1 did not facilitate detailed recall on Day 2. Instead, the Compression group produced recalls comparable to the Control group on Day 1. Furthermore, recall facilitation in the Detail group did not generalize to sentence recognition, as performance was similar across groups. Ongoing analyses will use natural language processing to parse the semantic content of recall across groups, with preliminary results suggesting that the language participants used in their recall differed systematically between the Detail and Compression groups.

Topic Area: LONG-TERM MEMORY: Episodic

E74 - Mnemonic traits differentially predict event recall across short and long delay

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People vary widely in how they remember the past. Some tend to recall events through vivid sensory detail, whereas others recall in more conceptual and semantic ways. These individual differences are thought to reflect stable mnemonic traits. The Survey of Autobiographical Memory (SAM) is commonly used to assess such trait-level memory abilities. However, findings linking SAM to objective measures of episodic memory have been mixed, partly because prior studies typically used autobiographical memories that are difficult to

verify or laboratory stimuli lacking episodic richness. These methods limit our understanding of how SAM relate to the memory content and its changes across time. We addresses these gaps by investigating whether self-reported episodic memory abilities predicts both the quality and quantity of a person's episodic memories for naturalistic video stimuli and changes in retention over short (30-min) versus long delays (2-week). Participants (n = 60/96 collected) completed the SAM and additional metacognitive questionnaires, then recalled narrative videos in two structured interviews after short and long delays. We analyzed interview transcripts using a mixed automated-manual scoring pipeline that leveraged a LLM to categorize memory details (central vs. peripheral), whereas human raters evaluated detail accuracy. In preliminary analyses, higher SAM–Episodic scores predicted superior short-delay recall but steeper forgetting across time, whereas lower scores predicted less detailed but more stable memories. Additionally, although visual imagery ability (VVIQ) was strongly correlated with SAM–Episodic scores, visual imagery alone did not predict memory. These findings clarify how mnemonic traits influence episodic memories retention and recall over time.

Topic Area: LONG-TERM MEMORY: Episodic

E75 - Electrophysiological evidence for forward and backward time-based search through episodic memory

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A critical feature of encoding events into episodic memory is the formation of associations among stimuli as well as with the broader spatial and temporal contexts in which they occur. These associations in turn can then be used to guide strategies at the time of retrieval. Although numerous studies have characterized the neurocognitive processes involved in the associative aspects of episodic memory, a recent research area of interest has focused on how transitions across events and stimuli encoded at different times are handled. Here, our goal was to further understand how search processes during retrieval operate in a forward versus backward manner, with the specific aim to provide novel insights into the neural correlates of such processes. Scalp EEG was acquired from 24 human subjects who completed a series of short encoding-retrieval cycles, with each consisting of a list of about 8 words followed immediately by a directional cued-recall task. In the recall task, subjects were shown an encoded word from a randomly selected list position along with arrows indicating that they should search and report the two words that either came after (forward) or before (backward) the cue in the list. EEG data from 5-second cuing periods was then submitted to multivariate pattern analysis (MVPA) to identify neural activity distinguishing the forward vs. backward conditions. The main results indicated that high-frequency (gamma-band) oscillations play a role in directional recall deliberation and search, suggesting that time-based strategies might serve successful episodic memory retrieval.

Topic Area: LONG-TERM MEMORY: Episodic

E76 - An electrophysiological investigation into the objective and subjective aspects of episodic memory

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In the laboratory, episodic memory (i.e., memory for specific and personal past events) is typically assessed using one of two approaches. Objective assessments require participants to retrieve a specific contextual detail from a studied episode (e.g., source memory for spatial context). In contrast, subjective assessments rely on introspective judgments such as those in the 'Remember/Know' procedure, in which participants discriminate between test items associated with the retrieval of any qualitative information ('Remember') relative to those recognized solely based on an acontextual sense of familiarity ('Know'). While functional magnetic resonance imaging data indicate that there exist unique brain regions that support objective and subjective assessments of episodic memory, it remains unclear whether the retrieval processes underlying them differentiate over time. To address this question, we utilized electroencephalographic event-related potentials (ERPs), a technique with high temporal resolution. ERPs were recorded during a memory test phase where participants made both objective (spatial source memory) and subjective (Remember-Know) judgments for each test item. Analyses focused on the late positive component (LPC), a parietal ERP component canonically linked to successful episodic memory, emerging between 500-800 milliseconds post-stimulus onset. Results indicated that the LPC was exclusively sensitive to the subjective experience of recollection, such that 'Remember' responses elicited significantly greater activity compared to 'Know' responses, regardless of source accuracy. These findings are the first to indicate that the LPC is differentially sensitive to subjective and objective aspects of episodic memory, and are consistent with proposals linking the parietal cortex to the phenomenal experience of recollection.

Topic Area: LONG-TERM MEMORY: Episodic

E78 - Cueing with key moments to facilitate recall of narratives

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Continuous experiences are represented and remembered as discrete events. While a great deal of research has focused on the influence of boundaries between events, recent work from our group suggests that people also reliably identify Key Moments (KMs) within events. These key moments – which are somewhat distinct from event boundaries – elicit synchronized neural responses across individuals, and are preferentially reinstated during memory retrieval. In the present study, we tested whether recall is facilitated when memory cues correspond to these KMs. In this ongoing fMRI experiment, participants watch two short films (Mr. Bean's Holiday and This Time Away), and after a delay, are presented with six image snapshots drawn either from peaks (KMs) or troughs (random moments) of a previously derived KM

distribution obtained from an independent sample. For each snapshot set, participants freely recall the portion of the story it depicted and rated the helpfulness of the images (1–100 scale). In a pilot sample, 23 participants rated KM snapshots as significantly more helpful than random ones ($p < 0.001$) for anchoring recall, indicating that KMs serve as subjectively effective cues for reconstructing event narratives from memory. In the in-progress fMRI sample, we predict that KMs as cues will facilitate rubric-scored memory accuracy, and will enhance reinstatement of neural patterns during encoding of individual events as those events are recalled.

Topic Area: LONG-TERM MEMORY: Episodic

E79 - Mass univariate analysis implicates the late parietal positivity in associative recognition success

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Successful associative recognition may recruit neural processes overlapping with item-memory, including the FN400 and late parietal positivity (LPP) event-related potentials. The FN400 is typically linked to item-specific familiarity, whereas the LPP is thought to reflect associative or recollective processing, suggesting it may serve as a robust marker of associative retrieval. Participants ($N=112$) studied 28 lists of 8 word pairs and performed an associative recognition task, distinguishing intact word pairs from pairs of rearranged words. Planned comparisons using electrodes and time windows pre-determined from published results replicated the significantly more positive FN400 old/new effect for hits versus correct rejections. However, this analysis revealed no significant retrieval success effects (contrasting hits with misses). Mass univariate analysis (MUA, Pernet et al., 2011), which analyzes all electrodes with cluster-based corrections for multiple comparisons, revealed significant clusters of activation in frontal and parietal electrodes for the old/new and retrieval success effects that extended beyond the planned electrodes and times of interest. Notably, both positive and negative old/new effects emerged bilaterally between approximately 600–1500 ms, overlapping with the temporal range of the LPP. For the retrieval success effect, MUA identified a right hemisphere posterior negativity from roughly 500–1500 ms that corresponds to both FN400 and LPP activity. The comprehensive, exploratory approach enabled by MUA revealed a nuanced pattern suggesting that the LPP may serve as a general neural marker of associative retrieval. However, the precise timing and topography of this effect appear to vary with task and stimulus characteristics.

Topic Area: LONG-TERM MEMORY: Episodic

E80 - Preserved Memory performance despite reduced hippocampal volume in treatment-resistant depression

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Individuals with depression show reduced hippocampal volumes compared to non-depressed controls, perhaps driven by volumetric reductions in the dentate gyrus (DG). Bilateral lesions to the DG are associated with impaired performance on mnemonic discrimination tasks, but it is unknown whether hippocampal subfield changes contribute to memory difficulties in depression. We examined individuals with treatment-resistant depression (TRD; $n = 12$, 6 males, mean age = 40.3, education = 14.8 years) and non-depressed controls ($n = 15$, 8 males, mean age = 36.5, education = 16.2 years). Participants underwent a 3T MRI brain scan, including a high-resolution T2-weighted scan of the hippocampus, and completed a battery of neuropsychological tests including two mnemonic discrimination tasks. Hippocampal volume was significantly reduced in individuals with TRD compared to controls ($p=.002$, $\eta^2=0.38$), and smaller hippocampal volume was associated with greater depression severity across the entire sample ($\beta=-42.19$ mm³, $p=.021$, assessed using the Questionnaire for Depressive Symptoms). These reductions were localized to the hippocampal body (DG/CA3/CA2, CA1, and subiculum), whereas extrahippocampal regions did not differ between groups. No group differences were observed in mnemonic discrimination or other memory tasks, though higher depression scores were associated with poorer performance on other neuropsychological measures, including Trails B ($\beta=3.0$, $p=.028$) and Phonemic Fluency ($\beta=-0.78$, $p=.035$). Individuals with TRD showed reduced hippocampal subfield volumes, particularly in the dentate gyrus and adjacent regions. These reductions were linked to greater depression severity but not to memory performance, suggesting hippocampal atrophy in depression might reflect mood-related rather than mnemonic processes.

Topic Area: LONG-TERM MEMORY: Episodic

E81 - Context reinstatement in the hippocampus supports retrieval of episodic memory details

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Though our experiences unfold continuously, they are remembered as individual episodes. It is well established that ongoing experience is discretized into episodes according to the stability of contextual features present at encoding that is disrupted at event boundaries. Evidence additionally suggests that context encoding is enhanced at event boundaries, and that retrieval of context aids in the retrieval of event details. In this study, we sought to further investigate the mechanism by which context supports episodic memory retrieval. Participants ($N=32$) encoded sequences of images that were organized into events defined by an associated auditory and motor context while being scanned by high-resolution fMRI. Participants

were then tested for item and temporal memory. When prompted to recall the temporal order of items within an event, we find that subregions of the hippocampus that are sensitive to event boundaries reinstate patterns of activity most similar to that of the items' respective event boundary during encoding. The extent of pattern reinstatement differentially supports correct memory decisions across hippocampal subfields. These results suggest a mechanism in which contextual information is reinstated to facilitate the retrieval of memory details independent of contextual cues.

Topic Area: LONG-TERM MEMORY: Episodic

E82 - Mesolimbic contribution to objective and subjective memory retrieval success

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Prior work shows that successfully retrieving information is intrinsically rewarding and engages regions within the mesolimbic dopamine system, including the ventral tegmental area (VTA) and nucleus accumbens (NAcc). However, it remains unclear whether these regions differentially track objective retrieval success (accuracy) versus subjective retrieval success (beliefs about memory performance). To address this question, we leverage the high-resolution Natural Scenes Dataset (NSD), in which eight participants completed thousands of continuous recognition trials while undergoing fMRI. Participants judged whether each image had been seen before, allowing us to dissociate objective and subjective retrieval outcomes by comparing hits versus false alarms, respectively. We examined mesolimbic responses to these retrieval signals and found that VTA activity was elevated when participants believed they had successfully recognized an image as familiar (hits and false alarms), whereas NAcc activity increased selectively for accurate recognition (hits only), suggesting partially dissociable roles in evaluating memory outcomes. We further assessed functional connectivity between the hippocampus and mesolimbic regions and observed that NAcc-CA1 connectivity differentiates hits from false alarms; whereas all other connections between the VTA or NAcc and hippocampal subfields (CA1, CA2/3, and dentate gyrus) did not, indicating a system-level distinction in the VTA and NAcc's interactions with hippocampus. We are currently applying drift-diffusion modeling to further link these neural dissociations to latent decision parameters underlying recognition judgments. Together, these results highlight complementary contributions of mesolimbic regions to memory retrieval success and provide a framework for relating neural reward signals to decision processes during memory-guided judgments.

Topic Area: LONG-TERM MEMORY: Episodic

E83 - Does Intentional Integration Influence the Fate of Memories When Reactivated During Sleep?

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Memory consolidation occurs primarily through neural "replay" of experienced events, a process which researchers have manipulated by playing event-related cues during sleep [a technique called targeted memory reactivation (TMR)]. TMR has been instrumental in the study of memory consolidation, as it provides some degree of control over which memories are replayed. However, which information is ultimately retained varies widely based on the method by which it was learned. Past research indicates that similar memories with overlapping material can be strengthened or weakened by TMR, depending on how the information is initially learned. In this ongoing study, we predict that intentionally integrating information during learning will improve memory for overlapping material and alter their fate when reactivated during sleep. Participants learned partially overlapping A-B, A-C word pairs either with or without instructions to integrate the pairs, after which they were reactivated during sleep via TMR. After sleep, they were tested on both learned (e.g., A-B and A-C) and inference associations (B-C). We have collected 28 out of 40 anticipated participants. Initial trends show neither an overall effect of cuing on learned ($p = 0.5$) or inference associations ($p = 0.14$) nor a cuing effect difference between conditions (both $p > 0.6$). In sum, this study explores the interplay of intention and memory complexity on consolidation, having implications for memory research and applications of TMR in educational and clinical settings.

Topic Area: LONG-TERM MEMORY: Episodic

E84 - Distinct Neural Dynamics in Emotional Memory Encoding between Insomnia and Healthy Sleepers

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Insomnia is associated with dysfunctional emotional memory processing, such as impaired dissipation of negative memories over time. However, the neural dynamics of emotional memory encoding that underlying the dysfunction in insomnia are not well understood. Elucidating these mechanisms could reveal novel interventions targeting maladaptive emotional memories to alleviate insomnia and negative affective outcomes. We collected electroencephalogram (EEG) data from 36 healthy controls (HC; 23 females, age, mean $\pm$ S.D., 24.42 ± 4.49) and 35 insomnia sleepers (IS; 23 females, age 24.55 ± 4.56), while they performed an emotional memory encoding task. During the task, participants learned 48 pseudoword-picture pairs (24 negative and 24 neutral pictures) across 4–6 learning-testing blocks. We first conducted a time-frequency analysis to characterize EEG oscillatory activity during encoding. We found that viewing negative emotional pictures elicited significantly higher power than

neutral pictures across 1-18 Hz over fronto-central and parieto-occipital regions at 0–1000 ms window (pclusters < .05, corrected for multiple comparisons across time, frequency, and space) in HC while such a significant difference was absent in IS (pclusters > .05). To investigate this absence, we calculated the between-subject SD within the significant time-frequency-space cluster identified by the previous test, and found that IS demonstrated significantly higher between-subject variability in the 1–8 Hz band (300–800 ms post-picture cue; Fligner-Killeen test, $p = .022$), indicating greater heterogeneity in emotional memory encoding. Our findings indicate that emotional memory encoding in insomnia is marked by neurophysiological heterogeneity and insomnia may consist of distinct subtypes regarding the emotional memory encoding.

Topic Area: LONG-TERM MEMORY: Other

E85 - The influence of event boundaries on attentional dynamics and event encoding

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Everyday experience involves continuous information flow, yet limited attentional capacity restricts the ability to process every sensory change. Research on event processing suggests that people naturally segment experience into discrete events at key moments, or event boundaries. In a preliminary study, we examined whether this segmentation process guides fluctuations in attention by prioritizing event boundaries. Participants performed a Continuous Performance Task (CPT) framed as browsing house catalogues. They viewed sequences of household objects within rooms across different houses, with each room type distinguished by wall color (e.g., green bedrooms, orange kitchens). Wall color changes at room transitions thereby marked event boundaries. Participants made speeded responses to indicate whether a household object was typical (93% of trials) or atypical (7%). Although wall color changes carried no information about object typicality, room transitions elicited significant response slowing that quickly recovered and remained stable over subsequent images. These results may reflect a boost in attention, particularly at event onsets. Ongoing work examines whether this attentional increase supports encoding of new events. After the CPT, participants will complete an object recognition task including new items that are perceptually similar to those seen earlier. If heightened attention at event beginnings facilitates event encoding, memory at these timepoints should be more detailed, with better discrimination between old and similar objects. Together, these findings may elucidate how attention dynamics across event boundaries shape event memory.

Topic Area: LONG-TERM MEMORY: Other

E86 - Charting Spatial Memory Over Time in Developmental Amnesia

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Spatial memory enables our navigation and orientation in the world. Cognitive Map Theory posits that the hippocampus is critical for allocentric spatial memory; however, evidence from the literature on hippocampal amnesia presents a mixed picture. While adult-onset hippocampal damage is associated with impaired formation of new allocentric representations, individuals with hippocampal damage have been shown to retain coarse, gist-like representations of highly familiar environments and even newly experienced environments. Preliminary evidence links spatial memory deficits in developmental amnesia to atypical development of the hippocampus and extended hippocampal system. This raises the question of whether extended learning can support the development of gist-like spatial representations. We investigated this question through a longitudinal examination of spatial memory in an individual with developmental amnesia, H.C. Building on prior work (Rosenbaum et al., 2015), H.C. was retested on a battery of mental navigation tasks based on familiar environments. Performance was compared to that of control participants with similar environmental exposure. Results indicate that extended learning supports the development of gist-like spatial representations in developmental amnesia. H.C. demonstrated preserved relational knowledge sufficient for coarse navigation and landmark anchoring, but continued to show reduced flexibility, limited detail, and swap errors. These findings suggest that while neocortical systems may support schematic spatial representations, the hippocampus remains critical for binding fine-grained relational detail within a coherent and flexible map. These results encourage refinement of traditional models of hippocampal involvement in spatial memory and highlight the role of experience in shaping spatial knowledge.

Topic Area: LONG-TERM MEMORY: Other

E87 - ERP Evidence that Disfluency is Resolved by Longer Prime Exposure during Recognition Memory

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Masked primes alter fluency and recognition memory judgments. Relative to non-letter control primes, Leynes, Kalelkar, et al. (2023) found that priming the target with the same word (match prime) increased fluency, familiarity, and N400 amplitudes. Alternatively, priming with an orthographically similar (OS) word (e.g., "SIGHT" primes "RIGHT") decreases fluency, familiarity, and N400 amplitudes. The present study manipulated the prime duration (50 ms vs. 200 ms) to measure how awareness of the probe alters fluency and ERPs. Thirty-six participants encoded words using a shallow task and then completed two recognition tests with match and OS primes. On both tests, match primes elicited the same pattern (more positive N400).

When the prime was presented quickly on the first test (unaware) the OS prime N400 was more negative than the unprimed control condition, replicating the previous result. The longer prime exposure on the second test (aware) produced a more positive N400 for the OS primes. These results suggest that subthreshold presentation of OS primes create a perceptual discrepancy because they don't match the target. The processing discrepancy lowers fluency and fewer old responses result. When the prime exposure is longer, the reason for the processing discrepancy becomes obvious, fluency is unaffected, and the overlapping letters increase N400 amplitudes. Exposure duration didn't alter match prime effects suggesting fluency could not be discounted in this case.

Topic Area: LONG-TERM MEMORY: Priming

E88 - Repetition priming is driven by the modulation of high-level, but not low-level, visual representations

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People are faster at classifying a previously seen stimulus than when they first encounter it (repetition priming). Classifying an object involves the processing of both low-level (e.g., color, shape) and high-level (e.g., category) visual features, but it is currently unclear to what degree each of these features contribute to the behavioral facilitation observed in repetition priming. We addressed this question in two experiments. In Experiment 1, subjects classified objects according to their origin (living/non-living) or size (large/small), with each object being presented twice. Employing a recurrent neural network, we modeled low- and high-level visual feature representations of each stimulus to predict behavior. Only high-level features influenced behavior, specifically, by modulating reaction time during the initial stimulus classification. This suggests that behavioral facilitation results from bypassing high-level feature processing on second presentation. In Experiment 2 we tested this hypothesis directly with neuroimaging data by combining the same protocol with fMRI and representational similarity analysis (RSA). We found that high-level visual features were represented in frontoparietal cortex (the Angular Gyrus and Inferior Frontal Gyrus), and that stronger neural representation of high-level features was associated with longer reaction times. Crucially — consistent with the behavioral findings of Experiment 1 — high-level features were more strongly represented during the first stimulus presentation. Taken together, our results indicate that stimulus repetition strongly modulates the processing of high-level but not low-level visual features, and that behavioral repetition priming effects result from people not having to re-represent the high-level features of re-encountered visual stimuli.

Topic Area: LONG-TERM MEMORY: Priming

E89 - Explore-Exploit Tradeoffs During Memory Search: The Predictive Role of Theta Oscillations

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Retrieval of concepts from semantic memory involves interactions between several brain regions and a complex interplay of lexical sources. Recent work with the verbal fluency task (VFT; where participants generate as many examples as they can from a given category within a fixed duration) has shown that individuals delicately balance exploiting current clusters (i.e., groups of related items) within semantic memory with exploring new clusters, similar to how animals search for resources in external environments. In this work, we investigated the temporal dynamics of explore-exploit decisions during semantic memory search by examining the role of predictive processing as indexed by theta oscillations using electroencephalography (EEG). Participants completed the VFT and two tasks commonly used to measure predictive processing: the balloon analogue risk task (BART) and the Cloze sentence fragment completion task. We used a computational model to predict explore-exploit decisions while measuring theta oscillatory power via EEG immediately before VFT transitions. We also examined the extent to which the differences in theta power for explore vs. exploit decisions correlate with amplitudes of event-related potentials (ERPs) related to uncertainty-based exploration in the BART task (measured via P300) and prediction of semantic information in the Cloze task (measured via N400). Overall, our results indicate that increases in theta power captured signatures of exploration and exploitation during memory search, and also showed robust correlations with ERPs of predictive processing. These findings suggest that the neural dynamics guiding external navigation also govern internal navigation in memory, consistent with a foraging-based framework of memory search.

Topic Area: LONG-TERM MEMORY: Semantic

E90 - Using network science to provide insights into people's understanding of activity centrality

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An important issue in event cognition concerns how activities such as “order a drink” come to mind when people think about events like eating at a restaurant. Human empirical research has demonstrated that an activity's centrality (importance) influences how people think about activities and events. However, no implemented computational measures have been used to predict or provide insights into people's understanding of activity centrality. We used network science to construct 80 temporally structured event networks from human participant ordering and production data, and derived quantitative predictions from those networks. We used five network centrality measures computed from the ordering and production networks: CheiRank, PageRank, 2D Rank, Betweenness, and Closeness. Participants ranked activity centrality on one of five measures: centrality, standardness, surprise, prominence, and goodness of fit.

Linear mixed-effect regression analyses showed that CheiRank, which assigns importance to activities that have influential outgoing links leading to other (later) influential activities, was the strongest predictor of participants' rankings for all five centrality measures. Closeness, which assigns importance to activities that have short paths to them from an event's earlier activities, was the second strongest predictor for all five measures. The remaining network centrality measures did not predict participants' rankings. Together, CheiRank and Closeness accounted for a large proportion of variance in participants' rankings with R² ranging from .23 to .34 across the five measures. These results show that people's perception of centrality can be predicted by a model that captures the rich and variable nature of the temporal structure of events.

Topic Area: LONG-TERM MEMORY: Semantic

E91 - When Stability Meets Change: Neural Dissociation of Statistical Learning and Adaptive Flexibility in the Motor Domain

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Statistical learning (SL) enables efficient pattern extraction, yet real-world environments demand flexibility when regularities shift. Applying functional magnetic resonance imaging (fMRI) with an interleaved-dual-structure serial reaction time task (IDS-SRTT), we investigated the neural substrates underlying this fundamental tension between learning stability and adaptive flexibility. Twenty participants learned an initial motor sequence before gradually transitioning to a novel sequence across sessions, with proportions systematically shifting from 100:0 to 0:100. Behaviorally, individuals demonstrating superior initial learning showed reduced flexibility when adapting to the new structure, confirming a trade-off between exploitation and exploration. Neuroimaging results revealed distinct neural signatures for learning versus switching. When comparing structured to random trials during initial SL, we observed repetition suppression effects, with reduced activation in cortical motor areas, cerebellum, and the frontoparietal network (FPN) and the salience network (SN), which reflected successful pattern consolidation. Conversely, during rule-switching phases, both FPN and SN exhibited increased activation, with critical differences in their temporal dynamics to highlight functional dissociation between these networks in detecting and adapting to environmental changes. The SN showed peak activation during early switching when the new rule first emerged, consistent with conflict detection and prediction error signaling. In contrast, FPN activation remained elevated throughout all switching phases, suggesting sustained goal-directed control, inhibition of outdated patterns, and working memory updating. Our findings provide the first integrated neural account of the learning-flexibility trade-off in motor sequence learning, demonstrating that a common cognitive control system centered on FPN and SN dynamically reconfigures to balance stability and change.

Topic Area: LONG-TERM MEMORY: Skill Learning

E92 - Classifying stimulus-level memory outcome using temporal versus spectrographic features

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An exciting recent trend in memory research is to use machine-learning-style classifiers to identify brain activity that is in some sense predictive of memory outcome at the stimulus level, rather than just descriptive. For example, brain activity during processing of a recognition probe item can be used to classify whether a target-probe trial is about to be a hit or a miss. This approach has been taken with fMRI and spectrographic (power as a function of time, frequency and electrode) features but rarely (Chakravarty et al., 2020), with the time-domain signal (voltage as a function of time and electrode). Danyluik et al. (in press), in a feedback-driven learning task, found spectrographic features far outperformed time-domain features, despite the fact that spectrographic features should have access to the same underlying information present in the time domain. Asking if the spectrographic advantage is always the case, we conducted the same kind of comparison in the test phase of an old/new verbal item-recognition dataset. Spectrographic features nominally outperformed time-domain features when classifying hits versus misses, but the advantage was not significant, despite a large sample (N=63). Hypotheses about the cause of the superiority like nonlinearity and temporal smoothing were not supported. In sum, memory classification should continue to use spectrographic features, but time-domain features hold comparable promise and have some unique advantages such as greater temporal specificity.

Topic Area: METHODS: Electrophysiology

E93 - Neural Signatures of Motion: A Deep Learning Framework for Classifying EEG Responses to Dynamic Facial Expressions

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Decoding cognitive states from electroencephalographic (EEG) data remains a foundational challenge in neuroscience. This study used a machine learning (ML) framework to classify neural responses to dynamic versus static facial expressions. We analyzed single-trial, artifact-free EEG data from 23 participants while they viewed static and dynamic displays of fear and anger. The data were pre-processed in Scan 4.5 (Compumedics, Neuroscan). Features were extracted by calculating the Differential Entropy (DE), a measure of signal complexity, across four frequency bands (Delta, Theta, Alpha, Beta) using a sliding time window. This process transformed each trial's raw EEG data into a 3D tensor (bands, channels, time-steps), capturing the dynamic evolution of neural activity across space, time, and frequency for input into the model. These DE features were standardized and structured into channel-by-frequency 'images'. A residual neural network (RESNET18), a deep convolutional neural network (CNN), was then adapted to classify the data. This method achieved a mean accuracy of 97% by learning a consistent neural

signature for discriminating between dynamic and static stimuli. The model learned that successful classification was driven by a pattern of decreased entropy in the alpha and beta bands, prominent at posterior visual processing regions. The same network was unsuccessful at accurately classifying neural activity to different facial expressions. Overall, preliminary results suggest that a decrease in entropy/randomness in EEG at lateral occipital regions may occur in response to dynamic facial displays. EEG features that distinguish between facial expressions may be manifested in other aspects of the signal.

Topic Area: METHODS: Electrophysiology

E94 - Effects of Transcutaneous Auricular Vagus Nerve Stimulation on Conflict-Related Neural Processes: A Blinded, Crossover Study

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Implanted vagus nerve stimulation (VNS) is an FDA-approved therapy for treatment-resistant depression; however, transcutaneous auricular VNS (taVNS) is a non-implanted alternative increasingly used in complementary medicine and described as inducing subjective “relaxation.” Despite its growing use, the neural mechanisms underlying taVNS and its cognitive effects remain unclear. We hypothesized that taVNS reduces external attentional engagement, which would lead to slower reaction times (RTs) and attenuated event-related potentials (ERPs) in a conflict-based attentional task. We used a single-blind, randomized, within-subject crossover study design to disambiguate the effects of taVNS from sensory stimulation (sham). Twenty-eight young adults (mean age=20.5y, SD=2.1; 13 males) completed a five-block color-Stroop task consisting of acclimation, stimulation (taVNS, no stimulation, or sham), washout, crossover stimulation, and final washout blocks. Preliminary analyses suggest taVNS modulated ERP components associated with cognitive control. Specifically, the frontocentral negative-polarity incongruency wave (Ninc, latency ~350-450ms), which has been linked to stimulus-conflict detection, was diminished during taVNS relative to sham. In contrast, the posterior Late Positive Complex (LPC, latency ~500-800), which has been associated with stimulus-conflict resolution, was enhanced during taVNS. Despite these differential effects, RT did not differ significantly between taVNS and sham conditions. These results suggest that neuromodulation via taVNS does not globally attenuate task performance but rather selectively modulates the instantiation of neural resources allocated across different processing stages in a cognitive-control conflict task. More broadly, brain state modulation by taVNS may influence task-related cognition by modifying the cascade of the task-elicited neural processes but without necessarily altering the final task performance.

Topic Area: METHODS: Electrophysiology

E95 - Impact of Age-Appropriate Functional Atlas on Associations Between Network Connectivity and Cognition in Older Adults

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Atlas 55+ has emerged as the first functional brain atlas derived from older adults, though it is unclear if such age-specific functional atlases are more sensitive to individual differences in cognitive performance in older adults. This study aims to compare the widely used Yeo-Krienen Atlas to Atlas 55+ in relation to cognition in n=123 older adults ages 65 to 85. Independent component analysis was used to define 5 networks shared by both atlases at the group-level, and dual regression was applied to define subject-specific networks for each of these. Spatial overlap with an atlas was quantified using Dice Coefficients (DSCs). Mixed-effects models tested associations between atlas-based measures of connectivity strength and atlas overlap with cognition, including covariates. At group level, DSCs show greater spatial overlap with the Yeo atlas; however, at subject level, most individuals overlapped more with Atlas 55+. Spatial overlap with a specific atlas showed no significant relationship with cognition. However, the magnitude of functional connectivity in atlas specific voxels of individual-level maps showed that Yeo-specific voxels in the Lateral-Frontoparietal Network and Pericentral Network (PN) were significantly and positively associated with executive function. This was also seen with memory in the PN. Results suggest Yeo-specific regions showing more cognitive relevance in aging populations, despite Atlas 55+ being created specifically for older adults. Therefore, although atlases derived from older adults may reflect individual differences in how networks reconfigure with aging, it is important to consider whether and how these individual differences reflect maintained cognitive function with aging.

Topic Area: METHODS: Neuroimaging

E96 - MEGgles: An integrated virtual reality platform for naturalistic neuroimaging with magnetoencephalography

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Understanding the neural mechanisms that support natural behaviour requires imaging methods that can operate reliably during movement and realistic sensory experiences. Wearable magnetoencephalography (MEG) using optically pumped magnetometers (OPMs) provides millisecond temporal and millimetre spatial resolution in freely moving participants. However, integrating OPMs with virtual reality (VR)—a tool for delivering immersive and fully controlled environments—has been constrained by electromagnetic

artefacts generated by conventional head-mounted displays (HMDs). Here, we introduce and validate a new OPM-compatible VR platform that enables naturalistic neuroimaging without compromising signal quality. We designed a HMD built from low-noise LCD panels and open-source electronics, achieving magnetic interference levels below those of commercial systems. The device integrates seamlessly with optical motion capture and standard VR development environments (e.g., Unity, Unreal), supporting interactive behavioural paradigms. We validated the system through a combination of hardware-level tests and seven experimental tasks across perceptual and cognitive domains. Our findings demonstrate that the headset introduces negligible magnetic artefacts and preserves source localisation precision. In experimental tests, the system robustly reproduced canonical neural signatures: alpha-band increases with eye closure, lateralised visual responses to flickering checkerboards, beta-band suppression and motor-cortex activation during grasping, and theta oscillations of medial frontal gyrus and hippocampus during N-back and imagination tasks. In sum, our platform enables reliable, whole-brain OPM-MEG recording in immersive VR environments. Its open-source design provides a flexible, scalable foundation for investigating embodied cognition and naturalistic behaviour in human neuroscience.

Topic Area: METHODS: Neuroimaging

E97 - Explainable Multimodal Models for Cognitive Aging: SHAP Analyses Reveal Clinically Relevant Nonlinear Structural and Graph-Theoretical Network Features

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Understanding cognitive aging (a continuum from preserved cognition to neurodegeneration) demands biomarkers that link regional structure, network organization and clinical staging. We introduce an explainable multimodal deep-learning framework to resolve black-box uncertainty and map continuous and categorical aging phenotypes. Methods: T1-weighted volumetrics and resting-state fMRI graph-theory metrics were combined from three public cohorts: OASIS3, NIMH-ds002415, and ANT-ds001907 (N = 959). Extracted features included cortical and subcortical volumes, and graph metrics (characteristic path length, global/local efficiency, modularity) computed within network atlas. Models were stacked neural networks producing a brain-age regressor and a dementia classifier; training used nested cross-validation and class-balanced sampling to reduce overfitting and imbalance. SHAP was applied to quantify main effects, nonlinear feature interactions and subgroup-specific contributions. Results: The dementia classifier achieved strong performance (weighted F1 $\approx$ 0.93 with precision and recall) and the brain-age model yielded low error in controls (MAE $\approx$ 0.7 years). Brain-Age Gap (BAG) correlated moderately with clinical severity (CDR; $r \approx$ 0.32), supporting

BAG as a continuous staging marker. SHAP indicated structural dominance: ventricular enlargement and focal temporal/insular volumes were primary drivers of classification, while connectivity metrics acted as modulatory signals that refined staging. SHAP distributions and subgroup analyses revealed heterogeneous, bell-shaped and context-dependent contributions, implying many imaging-clinical relationships are nonlinear and interaction-driven instead of strictly additive. Conclusion: Results argue for a shift: beyond linear biomarker mapping. XAI methods (SHAP) coupled with Complex Systems Theory may capture emergent dynamics, compensatory reserve and critical transitions, offering interpretable, clinically actionable monitoring of cognitive aging.

Topic Area: METHODS: Neuroimaging

E98 - Quantifying human neurophysiological variability across timescales

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Traditionally, noninvasive human brain imaging analyses have aimed to describe the central tendency of brain activity, while seeking to minimize within- and between-session variability. However, there is increasing recognition that, far from being purely noise, variability in the brain's signaling is essential to cognitive function and is altered in disease. Despite widespread interest in moment-to-moment neuroimaging signal variability, there is little work quantifying the dependence of variability/stability metrics on measurement timescale. We aim to compare how magnetoencephalography (MEG) activity varies across scales—from milliseconds to minutes, days, weeks, and months—and to determine which of any observed timescale dependencies are associated with fluctuations in cognition and mood. Twenty healthy adults will visit our laboratory 4 times in a month, on days 1, 2, 8, and 29. During each visit, we are collecting MEG data at rest and during somatosensory and auditory tasks, as well as measuring cognition (immediate memory, visuospatial abilities, language, attention, and delayed memory) and mood. In this Scratchpad, we present our analytical pipeline and pilot results, including whole-brain maps of timescale-dependency for task-free delta-, theta-, alpha-, beta-, and gamma-band spectral power across 5 participants. Future results will characterize these dependencies across all 20 participants, examine their associations with daily fluctuations in phenotype, and explore other signal features such as functional connectivity networks. These findings will provide a reference for future work on pathological patterns of variability in clinical populations.

Topic Area: METHODS: Neuroimaging

E99 - Sleep-like slow waves during wakefulness in attention-deficit/hyperactivity disorder (ADHD)

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Introduction: Attention-Deficit/Hyperactivity Disorder (ADHD), characterised by inattention and hyperactivity, is associated with altered neural activity. Recent research has shown that high-amplitude slow waves (SWs), typically associated with sleep, can also occur during wakefulness and predict inattention in neurotypical individuals. However, their role in ADHD remains unclear. This study examines differences in the number of sleep-like SWs between children with ADHD and neurotypical (NT) peers using resting-state EEG. **Methods:** Using a subset of the Healthy Brain Network, data included 83 children aged 5–18: 41 ADHD (9 female) and 42 neurotypical (9 female). SWs were detected using established algorithms (Andrillon et al., 2021). Average slow wave density (SW/min) was measured across 6 electrodes (F3, F4, C3, C4, P3, P4). One-way ANCOVA compared the density between ADHD and NT groups, and differences between frontal (F3, F4) and parietal electrodes (P3, P4), controlling for age and sex. Associations with ADHD hyperactive and inattentive traits (Conners 3-Self-Report) were examined using regression. **Results:** SW density was higher in NT than the ADHD group ($F(1,171) = 10.25$, $p = .002$) and higher in females than in males ($F(1,171) = 7.65$, $p = .006$). Parietal regions demonstrated higher SW density than frontal regions ($F(1,343) = 8.82$, $p = .003$). SW density was negatively associated with Connors-3 inattention ($p = .020$). **Conclusion:** Contrary to hypotheses, preliminary findings indicated that NT exhibited more SWs at rest compared to the ADHD, and SW density predicted better attention. Replicating these preliminary results with a larger sample and more electrodes is warranted.

Topic Area: METHODS: Neuroimaging

E100 - Dictionary choice matters when selecting tools for sentiment analysis in younger versus older adult populations

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People's writings can provide insight into the mental and affective state of a person. Computational sentiment analysis tools have shown promise in rapidly predicting emotional valence in human narratives. However, these tools have largely been trained and tested on narratives produced by younger adults. It is unclear whether their performance remains consistent in narratives produced by people across the lifespan. Here, younger and older adults were presented with clips from popular songs as memory cues. They wrote short descriptions of personal memories elicited, and self-rated their emotional valence. Classifications from five sentiment dictionaries (General Inquirer, Harvard IV-4, QDAP, TextBlob, VADER) were compared using conditional inference trees trained separately for each age group. VADER, which was originally designed for informal

language used in social media, offered better performance in the narrative style used by young adults. In contrast, TextBlob's use of grammatical context and lexical relations allowed it to better evaluate sentiment from narratives with more formal vocabulary and syntax used by older adults. The divergent performance of sentiment dictionaries across younger and older adults reflects fundamental differences in both the tools themselves and the language used in autobiographical narration across the lifespan. Findings demonstrate that dictionary choice is not neutral, and that analytic strategies must align with the evolving complexities of language across the lifespan.

Topic Area: METHODS: Other

E101 - Mapping Human Mesolimbic Circuitry for Risk and Reward: A 7T Structural Connectivity Atlas

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Mesolimbic circuitry is critical for motivation, reward, learning, memory, and affective behavior, yet its anatomical organization in humans remains poorly defined. Although these pathways have been extensively characterized in animal models, in vivo delineation in humans has been limited by imaging resolution and methodological constraints. Currently, no publicly available atlas exists describing the anatomical connectivity of these circuits. Using a large sample from the 7-Tesla Human Connectome Project dataset, we anatomically reconstructed projections from the ventral tegmental area (VTA) to the hippocampus, amygdala, and nucleus accumbens (NAc), as well as hippocampal efferents to the NAc and ventral pallidum (VP). Microstructural characteristics along each tract were modeled using neurite orientation dispersion and density imaging (NODDI). Tracts were visually inspected for anatomical accuracy, normalized to standard space, and aggregated across participants to create a probabilistic atlas. Endpoint distributions within seed and target regions were examined to assess connectivity gradients consistent with preclinical tracer evidence. We successfully delineated bilateral mesolimbic tracts with high spatial correspondence to prior preclinical and ex vivo cadaveric microdissection work. Endpoints of VTA-hippocampus tracts were localized mainly to the hippocampal body; all other tracts exhibited spatially heterogeneous termination patterns. Additionally, preliminary evidence suggests that some of these mesolimbic tracts are related to delay-discounting and affective measures. This open-access 7T atlas provides the first high-resolution anatomical template of human mesolimbic white-matter pathways, to be made publicly available to aid investigations of structural connectivity related to emotion, memory, and reward circuitry and advance research on their behavioral and clinical relevance.

Topic Area: NEUROANATOMY

E102 - Plasma Proteome Signatures as Transdiagnostic Markers of Clinical Severity in Neurodegenerative Diseases

Neurodegenerative disorders such as Alzheimer's disease (AD), Parkinson's disease (PD), and frontotemporal dementia (FTD) share molecular pathologies including synaptic dysfunction and immune dysregulation, yet clinical severity varies widely and is inadequately captured by diagnostic categories alone. Plasma proteomics offers a scalable, minimally invasive approach for biomarker discovery, potentially identifying transdiagnostic markers that better index disease burden and functional decline. This literature synthesis reviewed studies from PubMed, medRxiv, and Nature Portfolio published between December 2025 and January 2026, focusing on plasma proteomics in AD, PD, and FTD cohorts (n > 500 preferred), with outcomes tied to clinical severity scales like CDR and UPDRS. Extracted analyses included differential protein abundance, multivariate prediction models, and pathway enrichment; no primary data analysis was conducted. Findings reveal shared transdiagnostic markers, such as immune, synaptic, and axonal proteins, associated with severity across disorders, suggesting convergent mechanisms of functional decline. Disease-specific profiles include tau-associated and apoptotic pathways in AD, extracellular matrix and ER stress in PD, and cytoskeletal proteins in FTD. Plasma proteins correlate more consistently with severity than diagnostic distinctions, and multivariate models outperform single biomarkers in predicting impairment. In conclusion, plasma proteomics identifies transdiagnostic markers of clinical severity, with shared immune and synaptic pathways underlying impairment; disease-specific signatures enhance diagnostic resolution, and severity-based models surpass categorical diagnoses. Integrating these biomarkers with cognitive measures could improve disease modeling and support transdiagnostic approaches to cognitive decline.

Topic Area: NEUROANATOMY

E103 - Alcohol's Effect on Resting-State Brain Network Dynamics Using NASCAR Tensor Decomposition

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Alcohol consumption is known to influence cognition and brain activity. However, how alcohol consumption affects the organization and temporal fluctuation of brain network activity remains poorly understood. Previous studies have reported that certain brain networks are particularly susceptible to the effects of alcohol. However, the methods frequently used in those studies—such as independent component analysis (ICA) — cannot capture spatial overlaps or temporal interactions among networks, limiting understanding of how alcohol alters the competition or balance between brain networks. To overcome these limitations, we employed the Nadam-Accelerated Scalable and Robust (NASCAR) tensor decomposition method, which simultaneously estimates spatial maps,

temporal fluctuation in activity, and subject contributions. This approach allows the identification of spatiotemporally overlapping networks and clarification of alcohol effects on the interactions among networks. Using large-scale dataset from the Human Connectome Project (HCP), we first extracted robust interacting networks via NASCAR tensor decomposition, thereby forming a representative network atlas for a healthy population. In our experiment, 10 participants underwent two rs-fMRI sessions on separate days after consuming either alcohol or a soft drink (placebo). We then applied this network atlas to the acquired rs-fMRI data, estimating the subject contributions of each network. By comparing contributions score between the two conditions, we found decreased contribution of a network involving the default mode, attention, frontoparietal control, and salience systems in the alcohol condition compared with the soft drink (placebo) condition. These findings suggest that alcohol reduces the coordinated activity among networks related with attentional control and self-related processing.

Topic Area: OTHER

E104 - Complexity analysis of functional network development in endogenous high-density EEG of premature neonates

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The early development of sensory and functional networks in premature neonates is crucial for brain maturation. Before 28 weeks of gestational age (wGA), neural activity is mainly driven by spontaneous endogenous generators. One such generator, theta temporal activity coalescent with a slow wave (TTA-SW), emerges between 24–26 wGA, peaks at 27–30 wGA, and declines by 32–36 wGA. These oscillations likely shape early cortical connectivity. We investigated how TTA-SW modulates brain functional integration across gestational ages by assessing brain complexity during and after their generation. EEG was recorded from 46 preterm neonates (64 channels) at Amiens University Hospital, grouped by age: 26–28 wGA (n=19), 29–30 wGA (n=14), and 31–32 wGA (n=13). TTA-SW events were manually marked. A 2-second baseline of minimal power within 10 seconds before each event was compared to two response windows: the event itself and a 2-second post-event segment starting 0.5 seconds after offset. Complexity was calculated using the PCIST (Perturbational Complexity Index–State Transitions) framework (Comolatti et al., 2019). Complexity increased significantly between the youngest and older groups, reflecting maturation of cortical circuits, but showed no significant difference between 29–30 and 31–32 wGA, suggesting stabilization around 30 wGA. Post-event activity exhibited higher complexity in the oldest group, indicating a transition from discontinuous to more organized cortical activity, with mature background networks by 31–32 wGA capable of generating complex

activity after TTA-SW. TTA-SW thus emerges as both a marker and potential driver of early brain development highlighting the importance of endogenous oscillations in the earliest stages of human neurodevelopment.

Topic Area: OTHER

E105 - Navigating Knowledge Gaps: Cognitive Shifts from Books to Google and AI

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The rise of internet technologies and AI tools has prompted questions about their impact on human cognition. Previous studies have shown the 'Google Effect', where people automatically think of computers when faced with difficult questions, because that is where answers to such questions are most likely to be found. However, in today's digital age, AI systems have become popular sources of information, while Google remains a constant. This study aims to replicate the Google Effect and explore whether it extends to other sources, such as AI (e.g., ChatGPT) and books. Participants were asked general knowledge questions (easy and hard) followed by a modified Stroop task with target words (Google-related in Experiment 1, AI-related vs. Book-related in Experiment 2) and non-target words (non-technology-related) in red and blue. Reaction times to target and non-target words were measured to assess automatic priming. Results showed higher reaction times for Google-related and AI-related target words after hard questions, suggesting longer processing of these words when faced with knowledge gaps. Interestingly, this effect disappeared for book-related target words. These results suggest a shift in the relationship between humans and books, while also strengthening the association between humans and technology.

Topic Area: OTHER

E106 - Preliminary investigation of hemodynamic fMRI dynamics in aging

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Recent evidence from young adults suggests that the timing of the fMRI blood-oxygen-level-dependent (BOLD) signal in the nucleus accumbens (NAcc) is associated with underlying dopamine physiology. We tested whether these results extend to healthy older adults using $n=46$ participants (60-82 years old, 52% female) who completed two simultaneous PET/fMRI scans with the tracer [11C]raclopride to measure dopamine D2/3 receptor density and resting state fMRI scans to measure hemodynamic latency (blood flow timing). Each participant underwent separate scans on placebo and 20mg oral methylphenidate to enhance dopamine availability. Consistent with previous work, we found that the ventral striatum (VST), which includes NAcc, exhibited higher latency compared with dorsal caudate (DCA; $p=.003$) and trending higher latency compared

with dorsal putamen (DPUT; $p=.07$). Past work has shown that while there is no effect of a dopamine drug on latency, individual differences in VST [11C]raclopride predict drug-related changes in VST latency. We demonstrate similar findings: there was no direct effect of drug on VST latency ($p=.51$), but higher VST [11C]raclopride was associated with greater drug-related decreases in VST latency ($p=.03$), indicating that hemodynamic latency is sensitive to underlying components of dopamine function. We did not find relationships between VST latency and memory performance on a reward-motivated encoding task ($p=.32$). These results extend work in young adults to demonstrate that VST hemodynamic latency may be a useful and easily obtainable measure of dopamine function in older adults. Future work will consider cerebrovascular factors such as white matter hyperintensities, which may influence blood flow.

Topic Area: OTHER

E107 - Neural Encoding of Acoustic and Linguistic Speech Features Reveals Correlates of Understanding

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Listeners rely on multiple acoustic and linguistic cues to extract meaning from speech, yet the neural basis of this process under degraded listening conditions remains unclear. Using continuous EEG, we recorded neural activity from 38 young adults as they listened to a naturalistic story. Speech cues were manipulated along two axes: acoustic spectral clarity and linguistic intelligibility, with both intelligible and non-intelligible languages produced by a bilingual speaker. We modelled brain responses to spectro-temporal descriptors, such as spectral flux, and linguistic features, such as word onsets, using banded regression and permutation analyses to control for correlated predictors. Four low-level acoustic properties—the amplitude envelope, peaks in the envelope derivative, spectral variation, and spectral flux—accounted for distinct neural variance. When linguistic features were fitted to this model, robust word onset encoding emerged exclusively for intelligible speech, with more mixed results for phoneme, syllable, and lexical surprisal features. Group analyses revealed condition-specific effects reflecting interactions between spectral clarity and language intelligibility. A composite neural index summarising these effects strongly predicted self-reported comprehension of acoustically degraded but intelligible speech ($p = 0.90$, $p < .001$). The results show that cortical encoding of speech relies on multiple cues whose relative contributions depend on signal quality and speech understanding. Importantly, flexibility in speech encoding across contexts may provide a more informative neural correlate than the absolute magnitude of the response. These data link brain dynamics to subjective understanding during natural speech perception, shedding light on cognitive-sensory interactions and indicating potential clinical applications.

Topic Area: PERCEPTION & ACTION: Audition

E108 - Neural dynamics of music listening reflect predictions embedded in deep generative networks

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Predictive coding theory posits that the brain summarizes features across multiple timescales by comparing bottom-up sensory signals against top-down prediction signals. While recent approaches in language processing investigate predictions in the brain by comparing neural activity to embeddings in deep neural networks, less is known about how these predictions operate over continuous acoustic signals, and even less is known about how they play a role in music. Here, we test whether and how neural activity reflects continuous acoustic predictions during music listening by comparing human EEG activity to representations within MusicGen (Copet et al., 2023), a multi-stage transformer model trained on autoregressive acoustic prediction. Across two naturalistic music listening datasets collected in our lab (n=26; n=38), we tested whether including MusicGen's hidden state representations in ridge regression improved predictive accuracy on withheld EEG data over and above acoustics (lagged samples of cochlear-filtered audio). Parametric and non-parametric tests revealed significant improvements in encoding accuracy when including hidden state activity over acoustics ($p < .005$). After filtering neural and hidden state signals over a range of frequencies, we found that corresponding timescales in the delta, theta, and gamma bands contributed to strongest encoding improvements, suggesting nested timescales of prediction in the brain. To interpret MusicGen's representations, we performed frequency-based analyses of its hidden state activity over time, which revealed that nested oscillations emerge within the model at multiples of the musical beat purely from predictive constraints. Together, our results reveal how the time-varying aspects of musical prediction underlie the neural dynamics of music listening.

Topic Area: PERCEPTION & ACTION: Audition

E109 - MEG Evoked Power in Theta and Beta Frequency Band in Auditory Cortex Decodes Musical Perception and Imagery

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Imagery evokes perceptual-like experiences in the brain and mimics some of the neural activity of perception, resulting in shared neural activity of perception and imagery. This shared activity has been established in musical imagery studies, particularly highlighting the role of the secondary auditory cortex. In our prior EEG study, the evoked power—reflecting phase-locked activity in the brain corresponding to the event—in the theta and beta bands from temporal channels successfully decoded musical pitch imagery in musicians without Absolute Pitch. The current study uses MEG and 3T anatomical MRI to localize the brain sources of the evoked power that decodes musical pitch imagery specifically within the auditory cortex,

including superior temporal gyrus, superior temporal sulcus, and Hechl's gyrus, using dynamic Statistical Parametric Mapping method. Ten musicians listened to the first part of a melody, imagined its continuation, and completed a tone-matching task to determine if a test tone matched the actual continuation note of the melody. Decoding analysis using support vector machine was performed to classify each of seven diatonic imagined tones based on evoked spectral power in the theta and beta frequency bands from the auditory cortex. Preliminary decoding results show successful classification accuracy for imagined tones, significantly higher than the prior EEG study (average ~10% above chance). A similar trend was observed when this decoding algorithm was applied to perception. These findings emphasize the significance of phase-locked neural activity specifically in the auditory cortex, advancing our understanding of the neural basis of musical imagery.

Topic Area: PERCEPTION & ACTION: Audition

E110 - The Neural and Behavioral Correlates of Music Memorability

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Music plays a central role in the human experience and interacts with cognitive processes such as memory and emotion. While the interaction between music and memory is well understood, the cognitive mechanisms underlying music memorability, or the likelihood that a piece of music will be remembered, are largely unexplored. Including musicians and non-musicians, the current study investigated the behavioral and neural correlates of music memorability in an event-related potential (ERP) experiment. Participants completed a continuous recognition task, in which they listened to five-second musical excerpts categorized as high or low memorability and indicated whether each excerpt was “new” or “old.” This was followed by a rating task assessing perceived valence, arousal, and representativeness of genre. Behavioral analyses indicated that participants were more accurate and responded faster to repeated highly memorable stimuli than repeated less memorable excerpts. In the rating task, high-memorability excerpts received overall higher ratings and were specifically judged as more arousing and representative of genre. ERP data, collected during the continuous recognition task, revealed that repeated high-memorability excerpts evoked larger old/new effects, with these excerpts eliciting higher amplitudes for both the FN400 (~300-500 ms) and the Late Positive Component (~500-800 ms) when compared to repeated low-memorability excerpts. These neural effects align with enhanced recognition accuracy and faster responses for high-memorability stimuli, indicating that more memorable music involves stronger memory processes. Future work will test whether statistical regularity or distinctiveness best explains what makes music memorable and will further explore how music expertise modulates both behavioral and neural sensitivity.

Topic Area: PERCEPTION & ACTION: Audition

E111 - From high-energy consumption to efficient prediction: Developmental changes in neural dynamics of syllable processing

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Syllables are fundamental units of speech perception, yet the neural dynamics governing their processing in the developing brain remain to be fully elucidated. This study utilized Magnetoencephalography (MEG) to investigate syllable processing in 27 Mandarin-speaking children (4–10 years; mean=7.5, SD= 1.5) and 27 adults (19–25 years; mean=22.6, SD2.7) using a paired-stimulus discrimination task. Stimuli comprised eight Mandarin monosyllables varying by consonant, vowel, or tone, along with their time-reversed counterparts to examine linguistic experience effects. Behavioral results confirmed that children effectively distinguished syllables (accuracy >80%). Event-related field (ERF) analysis revealed distinct neural strategies. While early sensory components (M50, M100) were similar between groups, children demonstrated significantly broader cortical activation and stronger amplitudes in the late P3 component ($p < 0.05$). Crucially, language experience modulated responses differently. During the first stimulus (S1) processing, reversed speech induced higher P3 amplitudes in children than forward speech ($t=1.8901$, $p=0.0323$), a difference absent in adults, suggesting compensatory neural recruitment for unfamiliar signals. Furthermore, distinct context-utilization strategies emerged: adults displayed an efficiency-driven pattern (stable S1, enhanced S2), whereas children exhibited a "high-energy" mode with robust P3 responses to both S1 and S2 ($p < 0.001$). These findings indicate that pediatric speech processing is resource-intensive, relying on sustained neural engagement to parse acoustic-phonetic features. We conclude that language experience shapes the transition from exhaustive sensory analysis to efficient, context-driven neural processing.

Topic Area: PERCEPTION & ACTION: Development & aging

E112 - Active agency alters functional connectivity in a reach-to-grasp video game

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Human neuroimaging has moved toward increasingly naturalistic approaches (e.g., movie viewing); however, these approaches often treat participants as passive observers rather than active agents. Video games offer a naturalistic option in which the participant actively controls their actions and moment-to-moment outcomes. We tested how agency (one's control over their own actions) in a video game affected brain networks using a data-driven approach, functional connectivity multivariate pattern analysis (fc-MVPA). During fMRI, participants played a reach-to-grasp video game in which they controlled the virtual arm of a first-person avatar. Three conditions

manipulated the presence of agency and motor involvement: PLAY involved both motor control and agency, REACT involved motor control without agency, and WATCH involved neither motor control nor agency. All three conditions involved identical visual stimulation, while PLAY and REACT involved nearly identical motor outputs. The addition of motor control (REACT vs. WATCH) largely affected only the somatomotor network. Interestingly, the addition of agency (PLAY vs. REACT) evoked more distributed whole-brain connectivity differences across the somatomotor, control, dorsal attention, and default mode networks, as well as visual cortex, thalamus, and cerebellum. These results suggest that agency affects sensorimotor feedback loops in cortical and subcortical regions. With our connectivity analysis, we have demonstrated that the key benefit of video game paradigms comes through their ability to increase active agency rather than through simple motor control processes. Video games in fMRI offer a novel approach to study the gamut of brain functions with the participant actively in control of both actions and outcomes.

Topic Area: PERCEPTION & ACTION: Motor control

E113 - A dissociation between motor and declarative memory for duration

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Our recent work has demonstrated that humans can learn up to 12 arbitrary associations between words and their presentation durations (0.3–5s). These associations can be reliably retrieved via duration reproduction—robust motor-based memory. In contrast, participants performed at chance when retrieving the same learned word-durations, indicating which of a pair of words was associated with a longer duration—poor declarative memory. While the prior study examined duration encoding with a "what" feature, the current study used a "where" feature. Participants ($n = 25$) learned 12 durations (0.3–5s) associated with 12 locations by reproducing the duration of a square presented at each location four times in a fixed order. Following learning, participants twice reproduced the remembered duration at each location separated by a pairwise comparison task where they indicated the location associated with the longer duration for each pair of locations. Participants completed these tasks twice, first with visually presented squares and then with audiovisually presented squares (accompanied by a concurrent tone) during learning. To avoid memory confusion, a circular layout of locations was used in one condition and a grid layout in the other (counterbalanced). Motor duration memory was reliable and was improved by audiovisual presentation as in our prior study using words. Interestingly, declarative duration memory, which was at chance level with words, became reliable and substantially improved by audiovisual presentation with spatial encoding. These results suggest that while motor duration memory is equivalently supported by what and where features, declarative duration memory substantially benefits from spatial encoding.

Topic Area: PERCEPTION & ACTION: Multisensory

E114 - The conceptualization of time in participants with high and low musical experience

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Time is a dynamic and adaptive framework, integral to human cognition. Research shows that time perception and production rely on a flexible, experience-dependent network of brain regions influenced by a feedback loop between sensory and motor systems. Athletes and musicians, through repeated sensorimotor training, often demonstrate enhanced timing abilities, suggesting that sensorimotor training may enhance temporal perception. Although studies have explored components of the sensorimotor loop and time, there is a need to examine how musical experience and rhythm may shape the perception of time. Based on the current literature on the conceptualization and perception of time, this study aims to investigate time perception among participants with high and low musical experience. Participants complete a temporal reproduction task alongside questionnaires assessing interoceptive awareness, motor inhibition, and individual differences in time perception. We hypothesize that those with high musical experience may reproduce time intervals more accurately and may perceive time rhythmically. The findings from this study may offer insights into how musical experience and other potential factors may shape time perception and cognitive processes that involve internal timekeeping.

Topic Area: PERCEPTION & ACTION: Other

E115 - Same space, different plans: Sex differences in the organization of spatial cognition

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Spatial abilities involve perceiving, manipulating, and remembering spatial relationships among objects. Two subcomponents that consistently show sex differences are mental rotation (MR) and object location memory (OLM): males outperform females on MR tasks, whereas females excel on OLM. However, it remains underexplored whether relationships among these spatial subcomponents differ within each sex, limiting our understanding of the cognitive mechanisms underlying sex differences in spatial abilities. In the present study, human participants (adults ages 18 and older) completed the well-established MR (Shepard & Metzler, 1971) and OLM tests (Silverman & Eals, 1992). Participants were also given two ecologically valid board game tasks assessing similar abilities: Qbitz for MR and Spot It! for OLM. Consistent with prior findings, males outperformed females on the MR test and Qbitz, whereas females outperformed males on the OLM test and Spot It!. Importantly, the relationships among these tasks differed by sex. Regression analyses showed that, for males, performance in Qbitz and Spot It! uniquely predicted MR and OLM scores, respectively. In contrast, for females,

Spot It! predicted MR test scores, while no task predicted OLM results. These findings suggest that males exhibit a more specialized, modular organization of spatial cognition, with distinct mechanisms supporting different spatial processes. In contrast, females show a more integrated, less differentiated organization, where overlapping mechanisms contribute to performance across spatial domains. This sex-specific pattern of organization provides new insight into the cognitive mechanisms underlying spatial abilities.

Topic Area: PERCEPTION & ACTION: Other

E116 - Using MEG to understand the neural underpinnings of tactile sensitivity to clothing fabrics

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Tactile sensitivities are a shared feature of a range of neurodevelopmental, physical, and mental health conditions. They are also observed within the general population, with clothing fabrics a common trigger. The neural mechanisms underlying tactile sensitivities are unclear. However, one candidate mechanism is an increased ratio between excitation and inhibition (E:I ratio). Previous MEG studies have demonstrated that brushing the skin results in a suppression of sensorimotor beta oscillations, reflecting increased excitation, followed by a rebound above baseline when movement ends. Additionally, A β fibres have been shown to drive the early neural response, while C-tactile input drive peak responses in affective regions. In this study, we will use a MEG-compatible robotic arm to brush clothing materials along participants' skin, enabling us to investigate the neural mechanism underlying sensitivity to clothing fabrics. Pilot work has confirmed that this results in a reliable beta suppression and rebound over the sensorimotor cortex. We aim to explore whether the magnitude of this response varies depending on participants' subjective pleasantness ratings of the clothing fabrics, and on levels of neurodivergent traits and mental health symptomology. This will allow us to test whether differences in the E:I ratio explain differences in tactile sensitivity. Furthermore, identifying the spatiotemporal response to different fabrics will allow us to identify the relative contributions of A β and C-tactile fibres to the experience of tactile sensitivity.

Topic Area: PERCEPTION & ACTION: Other

E117 - Diffuse predictions reshape WM representations at encoding

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Previous work has shown that precise predictions can alter working memory (WM) representations through sharpening. However, we often deal with diffuse predictions with a range of potential outcomes.

How such predictions affect neural representations remains unclear. In this study, we recorded EEG data from 40 participants who judged whether a probe grating was rotated clockwise or counterclockwise relative to a memorized orientation. Each memory item was preceded by a central color cue (red, green, or blue); two of these colors (predictive) cued two non-overlapping 90° segments of orientations that the item was sampled from in half of the trials; in the other half, a third (non-predictive) color was presented that signaled the item could have any possible orientation. Behavioral results revealed higher accuracy for predictable items, with systematic biases toward the center of the cued segment. EEG results revealed equally successful decoding of orientation for both predictable and unpredictable items. However, cross-condition decoding was significantly weaker than within-condition decoding, suggesting that the encoding format changed between conditions. Representational similarity analysis showed higher similarity between predictable items, with a representational bias towards the cued segment. Covariance matrices showed higher variance for predictable items, reflecting higher representational variability under predictive contexts. These effects were absent during the maintenance phase. Together, our findings suggest that diffuse predictions shape encoding at perceptual stages, which is accompanied by increased representational variance.

Topic Area: PERCEPTION & ACTION: Vision

E118 - Spatial Navigation and Representations of Spatial Information in Visual Aphantasia

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Lower visual imagery vividness (aphantasia) is associated with impaired recall of visual details in autobiographical memories and reduced neural similarity between perception and imagery. People with aphantasia offer a way to investigate navigation without imagery, a neglected research area. In this sketchpad, we propose to evaluate the hypothesis that reduced visual input in aphantasia impairs recall of spatial knowledge via reduced neural similarity of spatial information across imagery and perception. In study 1, participants will learn a campus-like virtual environment and demonstrate knowledge of the locations of 8 landmarks. We predict that those with aphantasia will perform worse on spatial tasks presumed to require visual imagery (pointing to landmarks from an imagined facing direction) compared to those using visual perception. In study 2, participants with knowledge of the University of Texas at Arlington campus will complete verbal (imagery) and pictorial (visually guided) pointing tasks in a 3T MRI scanner. We will extract and average neural activation patterns for each location and facing direction for verbal and pictorial conditions, then compute similarity across conditions within visual scene regions (RSC and PPA) by creating representational dissimilarity matrices and testing cue-invariance of target correlations (i.e., across-task, within spatial feature). If attempted imagery representations lack spatial detail in aphantasia, cross-task correlations should only be significant in those without aphantasia. If navigation ability relates to neural

similarity, then accuracy in study 1 should correlate with cross-task decoding. Findings will inform theories on the role of visual cognition in navigation and development of navigation support tools.

Topic Area: PERCEPTION & ACTION: Vision

E119 - Dynamic Faces Distinguish N170 and VPP Activity in Face Perception

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ERP research has largely suggested that two ERP components associated with early face processing, the N170 and the vertex positive potential (VPP), are generated by the same neural sources and have identical functional properties despite differences in topographic distribution. However, given fMRI evidence of at least partially separable networks for dynamic and static face perception, the fact that most studies examining the N170 and VPP have used static faces may yield an incomplete picture of the relationship between these two components. To address this question, we examined ERP responses to static and dynamic displays of angry and fearful faces in 23 participants (13 female). Peak latencies and amplitudes were derived for each participant: the N170 was defined as the peak negativity between 150-240 ms at lateral occipital sites (PO7 and PO8), while the peak of the VPP was obtained from Cz during the same period. The N170 was larger and peaked earlier on the right relative to the left and amplitudes were sensitive to facial emotion (larger for fearful vs. angry faces at PO8). In contrast, VPP amplitudes were larger for angry faces and an effect of facial movement was observed, such that the VPP was enhanced for static vs. dynamic faces. Although preliminary, these findings challenge the notion that the N170 and VPP reflect the same neural processes; rather, they reflect the activity of both shared and complementary (but independent) sources during early face processing, depending on the nature of the display.

Topic Area: PERCEPTION & ACTION: Vision

E120 - Hypothesis-driven identification of neural algorithms with dynamical structure-preserving manifolds

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Understanding how neural circuits implement complex mental representations remains a central challenge in neuroscience. Existing approaches either lack neural grounding (probabilistic cognitive models) or provide limited algorithmic interpretability (task-optimized deep networks). We present Dynamical Structure-Preserving Manifolds (dSPMs), a framework that enables direct testing of algorithmic hypotheses against neural data by analytically programming physics-based representations into reservoir computers without training. We applied dSPM to identify the algorithm underlying physical prediction in macaque dorsomedial frontal cortex (DMFC).

Using high-resolution recordings from 1,889 neurons during a ball interception task, we tested whether DMFC implements structure-preserving physics-based representations versus task-optimized or statistical shortcuts. The dSPM model analytically embeds a 12-dimensional dynamical system encoding Newtonian mechanics—including position, velocity, collision detection, and reflection dynamics—into the connectivity of a reservoir computer by directly computing connectivity weights from symbolic specifications. dSPM reproduced a striking feature of DMFC: rapid endpoint prediction within 250ms of trial onset. More remarkably, dSPM predicted that the entire future ball trajectory, not just the endpoint, should be linearly decodable from this early neural state—a prediction we confirmed in DMFC activity. Representational similarity analysis revealed that dSPM significantly outperformed task-optimized RNNs and subsumed nearly all variance explainable by alternative models through partial correlation analysis. These results suggest DMFC implements interpretable, dynamical, and physics-based manifolds rather than learned statistical representations, and establish dSPM as a powerful tool for hypothesis-driven exploration of neural algorithms underlying complex cognition.

Topic Area: PERCEPTION & ACTION: Vision

E121 - Perceptual plasticity is gated by localized training-induced changes in excitation/inhibition balance measured using scalp EEG

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Some experiences lead to learning (i.e., plasticity), while other experiences do not. How does the brain regulate plasticity and stability? One prominent hypothesis is that a balance between excitation and inhibition (E/I balance) modulates the extent of neuroplasticity. While evidence for this hypothesis has been found using magnetic resonance spectroscopy (MRS), it is still unclear whether E/I balance changes linked to learning occur in a localized cortical region involved in the type of learning, as MRS measurements are only possible from a limited cortical area. Here, using E/I balance estimated from scalp EEG in humans, we tested whether an E/I balance increase is localized to early visual areas after training in visual perceptual learning (VPL). One group of participants was trained with an orientation detection task (n=24), whereas a control group (n=19) was exposed to similar but easily-detectable and roving stimuli such that no learning occurred. When comparing trained participants to controls, post-training rest was associated with elevated E/I balance in posterior channels. EEG-based measures thus allowed us to identify two novel phenomena. First, the E/I balance of posterior channels was altered by training, with no reliable group differences in the E/I balance of frontal channels. Second, higher posterior E/I balance within the trained group was reliably associated with greater VPL improvements, indicating a functional role for elevated E/I balance in effective training and neuroplasticity. We thus find that localized E/I

balance can be behaviorally regulated by training, and that the extent of these changes enables efficacious behavioral interventions.

Topic Area: PERCEPTION & ACTION: Vision

E122 - Tracking Concealed-Information Signatures Over Time: Passive EEG Decoding of Probe vs. Irrelevant Trials

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ERP-based Concealed Information Test (CIT) is a robust method for detecting crime-relevant knowledge. However, ERP-CIT paradigms are vulnerable to countermeasures, partly because examinees can infer the test's intention and strategically modulate attention or arousal to attenuate probe-irrelevant differences. To address this limitation, in this study we used sandwich-masking technique to unconsciously present the Probe and Irrelevant images while participants passively viewed the display. We quantified probe-versus-irrelevant discriminability using time-resolved EEG decoding with logistic-regression-based modeling, an analysis framework that has rarely been applied to probe-irrelevant discrimination in passive CIT settings. Statistical reliability was evaluated using one-tailed cluster-based permutation tests ($p < .05$) to control for family-wise error over time. We observed above-chance classification and identified five significant temporal clusters spanning 148–176 ms, 178–203 ms, 216–302 ms, 378–428 ms, and 522–548 ms. These results suggest that probe-related information becomes decodable shortly after ~150 ms and recurs across later processing stages, providing temporally specific evidence for when concealed-information signals are expressed under passive viewing. This temporal profile may refine mechanistic accounts of CIT-related neural dynamics and inform analysis-window selection in future ERP/MVPA studies.

Topic Area: PERCEPTION & ACTION: Vision

E123 - Event-related potentials to outcome valence are modulated by the decision to explore or exploit

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Maintaining a balance between exploitation and exploration, also known as the explore-exploit dilemma, is the key to optimizing decisions in uncertain environments. While many studies have investigated the effect of the number of trials (ie, horizons) on the explore-exploit dilemma, little is known about the effects of response availability and its neurophysiological correlates. We investigated how exploitation (selecting the option with the highest reward expectancy), informative exploration (selecting less sampled options), and random exploration (decision noise) would be modulated during 4- and 6-response versions of the same game while measuring electroencephalogram (EEG) activity. The game provided two types of feedback: early feedback, providing information regarding positive

(win) or negative (loss) outcome valence, and late feedback, providing information on outcome magnitude. At the behavioural level, exploitation increased post-win and as response availability decreased, random exploration increased post-loss and as response availability increased. Informative exploration was not modulated by either outcome valence or response availability. At the neurophysiological level, we observed larger amplitudes for feedback-related negativity (FRN) and P3 when participants explored and exploited, respectively, but only in response to early feedback. These results suggest that 1) increased response availability promotes random exploration while discouraging exploitation, and, 2) event-related potentials in response to outcome valence are modulated by our prior decision either to explore or exploit.

Topic Area: THINKING: Decision making

E124 - Shared beta network states are recruited for distinct cognitive processes in sensory decision-making

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Beta oscillations (15-30 Hz) are hypothesized to support various cognitive processes by coordinating distributed neural computations. They have been observed in the hippocampal-cortical networks at distinct stages of cognitive tasks. First, coordinated beta oscillations have been reported during cue-sampling in olfactory decision-making, where it is hypothesized to coordinate distributed neural networks for making sensory-based decisions. Second, beta oscillations have been reported after reaching the goal in spatial navigation tasks, where they are hypothesized to support learning from outcomes. These distinct task stages are typically associated with distinct cognitive processes, which raises the question whether beta oscillations at these distinct task stages correspond to similar or different hippocampal-prefrontal network states that support separate cognitive demands. To answer this question, we examined neural activity from dorsal CA1 (dCA1) and medial prefrontal-cortex (mPFC) as rats performed two-alternative forced choice tasks with olfactory cues. This allowed us to directly compare hippocampal-cortical activity during both cue sampling period and goal attainment in the same task and animal. We found bursts of beta activity in both regions during cue sampling and goal attainment. The amplitude and duration of beta bursts were similar between the two task stages. However, we found a difference in timing of the bursts relative to task stages, indicating that the timing of bursts can be flexibly adapted based on the cognitive demands. Our findings

suggest that beta oscillations may correspond to a shared network state that supports distinct cognitive processes.

Topic Area: THINKING: Decision making

E125 - Mental Imagery Shapes Emotions in People's Decisions Related to Risk Taking

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This research investigates how mental imagery shapes emotional responses and declared risk-taking decisions. Across four studies, including three experiments, we demonstrate that emotions mediate the relationship between the valence of risk-related visual mental images and people's willingness to engage in risky behaviors. Two factors moderate this relationship: the cognitive processing mode (analytical reasoning vs. visual mental imagery) and the vividness of imagery. In Study 1, the valence of imagined scenarios influenced the intensity of emotional reactions, which in turn predicted willingness to take risks. Positive imagery evoked stronger positive emotions and greater declared readiness to take risks. The experimental Study 2 provided causal evidence for these associations, showing that participants instructed to imagine risk-related behaviors in a positive manner experienced more intense positive affect and reported a higher inclination to take risks than those imagining them negatively. Two preregistered experiments (Studies 3 and 4) further corroborated the central hypothesis that mental imagery acts as a distinct driver of emotional responses in risk-related decision making and revealed potential boundary conditions for this effect. Study 3 demonstrated that imagery-based decisions elicited stronger emotional engagement than analytically based ones, while Study 4 showed that vividness of imagery amplified these effects—more vivid images led to stronger emotions and higher risk-taking propensity. Overall, the findings underscore the central role of emotions in decisions based on mental imagery and highlight vividness as a mechanism that amplifies the connection between imagined experiences and real-world risk behavior.

Topic Area: THINKING: Decision making

E126 - Adaptive and Maladaptive Behavioural Flexibility after Reward and Punishment: Evidence Across Dynamic Learning and Goal Contexts

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Reward and punishment are central concepts in neurocognitive models of adaptive learning, shaping neural circuitry and behavioural responses. Yet, how early experiences with reward or punishment shape flexible or inflexible future performance in dynamic environments remains not well understood. Across four experiments (n = 370), participants performed multi-phase Matching Pennies tasks with an early phase featuring reward or punishment manipulated by fixing win rates (Far/Close Win, Far/Close Loss). Later phases

featured computerized opponents that either followed an item bias (exploitable) or played randomly (unexploitable). Our analyses revealed robust asymmetries where early consistent reward (Far Win) promoted the development and persistence of exploitative win-stay and lose-stay strategies, leading to better strategy-performance links in late phases. In contrast, early punishment (Far Loss) generated elevated lose-shift behaviour but impaired the consolidation of effective win-based and stay-based strategies, even during late phase when environments became exploitable. Across Experiments 1-3, these effects appeared regardless of overall performance, with early punishment undermining reward-driven learning stability. However, in Experiment 4, using the same target score continuously across both phases, but with only the later phase allowing strategic exploitation, enabled participants to restore strategy-performance links despite early punishment. These findings demonstrate that early reward and punishment fundamentally alters the trajectory of behavioural adaptation. Even when later environments allow for exploitation, early punishment typically disrupts effective strategy development and persistence. However, this disruption is attenuated when the same target score is maintained across task phases, highlighting a boundary condition for neurocognitive mechanisms that support resilient strategy use.

Topic Area: THINKING: Decision making

E127 - Subcortical brain circuits reflect changing motivational demands at different time scales during effort-based decision-making

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Humans show remarkable flexibility in adapting their motivation to constantly changing environments. Prior work looking at motivated behaviour has largely focused on tasks where effort requirements are directly instructed. However, in everyday life, motivational requirements are not precisely signalled by the environment. In the current study, we used ultra-high-field MRI to examine how small subcortical nuclei of the human brain support effort learning and decision-making when effort is not signalled. Participants were asked to make decisions between two options with varying reward points and required effort, in environments with overall low versus high effort requirements. High average effort increased effort sensitivity and encouraged choice switches. A prediction error-based learning model was able to capture the influence of average effort demands on estimated effort updating across trials and effort devaluated reward differently in high compared to low effort contexts. 7T-fMRI BOLD showed that posterior hypothalamus reflected average effort demands, central/cortical amygdala reflected the effort required to persist, and nucleus accumbens represented rewards differentially in high and low effort environments. Finally, functional connectivity in this network changed as a function of effort changes. In summary, when effort is not instructed, subcortical circuits support flexible regulation of motivational demands at different timescales. Key words: motivation,

effort, volatility, average effort, learning, uncertainty, nucleus accumbens, amygdala, hypothalamus, subcortical region, flexibility

Topic Area: THINKING: Decision making

E128 - The unique neural circuits underlying top-down and bottom-up motivated self-control during nutritional decision making

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The ventromedial prefrontal cortex (vmPFC) is thought to encode an overall value signal based on a weighted sum of an option's attributes. Studies of dietary food choice show that individuals tend to naturally weigh tastiness over healthiness and, consequently, choose tasty but unhealthy foods. One well-studied approach to encouraging healthier food choices is through top-down cognitive regulation strategies. However, neural data suggests that regulation does not consistently modulate how the vmPFC represents attributes and instead relies upon compensatory mechanisms initiated by other regions. Here we test the idea that changes in bottom-up, physiological states may help individuals naturally attend to health information more, particularly in conjunction with cognitive regulation strategies. To do this, we manipulated participants' (current n = 32 out of 50) hunger levels across two fMRI study sessions while they alternated between making food choices naturally or using cognitive regulatory strategies. Behavioral analyses indicate that both regulation and being physiologically satiated helped participants incorporate healthiness more into their choices while reducing the influence of tastiness. Furthermore, the combination of these effects produced the greatest weighting of health on choices. However, fMRI analyses suggest that these different forms of motivated self-control exerted unique changes in vmPFC activity. Regulation increased the vmPFC's sensitivity to healthiness but did not affect taste. Conversely, satiation decreased taste representations as well as the vmPFC's correlation with preferences, while health representations remained unchanged. The current findings suggest that different forms of motivated self-control exert independent, attribute-specific changes in vmPFC activity.

Topic Area: THINKING: Decision making

E129 - Examining self-other intertemporal choices in individuals with ventromedial prefrontal cortex lesions

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Decision-making is a fundamental aspect of daily life that often occurs within a social context. Individuals may make choices on behalf of others, such as parents deciding for their children, or policymakers for

citizens. One well-established phenomenon in decision-making is delay discounting (DD), where a delay to a future reward decreases its subjective value. Existing evidence suggests that individuals often make more optimal, less impulsive choices—opting for a larger, delayed reward—when deciding for someone else rather than for themselves (e.g., in charitable donation contexts). However, this prior work has largely focused on healthy populations and has not addressed clinical groups known to exhibit steep DD and impaired future imagining, such as individuals with lesions to the ventromedial prefrontal cortex (vmPFC). The present study investigated how individuals with vmPFC lesions (n = 6) perform on intertemporal choice tasks when comparing decisions made for themselves (“self” condition), for a “close other,” and for an unfamiliar, “average other.” Their performance was compared to that of healthy adults (n = 28) and to individuals with medial temporal lobe (MTL; n = 9) lesions, who are shown to discount similarly to healthy adults despite compromised future imagining. vmPFC-lesion participants demonstrated steeper discounting in the self condition compared to controls and MTL participants. Group differences were not observed when deciding for close or unfamiliar others. These findings suggest the vmPFC’s crucial role in self-related intertemporal decisions, with damage to this region impairing future-oriented decisions for oneself while decisions for others were relatively intact.

Topic Area: THINKING: Decision making

E130 - Frontal, Parietal, and Temporal Modulation in Older Adults After Inference-Based Lego Robot Programming Training

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Inference processing is a central mode of brain functioning that implicates a proliferative range of neural computations across different cognitive domains. We expected training older adult active inference processing would modulate system-wide brain functional efficiency across frontal, parietal, and temporal areas. In a randomized clinical trial, 47 older adults (mean (SD) age = 69.3 (4.94)) were assigned to the Experimental (self-generated solutions; n = 24, 8 males) or Control (instructed solutions; n = 23, 7 males) groups of a 12-week Lego Robot Programming course. The course trained participants in inference

processing through code design, implementation, and updating to achieve goal robot behaviors. Before and after training, participants underwent a Visual Rule Inference Task (VRIT) functional magnetic resonance imaging experiment involving inferring assignments of stimuli color configurations to visual categories from feedback, and 19 additional cognitive assessments including episodic memory, working memory, reasoning, language, and perception. The experimental group improved in 12 cognitive assessments whereas the control group improved in five assessments. Both groups improved VRIT performances. Critically, the experimental group showed more focal neural response clusters in frontal, parietal, and temporal areas when self-generating color-category inferences in the VRIT. By contrast, functional responses in the control group during the same process were more diffuse in these brain areas. These findings suggest that the benefits of training self-generation of inferences transfers broadly to different cognitive domains. Moreover, a candidate neurocognitive mechanism for the observed broad cognitive transfer might involve better controls of frontal, parietal, and temporal operations for processing inferences.

Topic Area: THINKING: Other

E131 - The effects of short-term mindfulness and distraction on rumination: an fMRI study

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Rumination, the excessive maintenance of negative information in working memory, is a core symptom of anxiety and depression, accompanied by an overactive default mode network (DMN). This study focuses on two emotion-regulation strategies that both act on the DMN: Distraction, which involves externally guided attention, reflected in activation of the frontoparietal network and deactivation of the DMN – and mindful acceptance, which instead requires endogenous attention regulation, a meta-cognitive ability, mainly associated with DMN deactivation. To better understand their effects, we assess whether distraction and/or mindfulness can release rumination by examining functional neuroimaging data in relation to subjective experiences. 34 healthy participants with high rumination (RRS-brooding > 11) tracked their ruminative thoughts at home, before completing a rumination induction task in the MRI scanner. The next day, rumination was induced again on a trial-by-trial basis in the scanner, with each rumination induction followed by high-load distraction, mindful acceptance or control (low-load distraction). Planned representational similarity analyses will enable us to evaluate to which extent the ruminative brain state, isolated on day 1, can be decoded during and after mindful acceptance versus distraction on day 2. We hypothesize that the effect of distraction on the neural representational strength of ruminative thought is acute, whereas mindful acceptance might alleviate rumination more lastingly, reflected

in a reduced correlation of the ruminative brain state with the brain state after mindful acceptance versus distraction. Ultimately, examining effects of differential emotion regulation strategies on rumination and their neural correlates may guide the development of novel treatments.

Topic Area: THINKING: Other

Poster Session F

Tuesday, March 10, 2026, 8:00 – 10:00 am, Fairview/Kitsilano Ballrooms

F1 - Does Acute Stress Impact ERP Measures of Selective Attention in a Hillyard Dichotic Listening Task?

Ryan Giuliano¹ (ryan.giuliano@umanitoba.ca), Mohammad Soleyman Nejad¹, Leslie Roos¹; ¹University of Manitoba

A burgeoning field of research on the effects of acute stress on event-related potentials (ERPs) is revealing subtle impacts of stress reactivity on human cognition. With respect to selection attention, however, results are mixed; some work suggests that acute stress decreases the filtering of distractors, other work suggests that acute stress facilitates target selection, and yet other work suggests acute stress has no impact on select attention. Here, we examine the effects of acute stress on ERPs elicited during a classic dichotic story listening task (e.g., Hillyard et al., 1973) to isolate the effects of acute stress on to-be-attended and to-be-ignored sounds. Adult undergraduate students were randomly assigned to complete the Trier Social Stress Test (n=50) or a Control task (n=50), immediately followed by the dichotic listening task. EEG was recorded throughout the laboratory visit, along with electrocardiogram measures of cardiac reactivity and periodic samples of saliva to assess Cortisol reactivity. Analyses will examine whether aspects of the auditory ERP differ between the Stress and Control groups, as mean amplitudes of the P1, N1, and P3 elicited by to-be-attended (i.e., target selection) and to-be-ignored (i.e., distractor suppression) auditory probes embedded in the listening task. Based on previous results, we predict that the Stress group will show an enhancement of ERPs elicited by distractors, leading to an overall reduction in effects of selective attention on targets relative to distractors. We will follow this up with an examination of whether individual differences in stress reactivity contribute to stress-related impacts on ERPs.

Topic Area: ATTENTION: Auditory

F2 - Attention to Speech in the Ascending Auditory Nervous System: an EEG Investigation.

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Disorders, University of Memphis, ⁵Psychology Graduate Group, University of California, Davis, ⁶Departments of Otolaryngology | Head and Neck Surgery, University of California, Davis, ⁷Neurobiology, Physiology and Behavior, University of California, Davis

The majority of EEG research of auditory attention to speech has primarily focused on high-level processing in the cortex, while not exploring the interconnected role of attention along the ascending auditory nervous system. We posit that challenging speech listening requires both feedforward and feedback communication in the auditory pathway as early as the brainstem. For this project, 109 military Veterans performed a novel continuous speech spatial attention task. Participants were simultaneously presented with two spatially separated narratives. While attending to the target narrative and ignoring the distractor narrative, the participants' neural activity was recorded with EEG. Both narratives utilized our chirped speech (Cheech) stimuli which simultaneously facilitated a robust auditory brainstem response (ABR), middle latency response (MLR), and late latency response (LLR). This method enables us to investigate how ecologically relevant stimuli influences the neural activity from cochlea to cortex. We specifically investigated the relationship of attentional modulations across different levels of the auditory nervous system. Multiple regression models were used to evaluate the relationship of ERP morphology (peak amplitude, peak latency, and area under the curve) for components across different levels of the auditory nervous system. Differences in attentional modulations across ABR, MLR, & LLR components were significantly correlated. These correlated modulations across brain areas demonstrates the interconnected relationship of attention in the ascending auditory nervous system, showing the influence of attention spreading across all levels of auditory processing.

Topic Area: ATTENTION: Auditory

F3 - Threat and Prediction Modulations of Early Neural Responding to Facial Inputs are not Pre-Attentive

Philip Chalk¹ (p.t.chalk@student.uq.edu.au), Derek Arnold², Alan Pegna³; ¹The University of Queensland

Foundational theories of affective and cognitive neuroscience posit that threat and prediction signalling are automatic brain functions. Threat detection is thought to occur pre-attentively, driven by evolutionary mechanisms that prioritize survival, and the predictive coding framework asserts that prediction errors—mismatches between expected and incoming sensory information—can be registered pre-attentively. We conducted a direct test of these ideas and found them wanting. In our study, we examined how spatial attention and task relevance shape the early processing of emotional facial expressions. Thirty participants were shown pairs of bilaterally separated faces (one emotional, one neutral) or Gabor patches (one tilted, one vertical). We used electroencephalography (EEG) and measured event-related potentials (ERPs) that are associated with

early visual processing (i.e., P1 and N170). Participants either made judgements about facial expressions, the tilt of Gabor patches, or the location of missing pixels within a central fixation cross. Facial expressions could therefore be task-relevant and spatially attended in the emotion task, task-irrelevant and spatially attended in the Gabor task, and task-irrelevant and spatially unattended in the pixel task. Participants were also informed of the probability at which different facial expressions would appear. We found that event probabilities modulated P1 amplitudes and threat signals modulated N170 amplitudes, but only when facial expressions were relevant to the participants' contemporary goals. When faces were task-irrelevant – even if spatially attended – these modulations were abolished. Our findings call into question two foundational assumptions of contemporary neuroscience and brain function: that threat and predictive signals are processed pre-attentively.

Topic Area: ATTENTION: Other

F4 - Investigating Neuro-oscillatory Alpha Dynamics in Autistic Children at Rest and at Play

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Atypical sensory experiences are common in autistic children, ranging from hyper- to hypo-responsivity—and are often linked to feelings of sensory overload. A candidate neural mechanism involves alpha oscillations (~7–13 Hz), which regulate cortical excitability: lower alpha facilitates external sampling, whereas higher alpha promotes suppression of irrelevant input and supports internal processing. We examined alpha dynamics in children across rest and simple attentional tasks, testing whether group differences emerge more clearly in burst-resolved metrics than in averages. Three cohorts participated: non-autistic (NA), autistic (AU), and unaffected siblings (SIB). EEG analyses combined (i) periodic/aperiodic separation (FOOO/PSD) to isolate narrowband alpha from 1/f background and (ii) burst detection (eBOSC) to quantify abundance (time in alpha), amplitude, and duration. We modeled effects using linear mixed models across Group × Paradigm × Cluster, and related alpha features to clinical measures (FSIQ, Vineland, SRS). Topographically, all groups showed canonical parieto-occipital alpha at rest. Average alpha power (absolute/relative) was broadly similar between groups; however, alpha abundance was reduced in ASD, most prominently in a left parietal cluster. During tasks, modulation (task–rest) of periodic alpha power and alpha abundance was attenuated in ASD relative to

TD and SIB, indicating reduced adaptive adjustment of excitability. These findings suggest that burst-resolved, aperiodic-controlled alpha metrics and how they modulate with context may sharpen biomarkers of sensory–attentional regulation and highlight alpha periodic power and abundance as candidate targets for neuromodulation to enhance adaptive gating in autism.

Topic Area: ATTENTION: Other

F5 - Task-based fMRI analysis of the Midnight Scanning Club Coherence-Semantic task

Solana Redway^{1,2}, Helen Hsiao¹, Todd S. Woodward^{1,2}; ¹Faculty of Medicine, University of British Columbia, Vancouver, Canada, ²BC Mental Health and Addictions Research Institute, Vancouver, Canada

During task-based functional magnetic resonance imaging (fMRI), different cognitive processes reliably elicit distinct spatial and temporal configurations of blood oxygen level-dependent (BOLD) signal patterns, referred to as cognitive modes. Data was obtained from the Midnight Scanning Club (MSC), where ten participants each completed ten fMRI sessions while performing the Coherence-Semantic task, which included two conditions: (1) identifying whether an image depicted coherent or random movements (Coherence condition), and (2) determining whether a word was a noun or verb (Semantic condition). Task-timing-related cognitive modes were derived using Constrained Principal Component Analysis for fMRI (fMRI-CPCA), a data-driven dimensionality reduction method. We found a double dissociation between the Focus on Visual Features (FoVF) and Language (LAN) modes. Namely, BOLD changes for FoVF were observed in the Coherence condition, reflecting attention to perceptual aspects of visual stimuli, with no BOLD changes detected in the LAN mode. In contrast, BOLD activation for the LAN mode was strong in the Semantic condition, indicating engagement of regions associated with linguistic processing, but no BOLD changes were detected in the FoVF mode. In contrast, the multiple demand and default modes were involved in both conditions. This double dissociation from the MSC data provides further evidence for the distinct cognitive functions associated with the FoVF and LAN modes, contributing to research on precision medicine, prediction of treatment response, brain stimulation targets, and pre-surgical planning.

Topic Area: ATTENTION: Other

F6 - EEG Decoding of Poor Sustained Attention Beyond Failures of Selective Attention and Task Maintenance

Matthieu Chidharom¹ (matthieuchidharom@gmail.com), Henry Jones¹, Edward Vogel¹, Monica Rosenberg¹; ¹University of Chicago

Distraction is a universal aspect of human cognition, yet its neural origins remain unclear. Traditional models of sustained attention attribute distraction to lapses in cognitive control and task-set maintenance, whereas recent data-driven perspectives suggest it may arise from failures in selecting task-relevant information. This study

investigated the neural dynamics underlying distraction and tested whether its EEG signature represents a distinct pattern or overlaps with other attentional failures. Twenty adults performed a sustained attention go/no-go task (3,200 trials) requiring focus on either numbers or letters while EEG activity was recorded. Distraction was analyzed both at the trial level (no-go errors) and across broader attentional states defined by reaction-time variability (“in-the-zone” vs. “out-of-the-zone”). In both cases, distraction correlated with reduced event-related potentials, particularly a diminished parietal P3 component, and with weakened large-scale neural coordination revealed by inter-electrode correlation analyses. A machine-learning classifier trained on EEG data successfully decoded attentional state with about 80% accuracy, even after controlling for reaction time, indicating that the signal reflects more than behavioral performance. Additional decoding and representational similarity analyses confirmed that this EEG pattern was distinct from neural markers of selective attention (stimulus-side selection) and task-set control (letter vs. number). Overall, the results identify a consistent electrophysiological signature of distraction that generalizes across measures and tasks, offering new insight into the neural mechanisms that underlie momentary lapses of attention.

Topic Area: ATTENTION: Other

F7 - Conditional automaticity: Attention alters sound-spelling conflict effect

Niki Sinha¹ (nsinha7@uwo.ca), Marc Joanisse¹; ¹Western University

This reading study tested automatic recognition of familiar sound-spelling pairings using event-related potentials in EEG. In word recognition there is a known conflict effect which occurs when two words share similar spelling but do not rhyme. The goal of this study was to determine how task-related attention influenced conflict effects between rhyme and spelling in words presented too briefly to be consciously perceived. We recorded EEG data in 41 English-speaking adult participants as they completed tasks that focused their attention on either rhyme or spelling. In both tasks a masked prime word was presented for 33ms which either matched the target word in spelling and rhyme (cost/frost) or matched in spelling but not rhyme (host/frost). Results showed distinct conflict effects between the rhyme-focused task and the spelling-focused task. While there were no differences in behavioural reaction time between the two tasks, the spelling task had a significant N400 difference between trials with matching and non-matching rhyme. By contrast, the rhyme task showed no N400 differences between trials. These results indicate that goal-directed attention can influence how words are recognized even when they are only automatically perceived. Overall, this study adds to our understanding of automatic and controlled processes and the interplay between them which contributes to reading fluency.

Topic Area: ATTENTION: Other

F8 - The Immediate Effects of Sports Gambling, Surprise, and Suspense on Attention and Memory

Andrew Loehr¹ (andrewthomasloehr@gmail.com), James Antony¹, Colin Schmitt¹, Amrit Pradhan¹; ¹California Polytechnic State University, San Luis Obispo

The recent expansion of legalized sports gambling in the United States has increased the number of individuals who place bets while watching sports. Existing research has primarily focused on the chronic effects of gambling, leaving a gap in understanding how sports betting impacts real-time suspense, surprise, attention, and memory. The present study examined these processes during naturalistic basketball viewing. Participants (n = 24) watched the final five minutes of nine basketball games while wearing a 32-channel EEG cap. During viewing, participants placed live bets on selected possessions to earn small monetary rewards. Suspense was modeled as the variability in win probability on the upcoming possession based on historical data. After viewing, participants completed a surprise free-recall memory test. A General Linear Model assessed relationships between EEG spectral power [theta (4-7 Hz), alpha (7-14 Hz), beta (14-30 Hz)], suspense, bet status, game time, and recording time. Contrary to hypothesized results, higher suspense was associated with decreases in broadband (4-30 Hz), theta, alpha, and beta power. Bet status was not significantly related to EEG power. Time course analysis revealed decreased broadband power leading up to possession changes and increased power immediately afterward, consistent with event boundary offset responses in other neuroimaging paradigms. In the future, we will determine whether memory for basketball possessions correlates with suspense, betting status, or EEG measures defined above. These findings suggest a more complex relationship between suspense and neural indicators of attention than predicted and provide insight into the real-time neural effects of betting during sports viewing.

Topic Area: ATTENTION: Other

F9 - The Influence of Built Environments on People's Space Preferences and Attention Distribution Across Studying, Socializing, and Relaxing Activities

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People interact with built environments daily, however less is known about how environments impact people's choice of spaces for different activities, and what environmental features people attend to or use in the decision-making process. To fill this gap, we recorded undergraduate participants' gaze to index their attention during goal-directed free viewing of 15 real campus photographs using webcam-based eye tracking. For each picture, participants rated how much they would use the location for (i) studying, (ii) socializing, and (iii) meditating, relaxing, or praying (MRP) consecutively. We defined areas of interest (AOIs) for seating, nature, access (entrances or exits), light sources, windows, amenities, and other distinctive unclassified features (i.e. sculptures). Participants' personality traits

were evaluated through questionnaires. We first investigated whether people's environmental ratings and feature preferences differed across activities; we found that, overall people rated all spaces more favourably for socializing than the other activities, preferred indoor spaces for studying and outdoor ones for socializing and MRP, and showed personality-based differences, such as people who find it hard to switch their attention favor indoor settings. In addition, we investigated whether attention allocation differed during activity-directed environmental viewing by looking at their gaze pattern. We hypothesize that people would direct more attention (reflected as longer and more frequent fixations) to goal-relevant AOIs, and that personality traits would further modulate gaze patterns. Taken together, this study provides evidence that environmental features do affect the activities people would like to undertake, and that our personality traits also play a role.

Topic Area: ATTENTION: Spatial

F10 - Neural dynamics of global and local visual processing: magnetoencephalography (MEG) decoding with Navon letters

Advitya Hajela¹ (adi050317@gmail.com), Peter Kim¹, Sang-Ah Yoo², Hayoung Cho¹, Sung Jun Joo², Sang Chul Chong³, Hee Yeon Im^{1,4}, ¹University of British Columbia, ²Pusan National University, ³Yonsei University, ⁴BC Children's Hospital Research Institute

Humans flexibly switch between the global and local levels of visual scenes, seeing the "forest" or the "trees". Yet, neural dynamics supporting hierarchical visual processing remain poorly understood. Using Navon stimuli, in which a global letter is composed of smaller letters, we examined representational patterns of neural activity measured with magnetoencephalography (MEG). Participants (N=49) identified a letter "H" or "S" at the global or local level in separate, randomized blocks. Whole-brain source-localized MEG activity was classified using linear discriminant analysis, and representational similarity analysis was applied to identify neural patterns that reliably distinguished between global and local processing. Classification accuracy was robustly above chance across the time series, both before and after stimulus onset, indicating a sustained neural state specific to global and local visual processing. Time-resolved classification results were projected onto the brain surface using Haufe forward maps, which transformed classifier weights to determine when and where neural patterns distinguished between global and local processing. Haufe maps indicated that early visual regions, including cuneus/precuneus (temporal cluster: 260–360 msec), as well as posterior (60–160 and 260–360 msec) and anterior cingulate (660–860 msec) regions of the right hemisphere, carried neural patterns that more reliably distinguished local from global trials. In contrast, right inferior frontal regions (160–260 msec) contributed more to distinguishing global from local trials. These findings demonstrate that global and local processing modes instantiated before stimulus onset are maintained across time, reflecting sustained attentional states supported by coordinated activity between visual and frontal regions.

Topic Area: ATTENTION: Spatial

F12 - A Multiple Trace Model Unifying Statistical Learning and Intertrial Priming.

Dock Duncan¹ (d.h.duncan@vu.nl), Sander Los¹, Jan Theeuwes¹; ¹Vrije Universiteit Amsterdam

Visual selective attention is guided to a large extent by where we have encountered targets and distractors in the past. The influence of past behavior is often called "selection history". Two prominent forms of selection history effects are Intertrial priming (referring to effects on selection that are due to processing taking place during immediate preceding trial) and statistical learning (effects that are due to the overall average regularities during the overall experimental session). Traditionally, these effects have been thought of as separate mechanisms even though there is evidence that they interact. In the current talk, we present evidence that both effects are driven by the same core cognitive mechanism involving a short-term and long-term expression of the same cognitive process. By applying a multiple trace computational framework (in which each trial leaves a memory trace which decreases in influence over time according to a power function towards a nonzero asymptote), we present a model that can explain immediate effects of intertrial priming and higher order statistical learning effects. Together, these processes work to improve attentional behavior by biasing it towards global and local averages. We demonstrate that a multiple trace model successfully captures both short-term and long-term effects, including extinction, thereby unifying these disparate fields of study

Topic Area: ATTENTION: Spatial

F13 - Induced Stress Changes Affective Sensitivity and Eye Responses to Event Boundaries in Commercial Movies

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Event segmentation refers to the cognitive process through which continuous experience is organized into discrete, meaningful units. Prior research has shown that this process is linked to emotional changes perceived in the external world (Chen & Swallow, 2025), suggesting that external emotional cues may shape how people identify event boundaries. However, little is known about how internal affective states, such as positive or negative mood, influence the perception and organization of ongoing events. In this study, we examined how induced stress affects both behavioral performance and eye dynamics during an event segmentation task. Over five trials, participants first viewed either stressful (N = 27) or neutral (N = 28) induction videos. They then segmented the same task videos from commercially produced films while their pupil size and gaze were recorded. The induction procedure resulted in greater negative affect in the stressful group compared to the neutral group. These stressed participants, relative to neutral participants, identified boundaries that aligned more closely with fluctuations in the video's valence and arousal. This indicates that individuals are more sensitive to affective

changes under stress. In addition, participants in the stressful group exhibited larger transient increase in pupillary responses and gaze similarity at event boundaries compared to those in the neutral group. This suggests that stress induction leads to greater pupil reactivity and increased attention to normative information. Together, these results highlight the complex interplay between internal affective states, external emotional cues, and perception of ongoing experience.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

F14 - Threat extinction through unrecognizable mid-level visual features

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Emotional memories can contribute to psychological disorders. A primary treatment, exposure therapy, is effective but can be unpleasant because it requires repeatedly confronting feared stimuli. We explored a less aversive alternative using “texforms,” stimuli derived from images of animals and objects that preserve mid-level visual features and elicit similar ventral stream activation patterns as the original images, but are unrecognizable. We tested whether such mid-level visual representations support extinction. Participants underwent threat acquisition where they viewed animals and objects, with exemplars from one category sometimes paired with shock (CS+) and the other not (CS-). Threat response was indexed via skin conductance response (SCR). They then viewed new animals and objects (conventional extinction; $n = 32$), texform versions of those images (texform extinction; $n = 32$), or a neutral video (no extinction; $n = 32$), all without shock. Consistent with extinction learning, CS+ exemplars evoked higher SCRs than CS- exemplars during early trials of conventional extinction, but this was not observed for texform extinction. Two minutes later, participants viewed new animals and objects (test phase). Both conventional and texform extinction were successful; during the test phase, only participants who did not undergo either extinction showed significantly higher SCRs to the CS+ than the CS-. When asked after the test phase, participants were unable to identify the specific objects or animals corresponding to the texform stimuli. These findings suggest that exposure to unrecognizable images preserving mid-level features may reduce conditioned threat responses without evoking physiological reactions, offering a less aversive extinction method.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

F15 - Socioeconomic Status, Emotion Regulation, and Mental Health: Toward an Integrative Neurocognitive Framework

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Socioeconomic status (SES) is a well-established determinant of mental health, with individuals of lower SES showing more depression and stress-related symptoms. Yet the neurocognitive mechanisms linking SES and mental health remain unclear. Emotion regulation (ER) plays a critical role in mental health and relies heavily on prefrontal functions that may show SES differences. Examining SES, ER, and mental health together offers a powerful framework for understanding how structural disadvantage “gets under the skin.” This theoretical review synthesizes current evidence on (a) the relationship between SES and ER, and (b) the relationship between ER and mental health when SES is considered. Across studies, lower-SES individuals tend to use fewer adaptive ER strategies, such as reappraisal and acceptance, and rely more on suppression, self-blame, and withdrawal. However, empirical tests of ER as a mediator or moderator in the SES–mental health link remain scarce and methodologically heterogeneous. We propose three conceptual models: (1) ER as a mediator, whereby SES shapes ER tendencies that influence mental health; (2) ER as a moderator, in which ER buffers or exacerbates SES-related stress effects; and (3) a common-cause model, positing that ER profiles and mental health symptoms co-emerge from low-SES environments. We discuss shared correlates and causes involving chronic stress, family climate, and brain development. Together, this framework integrates cognitive, affective, and socioeconomic perspectives on mental health disparities and calls for multi-level approaches to clarify how SES shapes emotion regulation and resilience. These insights can inform interventions that address structural inequities while strengthening individual emotion-regulation capacity.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

F16 - Neural correlates of insight on psilocybin: a within-subjects, healthy volunteer study

Lorenzo Pasquini¹ (lorenzo.pasquini@ucsf.edu), Manesh Gim¹, Hannes Kettner¹, Avery Ostrand¹, Kate Allison¹, Christian Valtierra¹, Will Lucas¹, Patrick McConnell¹, Catriona Miller¹, Sydney Griffith¹, Dawn Weinstein¹, Brian Anderson¹, Andrea Rosati¹, Jennifer Mitchell¹, Robin Carhart-Harris¹; ¹University of California San Francisco

Psilocybin is a serotonergic psychedelic that induces altered states of consciousness characterized by profound psychological insights, which can catalyze powerful therapeutic breakthroughs for a range of psychiatric conditions. However, the neuronal signatures of different psychedelic substates that arise within a dosing session, as well as across sessions and individuals, have not been fully characterized. To address this gap, we conducted a personalized neuroimaging study in healthy, psychedelic-experienced volunteers. 10 participants were dosed with up to 25 mg psilocybin on four distinct dosing days, with each dosing day separated by the next by at least one week. On each

dosing day, we measured participants' brain activity multiple times using fMRI, with three runs being collected before dosing as well as at 50-, 120-, and 190-min post-dosing. Each scan session was followed by a brief resting-state EEG session. Normalized global signal complexity – NGSC, an index of the unpredictability of brain activity – initially increased at 50 min post-dose, peaked at 120 min post-dose, and gradually decreased at 190 min-postdose when compared to the pre-dose scans. NGSC increases were particularly prominent among medial parietal and prefrontal brain areas overlapping with the default mode network. NGSC correlated with EEG-based increases in signal complexity assessed via Lempel Ziv Complexity as well as with self-reported levels of psychological insight, assessed through visual analog scales after each fMRI run. Our findings show that personalized approaches applied to neuropharmacological studies have the potential to elucidate the dynamics of psychedelic substances on both brain function and individual experience.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

F17 - Cultural Variation in the Cognitive Mechanisms of Self-Forgiveness

Kaylee Miceli¹, Sonia Pan¹, Charlotte Lin¹, Aditya Singh¹, Felipe De Brigard¹, Cristina Salvador¹; ¹Duke University

Forgiveness is a process critical for resolving conflict and has important implications for health and well-being. Recent research supports the emotional reappraisal account of forgiveness, suggesting that forgiven (vs. unforgiven) transgressions are remembered with less negative valence, but the episodic characteristics (sensory, contextual, temporal, and spatial) remain unchanged. This work, however, has not addressed self-forgiveness. Given its unique nature, whereby the transgressor is simultaneously the victim, it is uncertain if self-forgiveness follows the same mechanisms as observed in interpersonal forgiveness. Moreover, existing literature highlights cultural differences in interdependence (embeddedness of self with others), cognitive style (emphasis of dispositional vs. situational causes), and self-enhancement, suggesting that memory for self-transgressions might be moderated by culture. To address these gaps, our current study examines cultural variation in the episodic and affective characteristics of self-transgressions via online survey platforms (Prolific, BeSample, and Credamo). We utilize a 3 (Condition: neutral memory, forgiven transgression, unforgiven transgression) x 4 (Country: United States, Colombia, China, India) mixed within- and between-subjects design to assess whether episodic content and affect differ based on whether individuals have forgiven themselves, across cultures varying in interdependence, cognitive style, and self-enhancement. Preliminary pilot data from all four countries (N = 160) will be presented at this sketchpad poster session. We aim to gather feedback on our experimental design, discuss study expansion using neuroimaging (EEG), and explore implications of our initial findings. If self-forgiveness mechanisms are found to differ from interpersonal forgiveness, or vary significantly

across cultures, it will substantially inform targeted therapeutic interventions.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

F18 - Inhibitory control is modulated by emotional valence and task-relevance: An ERP Study

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Emotional stimuli have been found to impact inhibitory control, with differing effects for positive and negative valence. Pessoa's Dual Competition Framework explains these effects as resulting from competition for shared resources, which is affected by emotional valence, intensity, and task-relevance. In this study, we used a flanker paradigm to test the effect of emotional task-relevance on inhibitory control, along with valence and role within the task (target vs. flanker). Outcomes included task performance and P1, N1 and N2 ERPs. Participants (17-25 years) completed a modified flanker task using schematic facial stimuli, where they responded to the gaze direction of the target. Both targets and flankers displayed either task-irrelevant or relevant emotional expressions. There was an interactive effect of valence, task-relevance and target/flanker location of emotion on performance and ERPs. Task-irrelevant positive targets elicited faster responses and smaller N2 only when paired with positive flankers, while task-relevant positive targets delayed responses. Furthermore, positive and negative flankers elicited faster and slower N1 latency, respectively; this may reflect speed of attention reorientation. Findings confirm that emotions influence inhibitory control but indicate that the nature of this influence changes depending on whether the emotional information is irrelevant or relevant to the task.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

F19 - Sequence-Level Emotional Context Reactivation during Sleep: Driving Positive Memory Learning Across Wakefulness and REM Stages

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Rapid eye movement (REM) sleep plays a crucial role in emotion and memory. Prior studies have shown that targeted memory reactivation (TMR) during REM can modulate emotional responses upon waking up. However, how TMR may induce emotional learning during REM remains underexplored. This study examines how reactivating positive emotional sequence during REM sleep can drive positive memory learning. During wakefulness (N=30), participants first learn two sets of word-picture pairs (positive vs. neutral) via sequential presentation. Each sequence involves eight items: six real positive words together with two pseudowords positioned in the middle and at the end of the sequence. During REM sleep, we replayed the positive words sequence, interspersed with novel pseudowords. Upon waking up, participants performed an implicit emotional preference task for pseudowords and a recognition task for all words. Results revealed

Cognition task. In this task, participants evaluated whether the movements of animated shapes depicted social or random interactions, corresponding to the Mentalizing and Random conditions, respectively. Five cognitive modes were derived: (1) DM, (2) Multiple Demand (MD), (3) Language (LAN), (4) Focus on Visual Features (FVF), and (5) Re-Evaluation (RE-EV). All exhibited higher activation in the Mentalizing condition, except for the RE-EV mode. Their functions in the context of ToM were proposed as engaging in mental projection into social narratives (DM), allocating external attention to task-relevant components (MD), processing non-verbal communication (LAN), focusing on visual features of the social stimuli (FVF), and re-evaluating ambiguous patterns of the random stimuli (RE-EV). Our results confirmed the activation of DM during ToM and revealed the contributions of additional cognitive modes. The temporal patterns of these cognitive modes can serve as inputs for machine learning algorithms aimed at subtyping patients with psychiatric conditions to advance toward precision psychiatry.

Topic Area: EMOTION & SOCIAL: Other

F23 - It's Time for Resting Pitch Face: How Musical Key and Tempo Influence Neutral Face Appraisals.

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Music enhances facial-affect perceptions (Logeswaran, 2009). The present study explores how musical key and tempo influences neutral-face judgements. Sixty undergraduates (mostly female) were randomly assigned to an instrumental-music condition: major/fast, major/slow, minor/fast, and minor/slow. They completed 2 tasks, during which they viewed neutral faces (Chicago Face Database), indicating perceived valence through a 5-point Likert-scale (very negative to very positive). This task was first completed while listening to background white noise (control) and subsequently listening to their assigned musical condition. Valence measures and task reaction time (rxnt) were measured. Between-samples non-parametric Kruskal-Wallis tests were performed. Valence ratings were not influenced by key nor tempo ($p > 0.05$). There were effects on rxnt, measured in seconds. Concerning key, a main effect revealed quicker rxnt for minor (2.57) compared to control (3.38), $p = 0.015$. Regarding tempo, main effects uncovered quicker rxnt for all musical conditions (fast:2.73; slow:2.41), compared to control, $p = 0.019$. Further investigations reveal an interaction ($p = 0.0002$) with faster rating responses for congruent musical pairings (minor/slow:2.17 and major/fast:2.62) compared to the control. This musical quickening was not maintained for incongruent pairings (minor/fast and major/slow). The current valence findings do not align with prior research, which may be explained by methodological differences, with our instrumental music being continuously played in the background (vs. music prior to ratings). Meanwhile, faster rxnt align with increased cognitive arousal associated with background musical inductions (Prasad, 2013; Young-Sung, 2022). Pairing congruence of musical features may yield higher

cognitive availability (faster rxnt), compared to non-congruent pairings, whose features may occupy cognitive reserves.

Topic Area: EMOTION & SOCIAL: Person perception

F24 - Rapid and persistent neural representations differentiate crowd vs. individual faces: an magnetoencephalography (MEG) study

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Reading the “mood of a crowd” is essential for adaptive social behavior, from avoiding threats to navigating everyday interactions. Prior work suggests that processing emotional information in crowds versus individual faces engages distinct neural pathways, with earlier dorsal-stream activation for crowds and later ventral-stream activation for single faces. However, it remains unclear how representations of crowds versus individuals unfold relative to other facial dimensions (e.g., sex) and whether these neural representations predict behavior. Using time-resolved representational similarity analysis (RSA) of MEG data, we examined how the brain encodes different types of social information from facial crowds and individual faces. Adult participants ($N = 44$) viewed either two crowds (four faces each) or two individual faces presented bilaterally, with one side displaying angrier or happier expressions and the other neutral. Participants indicated which crowd or person they would avoid. Whole-brain RSA revealed that the brain discriminated crowds from individual faces as early as 110 ms post-stimulus, comparable to the latency for recognizing facial sex, indicating that distinguishing crowds from individuals is an early and fundamental perceptual process. This distinction continued to explain the largest variance in neural time courses, whereas sex-related effects plateaued rapidly, suggesting sustained engagement of crowd-versus-individual representations during the task. The strength of this distinction correlated with behavioral accuracy in avoiding the angrier side ($r = .40$, $p < .05$), underscoring its functional relevance for adaptive social-emotional decisions. These findings demonstrate that neural encoding of facial crowds emerges rapidly, persists throughout processing, and predicts behavioral performance in social-emotional decision-making.

Topic Area: EMOTION & SOCIAL: Person perception

F25 - Visual perception reveals a paradoxical relationship between emotions and our sense of the persisting “self”

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People can seem “not quite like themselves” when moved by grief or anger. How do emotions (which we typically think of as transient) interact with our notion of who a person is over time (which we typically think of as stable)? Questions on identity are long-standing philosophical puzzles that are difficult to explore empirically. Here, we take a novel experimental approach inspired by work in visual

perception, where identity can instead be thought of in terms of *perceptual correspondence*: is an object that passes behind an occluder the same object that leaves? We investigated how emotions might interact with perceptual correspondence in *people*, not just objects. We first verified that perceptual correspondence is disrupted with a switch in actual facial identity across the occluder, after which we tested this in the context of emotions. The face could either maintain its emotional expression, or undergo an emotional transition (e.g., start neutral and become sad). In theory, we should observe perceptual correspondence, since facial identity remains the same—unless emotions are encoded uniquely in perception. Results revealed this striking pattern, where perceptual correspondence disappeared when the face's emotion changed, despite preserved facial identity. This generalized to other emotional transitions, and did not occur for other visually equivalent changes that should be extrinsic to identity (e.g., changes in shadows cast on the face). These results provide a new way of understanding identity: a person's persisting "self" may be more paradoxically tied to the transient ebb and flow of their emotions over time.

Topic Area: EMOTION & SOCIAL: Person perception

F26 - Neural reactivation of self-relevant traits during sleep predicts selective consolidation of the positive self

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Depression is characterized by negative self-schema, i.e., a habitual tendency to interpret one's own qualities and experiences negatively. Strengthening positive self-referential memory may foster resilience and counteract depression. We tested whether replaying positive personality traits during non-rapid eye movement (NREM) sleep through targeted memory reactivation (TMR) promotes positive self-evaluation and to what extent individual differences in depressive symptoms modulate this effect. Sixty-five adults completed a baseline self-referential encoding task in which they evaluated whether a series of positive or negative personality adjectives described themselves, followed by overnight sleep. During stable NREM sleep, half of the positive traits and neutral adjectives were re-played to sleeping participants. Participants repeated the task immediately after awakening and approximately three days later. Bayesian linear mixed-effects models showed that TMR selectively increased self-endorsements for cued positive traits relative to uncued ones, with larger TMR benefits among individuals reporting lower depressive symptoms. Cue-locked EEG analyses revealed enhanced delta–theta and sigma power for positive-trait cues compared to neutral adjectives. Representational similarity analysis indicated that differences in sigma

band power features during 2.3–2.76 s post-cue intervals positively correlated with changes in self-referential endorsement, linking sleep physiology to behavioral change. During TMR, cue-locked slow traveling waves propagating backward predicted greater positive self-endorsement. Together, these findings demonstrate that positive traits can be selectively reactivated during sleep with item-specific neural representation. However, this reactivation process was reduced in individuals with higher depressive symptoms, suggesting impaired offline consolidation of positive self-referential memories as a potential mechanism underlying negative self-schema in depression.

Topic Area: EMOTION & SOCIAL: Self perception

F27 - Perceived burdensomeness and attention to words signifying social ostracism

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Social rejection (SR) and its consequences, especially feeling like a burden on others (perceived burdensomeness, PB), are precursors of anxiety, depression, and suicidal ideation; risks that may be exacerbated by stress. This study examined the effects of an acute, non-social stressor on event-related potential (ERP) indices of attentional biases to SR words (which should be self-relevant) in individuals high in PB. Twenty-two high PB individuals (Interpersonal Needs Questionnaire PB subscale > 11) completed 2 lab visits consisting of a series of 3-stimulus oddball tasks while ERPs were recorded. On one visit (order counterbalanced) they completed 2 runs of the oddball task; one with SR-related targets, the other with neutral target words, both before and after a verbal math task. On a different visit, a control task (computer game) intervened. Analyses focused on the peak latencies and amplitudes of 2 components sensitive to self-relevance: an early frontal positivity (P150) and subsequent negativity (N2). Repeated measures ANOVAs revealed that P150 latencies varied as a function of target status (target vs. non-target) and stimulus type (PB vs. neutral words). PB targets and non-targets did not differ in onset, while non-targets for neutral words were delayed relative to targets. N2 amplitudes were attenuated for PB relative to neutral words, converging with studies showing attenuation to self-relevant stimuli. Notably, these effects were not modulated by the stressor. Although preliminary, results suggest that words associated with SR are self-relevant in individuals high in PB, a bias that is not affected by an acute non-social stressor.

Topic Area: EMOTION & SOCIAL: Self perception

F28 - Baseline Anxiety Shapes The Mental Health Effects of an Interceptive Enhancement Intervention

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INTRODUCTION: Interoceptive accuracy—the ability to perceive internal bodily states—is closely linked to mental health, yet causal evidence remains scarce. While theories suggest interoception buffers against psychological distress, literature reveals significant inconsistencies and a lack of direct experimental manipulation. **METHODS:** This crossover study (N=28 students with elevated alexithymia) investigated whether an interoceptive enhancement intervention could improve mental health. Participants wore a watch for two weeks (one week per condition) that delivered vibrations matching either their real-time heart rate (active) or their heart rate from one hour prior (sham). Mental health outcomes (GHQ-12, anxiety, depression, alexithymia, anhedonia) and interoceptive function were assessed at baseline, post-condition, and at a one-week follow-up. **RESULTS:** No significant main differences were found between sham and active conditions. However, a significant interaction between baseline anxiety and feedback condition predicted anxiety, depression, and GHQ-12 scores, where sham feedback reduced distress more than real feedback in high anxiety participants. Follow up analysis showed that in highly anxious participants, sham feedback (but not real feedback) improved mental health compared to baseline. **CONCLUSION:** Contrary to hypotheses, sham feedback was more beneficial than real-time feedback for anxious individuals. This suggests that sham feedback may disrupt pathological interoceptive hypersensitivity. These findings highlight baseline anxiety as a critical moderator that may explain previous inconsistencies in interoception research.

Topic Area: EMOTION & SOCIAL: Self perception

F29 - Young and old adult brains experience opposite effects of acute sleep restriction on the functional connectivity network

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Chronic, long-term sleep loss is detrimental to brain health and cognitive ability. However, older adults are affected differently by acute, short-term loss of sleep than young and middle-aged adults. Older adults are more resilient to the effects of acute sleep loss and, depending on the cognitive domain, may be completely unaffected while younger adults suffer. To elucidate the brain network responses to sleep loss underlying these cognitive differences between age groups, we investigated the static and dynamic functional connectivity effects of sleep restriction (sleep limited to 3 hours) and how these effects differ between younger adults (20-30 years) and older adults (65-75 years). We found a functional connectivity subnetwork that was primarily strengthened in younger adults after sleep restriction but weakened in older adults after sleep restriction. Similar crossover interactions were consistently observed in further analyses of functional connectivity degree, modularity, and dynamic functional connectivity state fractional occupancy. Our findings demonstrate that the effect of sleep restriction on older adults is fundamentally different from younger adults. These results most strongly support the

compensation theory of aging, which predicts a fundamental shift in the effects of sleep loss, rather than a mere dampening of the sleep benefits experienced by younger adults.

Topic Area: EXECUTIVE PROCESSES: Development & aging

F30 - A longitudinal investigation of a potential experience-dependent bidirectional relationship between white matter & executive function

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Brain structure and cognitive functioning are inherently related, but nuances remain unclear. Some findings suggest that white matter (WM) drives cognitive change, while others suggest the reverse. The present longitudinal analyses attempted to disentangle directionality and timing of this relationship with regard to executive functioning (EF) and the right cingulum cingulate (CGC), a tract previously associated with EF. Across two longitudinal samples (N=93 at ages 5.5 and 6.5 years; N=134 at ages 7.5, 8.5, and 9.5 years), EF was measured using the parent-report Behavior Rating Inventory of Executive Function (BRIEF). Diffusion MR images were preprocessed, tracts were reconstructed, and DTI metrics (particularly FA, a proxy for fiber coherence, and RD, a proxy for myelination) were extracted using QSIprep and mrtrix3 (tractography) and pyAFQ (tractometry). Cross-lagged panel models controlling for age were then run to examine bidirectional relationships between right CGC and EF. Findings from cross-lagged panel models investigating fiber coherence (FA) suggested that FA of the right CGC at age 7.5 was related to EF at age 8.5 years, and FA of the right CGC at age 8.5 was related to EF at age 9.5 years. Additional models suggested that these relationships were largely driven by an index of myelination (RD). This particular set of findings suggests that WM drives cognitive change, but not vice versa.

Topic Area: EXECUTIVE PROCESSES: Development & aging

F31 - Independent Regulation of Cognitive Stability and Flexibility in Visual Search

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Research on cognitive control and visual search has progressed largely in parallel, despite the shared underlying focus on controlled attention. The current study aimed to bridge this gap by testing whether a recent key finding in cued task-switching—the observation of independence rather than a trade-off between cognitive stability and flexibility—would generalize to the domain of visual search. We developed a novel cued singleton search task where a central cue instructed participants to locate either a size or a luminance singleton feature while ignoring the alternate singleton feature, which could either overlap with the target singleton (congruent trials) or not (incongruent trials). This allowed us to simultaneously measure cognitive stability (singleton congruency effect) and flexibility (target-

switch cost). In a within-subjects factorial design, we orthogonally manipulated the block-wise proportions of incongruent trials (25% vs. 75%) and switch trials (25% vs. 75%) to independently vary the contextual demands on each function. These manipulations produced a clear double dissociation in behavior: The proportion of incongruent trials selectively modulated the congruency effect (260 ms vs. 113 ms) without affecting the switch cost. Conversely, the proportion of switch trials selectively modulated the switch cost (121 ms vs. 61 ms) without affecting the congruency effect. These results provide strong evidence against an obligatory stability-flexibility trade-off in visual attention. Instead, these data suggest that the independent regulation of stability and flexibility may be a general principle of controlled attention, thus providing an empirical link between cued task switching and visual search.

Topic Area: EXECUTIVE PROCESSES: Goal maintenance & switching

F32 - Intracranial EEG Correlates of Concurrent Demands on Cognitive Stability and Flexibility

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Two core capacities of cognitive control are cognitive stability (focusing attention on task-relevant stimuli while ignoring distracters) and cognitive flexibility (shifting between different task sets to guide behavior). Whether these capacities arise from distinct or overlapping neural mechanisms remains unclear, as prior studies investigated them in isolation using macroscale neural data (fMRI, scalp EEG) that lack sufficient temporal/spatial resolution. We obtained mesoscale neural data (iEEG) from 17 epilepsy patients (mean age=31, 7 females) during a local/global Navon letter task that independently varied demands on stability (congruent vs. incongruent stimuli) and flexibility (repeating vs. switching tasks) via trial-proportion manipulations. Subjects demonstrated robust behavioral congruency effects and switch costs that were selectively modulated by the proportions of incongruent trials and switch trials, respectively. We examined high-frequency (70-150 Hz) activity in lateral prefrontal cortex (LPFC) electrodes. Activity in most task-sensitive electrodes (N=29/47) was modulated by stimulus congruency and/or task switching demands, with effects emerging ~500ms post-stimulus. Some electrodes displayed exclusive congruency or switching effects (N=20/29), while others showed mixed selectivity via additive or interactive effects (N=10/29). A linear-discriminant classifier was able to decode both congruency (60% accuracy) and task switching (64% accuracy) processes from the LPFC electrode population, with classification accuracy for each process being selectively modulated by demands (proportion of incongruent/switch trials) on that specific process but not the other. These results demonstrate that LPFC employs a combination of domain-specific and domain-general neural ensembles to mediate independent, concurrent adjustments in cognitive stability and flexibility.

Topic Area: EXECUTIVE PROCESSES: Goal maintenance & switching

F33 - Preserved Performance, Altered Timing: Age Differences in Preparatory Neural Dynamics During Cross-modal Attention Switching

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Flexible allocation of attention across sensory modalities relies on preparatory control mechanisms that support efficient task switching. The present event-related fMRI study examined how advanced preparation modulates behavioral performance and cue-evoked neural dynamics in younger and older adults during a cued cross-modal attention-switching task. Thirty-six younger adults (19–27 years) and thirty-seven older adults (60–79 years) identified target location in a task-relevant sensory modality (visual or auditory), with preparation time manipulated via the cue–target interval (200 ms vs. 2100 ms). Behavioral results revealed robust switch costs, general preparation benefits, and switch-specific preparation effects, with comparable patterns across age groups, indicating preserved cross-modal flexibility in older adulthood. Whole-brain analyses identified switch-related activation within a frontoparietal control network and overall age differences in cue-evoked BOLD responses, but no evidence for age-related over-recruitment or age-by-condition interactions. Critically, ROI-based analyses of BOLD temporal profiles revealed age-dependent differences expressed more consistently in the timing, rather than the amplitude, of cue-evoked responses. In posterior regions (including the angular gyrus and cuneus) and frontal control regions (including the middle frontal gyrus), younger and older adults differed in how the timing of cue-related BOLD responses varied as a function of transition type and preparation interval, despite similar response amplitudes and preserved behavioral performance. These findings indicate that age-related differences in cross-modal attention switching are primarily reflected in altered temporal dynamics of preparatory neural processes rather than compensatory increases in activation magnitude.

Topic Area: EXECUTIVE PROCESSES: Goal maintenance & switching

F34 - Maintenance suppression and retrieval suppression share common neural mechanisms to regulate intrusive thoughts

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The ability to control unwanted memories is a core feature of cognition that supports adaptive behavior. Individuals can exert inhibitory control over representations in long-term memory (LTM; retrieval suppression) and working memory (WM; maintenance suppression) to

modulate their accessibility. However, because these processes have typically been studied separately, their relationship remains unclear. When retrieval suppression fails, unwanted information can intrude into WM, creating a need for maintenance suppression to reestablish control. We hypothesized that maintenance suppression and retrieval suppression rely on overlapping yet distinct neural mechanisms that support the control of intrusive thoughts. We developed a novel fMRI paradigm integrating the Think/No-Think task with a WM removal task to test this prediction. Participants (N = 51) learned arbitrary cue-target image pairs, then completed alternating WM and LTM control blocks. In WM blocks, participants viewed target images and were instructed to either Maintain or Suppress them in working memory. In LTM blocks, participants viewed cue images and were instructed to either retrieve (Think) or suppress retrieval (No-Think) of the associated target. After each trial, participants reported how often the target intruded into awareness during the 10s control period. Whole-brain fMRI classification analyses revealed that each control strategy engaged distinguishable multivariate activity patterns. Critically, when intrusions occurred on No-Think trials, neural patterns for No-Think and Suppress operations converged, suggesting WM control was recruited in these situations. These findings suggest that maintenance suppression and retrieval suppression are distinct processes that work in concert to prevent unwanted memories from occupying the focus of attention.

Topic Area: EXECUTIVE PROCESSES: Monitoring & inhibitory control

F35 - An Investigation into the Effects of a Single Bout of Passive Versus Active Exercise on Arousal and Executive Function

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Extensive literature reports that a single bout of active and passive exercise elicits a postexercise executive function (EF) benefit. Previous work proposed the benefit – in part – relates to an exercise-mediated increase in cerebral blood flow (CBF). It is, however, possible that an increase in CBF is an unrelated epiphenomenon and that the EF benefit reflects an exercise-mediated increase in psychophysiological arousal. Here, healthy young adults (N=17) completed, on separate days, 20-min sessions of a non-exercise control condition, and conditions involving 20-min of passive (via mechanically driven cycle ergometer flywheel) and active light intensity (cycle ergometer at 37 W) exercise. For all conditions, heart rate variability (HRV) was measured to provide an intervention-based measure of arousal, and EF was assessed prior to and immediately following each condition via the antisaccades task (i.e., saccade mirror-symmetrical to target). Results showed that passive and active exercise decreased time and frequency domain indices of HRV and thus indicated an increase in arousal. As well, active ($p=0.0004$) and passive ($p=0.008$) exercise produced a postexercise reduction in antisaccades reaction times; however, the magnitude of the reduction

was not associated with HRV metrics. Thus, a single bout of active and passive exercise provides an EF ‘boost’ and offers convergent evidence that the benefit is not attributed to a unitary mechanism related to increased psychophysiological arousal or CBF.

Topic Area: EXECUTIVE PROCESSES: Monitoring & inhibitory control

F36 - Unraveling Psychiatric Heterogeneity: Integrating Genes, Circuits, and Immunity

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Psychiatric disorders such as major depressive disorder, bipolar disorder, schizophrenia, and generalized anxiety disorder are still diagnosed through symptom-based systems like the DSM and ICD, which overlook the biological heterogeneity within diagnoses. Patients sharing the same diagnosis often differ in symptoms, treatment response, and neurobiology. This unseen heterogeneity has delayed progress, preventing precision medicine in psychiatry. This study proposes a multi-dimensional framework reconceptualizing psychiatric illness as the emergent product of genetic, neurocircuit, neuroimmune, and phenotypic interactions. Analyzing findings from over 40 studies spanning from GWAS, polygenic risk scores, neuroimaging (fMRI, DTI), and immune profiling, this paper bridges categorical diagnosis with dimensional biology to further advance precision psychiatry. The framework examines four domains of heterogeneity: (1) Genetic, identifying pleiotropic loci and shared heritability across disorders; (2) Neuroimaging, highlighting variable default mode network connectivity and gray matter alterations; (3) Neuroimmune, detailing cytokine dysregulation and microglial activation underlying immunophenotypic subtypes; and (4) Clinical, exploring how sex, trauma, and age of onset shape divergent symptom clusters. Using behavioral datasets, symptom patterns were mapped to illustrate how trauma modifies psychiatric presentation. The resulting model identifies biologically coherent “biotypes” that transcend traditional categories, such as subgroups sharing elevated IL-6, reduced prefrontal activation, and immune-linked polygenic risk—enabling targeted, equitable interventions. Finally, the study addresses ethical and infrastructural challenges of multimodal data integration, advocating open-access consortia and policy provision. By aligning molecular biology with human narrative, this paper changes the standpoint on psychiatry and highlights the importance of systems-based science of the individual mind.

Topic Area: EXECUTIVE PROCESSES: Monitoring & inhibitory control

F37 - Transdiagnostic Disruptions of Dorsolateral Prefrontal Engagement in Cognitive Reflection

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Cognitive reflection, the ability to override intuitive but incorrect responses, relies heavily on executive control processes supported by the dorsolateral prefrontal cortex (dlPFC). The Stroop task similarly requires inhibition of prepotent, automatic responses. Although deficits in cognitive reflection have been observed across psychiatric disorders, the associated neural correlates remain unclear. This study examines whether cognitive reflection performance is associated with right dlPFC activation during the Stroop task, and whether this relationship is moderated by psychiatric diagnoses. Cognitive reflection was assessed using the Cognitive Reflection Test (CRT). Functional MRI data were obtained from 123 adults currently diagnosed with a broad range of psychiatric illnesses and 81 healthy participants from the Transdiagnostic Connectome Project. We extracted the right-dlPFC BOLD signal during the Stroop task (incongruent > congruent) using the Schaefer (17-network) parcellation between patients and healthy participants. Patients and healthy participants did not differ in right dlPFC activation during the Stroop task ($t = -0.43$, $p = 0.67$). Healthy participants performed better on the CRT ($t = -2.49$, $p = 0.014$) than patients, although there were no group differences in total response time ($t = 1.85$, $p = 0.066$). Among healthy participants, higher right dlPFC activation during the Stroop task was positively associated with CRT performance ($r = 0.26$, $p = 0.017$), whereas this association was not observed in patients ($r = -0.13$, $p = 0.16$). These findings suggest that while the right dlPFC supports cognitive reflection in the healthy population, such prefrontal engagement may be disrupted in people with psychiatric disorders.

Topic Area: EXECUTIVE PROCESSES: Monitoring & inhibitory control

F38 - What Gets Decoded in Frontoparietal Cortices?

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Numerous studies have claimed that conscious, task-relevant, attended, working memory (WM) items may be decodable from frontoparietal regions. However, their designs unwittingly had a key confound. The exemplars being decoded (e.g., different WM contents) corresponded to specific and unique trials. Since trials are the task units participants execute, this ends up linking the distinct exemplars being decoded with distinct task or goal identities, leaving it unclear if these studies decoded anything other than these identities. Here, we removed this confound. Instead of the usual design of one exemplar occurring on a single trial and different exemplars occurring on distinct trials, we had participants execute an extended task episode that had them attend to a series of 6 pictures, presented one at a time. Participants were given the goal of detecting up to 3 instances of pictures repeating after two steps. This required participants to encode and keep every presented picture in their WM across two steps. Since goal completion involved going over multiple pictures, individual pictures could no longer be linked to distinct goal identities. We found that despite being task-relevant, attended, and encoded into WM, such pictures could not be decoded from frontoparietal regions and were

only decodable from visual regions. Three other multivariate methods confirmed that distinct pictures did not elicit distinct activity patterns in frontoparietal regions. In contrast, goal-related information – the number of repeats detected so far – was readily decodable in frontoparietal regions, suggesting that only higher-level, goal-related entities are represented in them.

Topic Area: EXECUTIVE PROCESSES: Other

F39 - Transdiagnostic Identification of Cognitive Subtypes and White Matter Correlates

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Cognitive impairments are widespread across affective and psychotic disorders, frequently persisting beyond symptom remission and limiting both functional recovery and treatment engagement. Yet substantial heterogeneity remains. Individuals with the same diagnosis can show markedly different cognitive, clinical, and neurobiological profiles, while patients with different diagnoses may share similar characteristics. Transdiagnostic identification of cognitive subtypes, along with investigation of underlying neural mechanisms such as white matter tract integrity, may therefore provide a more powerful framework of variability in illness presentation and support personalized, mechanism-based interventions. Using data from our large-scale transdiagnostic and deeply phenotyped cohort ($N = 2472$; HC, MDD, BD, SSD), we applied k-Means clustering, based on principal components derived from eight neuropsychological tests comprising more than 40 variables, to derive transdiagnostic cognitive subgroups. Group differences in cognitive and clinical variables were examined using non-parametric tests, with multiple comparison control and rank-based effect sizes. Logistic regression assessed associations between sociodemographic, clinical, and symptom characteristics and cluster membership. To explore neurobiological relevance, diffusion-tensor imaging was used to examine whether cognitive subtypes differ in white matter microstructure. Since white matter pathways support information processing across distributed brain networks, structural alterations may offer mechanistic insight into cognitive variability beyond categorical diagnoses. Two transdiagnostic cognitive subtypes emerged, showing significant differences in neuropsychological performance, white matter integrity, and clinical characteristics. These findings highlight clinically meaningful cognitive heterogeneity in major psychiatric disorders and emphasize the value of cognitive profiling for improving prognostic assessment and guiding personalized treatment approaches.

Topic Area: EXECUTIVE PROCESSES: Other

F40 - Greater daily variability in cognition and mood predicts lower mean cognitive function in young adults

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In older adults, greater day-to-day variability in cognitive function appears to be associated with higher rates of cognitive decline, relative to those showing less daily cognitive variability. Such findings suggest that daily cognitive variability isn't simply measurement noise, but rather, vitally informs on cognitive status in older adults. But what about these dynamics in younger adults? Does daily variability in cognition potentially inform on cognitive wellness for those in their neurocognitive prime? Here we addressed this question using an experience sampling method to assess participants' subjective sense of their cognition and mood three times a day over 14 days in a sample of 215 young, healthy adults. After controlling for four baseline measures of cognition (metacognitive awareness, executive function, propensity for cognitive failures, and memory failures) and four baseline measures of mood (depression, state and trait anxiety, and loneliness), we found that not only did subjectively-assessed cognitive function show significant day-to-day variability across the sample population, but greater cognitive variability across the two-week period predicted lower mean function across the two weeks. While daily cognitive variability also showed a significant correlation with daily measures of both negative and positive mood, notably, some individuals were more resilient to these daily mood impacts on cognition than others. Taken together, our findings suggest that daily variability in cognition and mood may be important predictors for understanding cognitive wellness in younger adult populations.

Topic Area: EXECUTIVE PROCESSES: Other

F41 - Neurobiological mechanisms associated with reading and math processes

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Children's reading and math skills are critical to their future educational outcomes, career readiness, and overall health and well-being, yet many children do not reach proficient status in either academic domain. Individuals who struggle with math or learning to read often display weaknesses in executive function skills on behavioral measures, which may underlie a fundamental basis for their deficits. Conversely, individuals who struggle with reading or math may need to recruit additional executive function skills to compensate for their poor reading and math problem-solving to meet task demands. This study aims to distinguish the neurobiological mechanisms underlying reading and math processes, especially highlighting those associated with executive functions, to help understand the development of these academic skills. Children, ages 7-9, completed behavioral and neuroimaging tasks related to reading, mathematics, and executive functions. Behavioral findings indicate that working memory was positively correlated with reading and mathematical ability. Interestingly, attention and inhibition were positively correlated with

math, but not reading. Preliminary brain imaging results indicate that although there was activation in brain regions associated with EF across tasks, the patterns of activation in these regions were distinct for reading, math, and executive functioning tasks. Data will continue to be analyzed to further examine the underlying role of executive functions in reading and math in children. By understanding the association between executive functions and domain-specific academic skills, we will gain greater insight into the development of reading and math, and how executive functions can hinder or facilitate academic growth.

Topic Area: EXECUTIVE PROCESSES: Other

F42 - Visual working memory representations of naturalistic images in the early visual cortex are not sensory-like

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Sensory working memory has long been thought to be supported by sustained activity in prefrontal and parietal areas. This view has been challenged by the "sensory recruitment model", which proposed that sensory areas are involved in the maintenance of working memory representations. Evidence for this model comes from human neuroimaging studies using multivariate pattern analysis showing that working memory contents can be decoded from sensory areas during maintenance. However, the presence of stimulus-related information in sensory regions, does not necessarily indicate that this information is encoded in a perceptual format, similar to how sensory stimuli are initially encoded. Working memory contents could instead be encoded in distinct formats, potentially undergoing dynamic changes throughout the delay phase. This question has rarely been examined directly. Here, we address this gap by requiring participants to briefly memorize naturalistic object-scene stimuli. These stimuli were generated synthetically using a procedure based on a generative AI model (Stable Diffusion), which allowed us to control the similarity

between them parametrically. We directly compared the way information is encoded in patterns of brain activity in the early visual cortex during perception and working memory maintenance. Consistent with prior work, we found robust stimulus-related information throughout the delay period. However, despite robust information, the encoding of memory contents in the later delay period did not employ the same format as during pure perception. This result was replicated in higher visual areas as well. Thus, although sensory areas contain working-memory-related information, the format of this information is not strictly sensory-like.

Topic Area: EXECUTIVE PROCESSES: Working memory

F43 - No evidence for an object working memory capacity benefit in a whole-report task

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Visual working memory (VWM) is the ability to hold and manipulate visual information in mind. Oftentimes, researchers study VWM with simplistic stimuli such as colored squares. However, several prior studies suggest that simplistic stimuli underestimate the capacity of VWM since they found an object benefit, whereby VWM performance is higher for meaningful real-world objects compared to colored squares. In this study, we sought to (1) replicate and extend the VWM object benefit in a whole-report VWM task and (2) test whether proactive interference may modulate the difference between simplistic stimuli and meaningful stimuli. In two experiments (n=26 each), we compared VWM performance for colored squares versus real-world objects. On each trial, participants remembered 6 items across a blank delay, and reported the correct binding of each item to its location at test (i.e., participants made 6 memory responses in a “whole-report” paradigm). In Experiment 1, the stimulus pools were matched between colored squares (9 possible colors) and objects (9 possible objects). In Experiment 2, the stimulus pool was smaller for colors (9 possible colors) than for objects (hundreds of trial-unique objects). In both Experiments 1 and 2, we found no evidence for an object benefit in VWM. Instead, we found a significant color benefit, such that participants remembered significantly more color-location bindings compared to object-location bindings ($p < .001$). Based on our results, we speculate that the object benefit effect observed in recognition tasks (e.g., 2-AFC) does not generalize to other tasks such as whole-report.

Topic Area: EXECUTIVE PROCESSES: Working memory

F44 - The Pink Of A Blue Flamingo: Effects Of Prototypical Object-Colour Representations On Visual Working Memory

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Visual working memory relies on both sensory and abstract representations. Previous research has shown that visual working memory can be influenced by perceptually presented distractors. Here, we demonstrate that colour working memory can be subject to abstract interference without distracting visual input, and that this distraction effect depends on the similarity between memoranda and abstract distractor. In each trial of the experiment, we asked participants to memorize and recall the colour of two stimuli. Twelve stimuli were drawn from a pool of previously studied objects that have a strong association with one colour (e.g., flamingo with pink). We confirmed the prototypical colours in a pilot experiment and selected four non-prototypical sample stimuli that were either near to (+/- 60°, e.g. blue flamingo) or far from (+/- 120°, e.g. green flamingo) the prototypical colour of the objects. Prototypical object-colours were never shown, but their internalized representation (e.g., flamingos as pink) served as distractor for the to-be-memorized stimulus (e.g., green flamingo). We found that these purely internal distractors had an effect on the recalled colour that depended on distance to the prototypical colour. Participants recalled near colours (+/- 60°) as more similar to the prototypical colour (attraction bias), while far colours (+/- 120°) were recalled as further away (repulsion bias). A blue flamingo was thus reported as more purple, while a green flamingo was reported as more yellow. These results suggest that visual working memory is affected by abstract representations of prototypical object-colour pairs that were never shown.

Topic Area: EXECUTIVE PROCESSES: Working memory

F45 - Beta oscillatory—not burst—dynamics support priority coding in working memory

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Flexible control of working memory (WM) requires prioritizing immediately relevant information while deprioritizing information with potential future relevance. We examined the role of oscillatory dynamics in priority coding. With double serial retrocuing (DSR), we manipulated prioritization in WM by presenting two oriented sample gratings, then a cue indicating which sample will be tested at “Recall1,” then Recall 1, then a cue indicating which sample (equal probability) will be tested by “Recall 2”. A matched neutral-cue condition (NEU) used uninformative cues. Experiment 1 used dense behavioral sampling, varying the cue-to-recall delay from 500 ms-1200 ms, in 16.67 ms increments, and permutation-based FFT indicated that mean absolute error on DSR oscillated at ~15 Hz (i.e., “low-beta”) and on NEU at ~20 Hz (i.e., “higher-beta”). We interpret these beta events ~1200 ms as oscillations rather than bursts. For Experiment 2, we recorded EEG. Using Specparam (previously FOOOF) to identify oscillatory peaks, we observed that, for DSR only, the cue shifted the

distribution of oscillations to the low-beta range. Finally, we carried out a time-resolved representational similarity analysis (RSA), which also fluctuated across the delay period. FFT of the RSA time course revealed that whereas, for DSR, the cue increased peak density in low-beta, for NEU, it increased peak density in “higher-beta.” Whereas many recent accounts have emphasized a role for beta bursting in the implementation of cognitive control, these results—from behavior, raw EEG, and RSA of EEG—suggest a role for prolonged oscillatory activity in the low-beta band in controlling priority in WM.

Topic Area: EXECUTIVE PROCESSES: Working memory

F46 - Biomarkers of Strategy Use in Cognitive Ageing: Insights from Neural and Eye Movement Data

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In visual working memory (VWM) tasks, both the encoding and maintenance of information engages the dorsolateral prefrontal cortex (DLPFC). However, activation within this network varies with age, where older adults may exhibit reduced lateralisation and less efficient prefrontal activity. To compensate for age-related declines in more specialised regions, the brain may recruit additional prefrontal resources to strengthen existing connections – a process referred to as ‘scaffolding’. Cognitive strategies such as prioritising certain information may serve as one such compensatory mechanism. Yet, despite its theoretical importance, the influence of strategic approach on neural activation in ageing remains underexplored. To address this, we combine functional near-infrared spectroscopy (fNIRS) and eye-tracking to investigate: (1) general age-related differences (younger vs. older adults) in prefrontal activation during a VWM task, (2) the impact of instructing prioritisation and verbalisation strategies on behavioural performance, prefrontal neural activity and eye movement patterns, and (3) the relationships between behavioural performance, prefrontal neural activity and eye movement patterns in both age groups. Importantly, we employ realistic, real-world object stimuli generated by artificial intelligence, enhancing ecological validity beyond standard laboratory paradigms. By integrating multimodal measures of brain and behaviour, this research aims to uncover how strategic processes and compensatory mechanisms affect young and older adult’s visual working memory performance.

Topic Area: EXECUTIVE PROCESSES: Working memory

F47 - Feedback to early visual cortex is required for conscious visual experience during working memory maintenance

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The role of the early visual cortex (EVC) in visual working memory (VWM) maintenance has remained controversial. While human fMRI studies consistently report sustained maintenance of stimulus-specific representations in the EVC during VWM, electrophysiological recordings in non-human primates have largely failed to find such evidence. Here we investigated a previously understudied aspect of VWM, conscious visual experience during maintenance, that may explain EVC functions in human VWM. We studied individuals with aphantasia, who subjectively report an inability to generate and sustain visual mental images despite being able to perform VWM tasks. Using fMRI, we compared perception-, imagery-, and illusion-based VWM between typical imagers and aphantasics while they viewed or imagined a moving Gabor patch in the right visual periphery and maintained it across a delay. Time-resolved decoding of motion paths across the visual hierarchy revealed impaired imagery generation signals in contralateral intraparietal sulcus (IPS) of aphantasics. Furthermore, aphantasics exhibited normal feedforward activity during the sample period, but reduced representations of motion paths across all three conditions during the delay in contralateral EVC. These representational impairments were accompanied by reduced delay-period functional connectivity between contralateral IPS and EVC. In contrast, ipsilateral IPS maintained intact, non-visual representations that potentially supported successful memory performance in aphantasics. These results suggest that normal, delay-period stimulus representations in the EVC depend on top-down feedback from higher-order regions such as the IPS. Such feedback to the EVC is critical for the conscious visual experience of visual content during VWM maintenance.

Topic Area: EXECUTIVE PROCESSES: Working memory

F48 - Competition during working memory enhances long-term memory

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Working memory (WM) continually interacts with the external environment, yet how such interactions shape short- and long-term memory remains unclear. A key factor modulating this influence is the perceptual similarity between visual inputs and WM content. Inputs that resemble what we hold in mind could facilitate or interfere with WM content, or simultaneously engage both processes. To adjudicate between these possibilities, we developed a WM task using naturalistic

stimuli in which a task-irrelevant distractor appeared during WM maintenance. We systematically varied the similarity of this visual input to both task-relevant and -irrelevant WM items. To assess how competition between WM and visual inputs shapes long-term memory (LTM), we later tested memory for stimuli encountered in the WM task. Across two studies, we found that moderate similarity between visual inputs and behaviorally relevant WM content yielded the best WM performance, whereas dissimilar or highly similar inputs impaired it. These results suggest that perceptually similar inputs can support WM representations up to a point, beyond which interference dominates. Strikingly, stronger interference during WM predicted better long-term memory, indicating that competition between internal and external representations promotes durable encoding. Together, these findings reveal how overlap between thought and perception shapes both momentary cognition and lasting memory.

Topic Area: EXECUTIVE PROCESSES: Working memory

F49 - Structural and Functional MRI Insights into Bilingualism & Cognition in Aging

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As the global population ages, the prevalence of dementia and age-related cognitive decline rises. Understanding the neural mechanisms that contribute to cognition is therefore increasingly important. Previous research has examined the role of white matter in relation to structural and functional brain regions, often considering these domains separately. Much of this work has focused on entire white matter tracts; however, not all fibers in a white matter bundle are necessarily relevant for a particular cognitive function. This research investigates whether sub-bundles of white matter tracts provide a more robust measure of the relationship between white matter organization and cognition in younger and older adults. Additionally, it examines how bilingual experience may enhance white matter tract properties, potentially supporting more efficient neural communication. Fifty participants (26 younger adults aged 18–30 and 24 older adults aged 60+) completed three sessions involving behavioural, language, and MRI assessments. Bilingual experience was measured using the Language and Social Background Questionnaire and a Verbal Fluency Ratio derived from the Bilingual Aphasia Test. Cognition was measured with the arrow Flanker task performed during fMRI scanning. Using FSub-Extractor, we identified functional sub-bundles connecting task-related regions of interest. Multivariate analyses will be conducted to examine relationships among white matter integrity, bilingual experience, and behavioral performance. By linking white matter microstructure to both structural and functional measures, this work aims to advance our understanding of the neural pathways that support cognitive function across the adult lifespan.

Topic Area: LANGUAGE: Development & aging

F50 - Vocalization Processes Across Age and Sex in Common Marmosets

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Understanding the complexity of vocal communication is essential in the study of social behaviours and neurological disorders, as it provides an insight into cognitive and neural processes underlying social interactions. With their very social organization, and complex vocal repertoire, common marmosets (*Callithrix jacchus*) are the ideal model to study vocalization and its development. In this study, I aim to understand the complexity and development of marmosets' vocalization. To do so, I recorded groups of marmosets sharing common features (age, sex, and/or group affiliation). I developed an XGBoost algorithm-based classifier to predict the sex and age of adult marmosets based on acoustic features extracted across different call types. The model achieved good accuracy and identified key voice features contributing to sex and age discrimination. I am examining longitudinal changes in vocalization among young marmosets (4 to 24 months old) using UMAP dimensionality reduction to visualize and quantify developmental trajectories based on acoustic features. I was able to observe possible call subtypes forming cluster that become more distinct and display stronger familial signature between 4 and 10 months of age. Finally, I will perform awake fMRI paradigms in adults and young marmosets, to investigate how the marmoset brain processes others' calls, encodes voice features, and how these evolve through development. Together, these studies aim to establish a comprehensive framework linking vocal production, development, and neural processing, to ultimately better understand communication and its alterations in neurodevelopmental disorders.

Topic Area: LANGUAGE: Development & aging

F51 - Interactive Auditory Experience Accelerates Maturation of Beta–Gamma Coupling in the Infant Brain

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The infant brain undergoes rapid structural and functional reorganization during the first year of life, making it exceptionally plastic and responsive to auditory input. Early experience with sound provides critical scaffolding for neural systems that later support language and cognition. This poster examines how the timing and type of early auditory experience influence the maturation of spontaneous cortical oscillations during infancy using data collected from two different studies. In the first study, infants were assigned to one of three groups: Active (interactive auditory training at 4.5–6 months), Passive (exposure without interaction), or Naïve (no exposure). Analyses of spontaneous EEG revealed that early interactive experience accelerated developmental increases in beta and gamma power, promoting more mature cross-frequency relationships and

suggesting enhanced functional organization of cortical networks. A second longitudinal study, which considered a separate group of infants, evaluated the impact of shifting the onset of auditory training to 6.5–8 months. Within-group maturation trajectory comparisons of trained (Active) and untrained (Naïve) cohorts demonstrated that intervention produced stronger and more sustained modulation of high-frequency oscillatory power in the Active group. Cross-frequency analyses further revealed similar developmental changes in beta–gamma coordination as observed in the first cohort, with early enhancement of coupling followed by an increase in independent frontal gamma power, indicative of local cortical maturation. This poster presents converging evidence that early interactive auditory experience enhances the neural dynamics underlying sensory and cognitive development, offering insight into mechanisms that may mitigate the risk of developmental language disorders.

Topic Area: LANGUAGE: Development & aging

F52 - Oscillatory Bursts as Neural Markers of Predictive Speech Processes

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Predictive speech processing relies on oscillatory dynamics in the auditory and higher order language regions, with theta (4-8 Hz) oscillations tracking syllabic rhythms and supporting bottom-up auditory signalling, and beta (15-30 Hz) oscillations mediating top-down inhibitory control and prediction. These signals often manifest as transient bursts with precise temporal characteristics offering insight into neural timing. However, the functional roles of bursts in continuous, natural speech processing remain unresolved. Our work investigates beta and theta bursts in naturalistic speech processing using MEG data from 11 healthy participants listening to TED talks. An artificial neural network predicted upcoming words, and outputs were used to derive proxy measures of contextual uncertainty and lexical surprise for each word. We mapped cortical sources of MEG data and detected beta and theta bursts in 200 regions of interest. Throughout natural speech, beta and theta bursts changed with auditory input, with beta bursting increasing in bilateral auditory and language regions during pauses and theta increasing in similar left-lateralized regions during word presentation. Furthermore, uncertainty and surprise of presented words modulated bursting responses: predictable words elicited early beta burst suppression and reduced theta bursting, while surprising words elicited delayed but prolonged beta burst suppression and increased theta bursting. Spatial analysis revealed both bottom-up and top-down beta and theta burst propagation relative to the auditory cortex depending on contextual uncertainty. Our results shed light on the temporal dynamics of speech processing, demonstrating complementary roles of beta and theta bursting in signalling predictive speech features.

Topic Area: LANGUAGE: Lexicon

F53 - EEG and Cognitive Markers of Comorbid Dyslexia and ADHD

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ADHD and reading disabilities (RD) are frequently comorbid in children. What underlies this comorbidity is unclear, but a shared underlying deficit that increases the likelihood of either disorder has been suggested. A variety of domain-general skills have been implicated, most commonly processing speed and working memory. This study addresses the uncertainty by drawing on children and adolescents from the Healthy Brain Network (HBN) biobank with RD (N = 101), ADHD (N = 533), both ADHD and RD (N = 80) and 404 typically developing controls. Groups were compared on processing speed, working memory, rapid naming and executive functioning tasks, as well as resting-state alpha-band EEG. The results do not support processing speed or working memory as a shared deficit between RD and ADHD. However, in the comorbid group, the presence of an RD, not ADHD, contributed most to a greater impairment across all cognitive assessments. Resting-state alpha-band EEG in eyes-closed or eyes-open trials failed to significantly distinguish between groups. Moreover, multinomial logistic regression used cognitive task scores and alpha power anterior-posterior difference scores to best predict classification to the RD, ADHD, ADHD+RD or control groups. Overall, group classification was primarily predicted by a set of common cognitive factors, as well as several distinct factors that jointly determine whether an individual shows ADHD, RD, both or neither.

Topic Area: LANGUAGE: Other

F54 - Modulating neural oscillations to improve functional communication in post-stroke aphasia

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Post-stroke aphasia is associated with changes in neural oscillations underlying language, with abnormal activity in the theta frequency range predicting poorer recovery of language production abilities. Although some studies have suggested transcranial direct current stimulation (tDCS) can improve word-level production in people with aphasia (PWA), most have not evaluated effects of stimulation on measures of complex, real-world functional communication or the cognitive processes that support it. Moreover, while tDCS tonically increases neural activity, transcranial alternating current stimulation (tACS) has the potential to entrain neural oscillations that underlie complex communication, which relies on both language processes and cognitive functions such as working memory (WM). In an ongoing within-subjects pilot experiment, N=12 participants with non-fluent post-stroke aphasia receive sham or active (2mA) high-definition theta-tACS (6.5Hz) over the left inferior frontal gyrus (IFG) while completing tasks designed to measure language production and

comprehension under varying WM loads. Speech-analysis software is used to extract measures of functional communication, including accuracy, response latency, speech rate, and utterance length. We hypothesize that, compared to sham, active theta-tACS over the IFG will improve functional communication performance, particularly under higher WM load, reflecting a role of theta oscillations in complex language production that relies on WM processes. Results will inform our understanding of language-cognition interactions and elucidate the potential for neuromodulation to improve real-world communication in PWA.

Topic Area: LANGUAGE: Other

F55 - Neural encoding of articulatory features during naturalistic speech perception

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The role of the speech production system during speech perception has long been debated. Although previous findings support that phonetic perception recruits cortical articulatory representations, this interaction has largely been studied in unnatural listening paradigms. For example, finding that motor cortex activates somatotopically when a listener hears individual syllables, and perceptual judgements of isolated words can be biased according to the listener's own orofacial configuration. It remains unknown, however, whether sensorimotor integration is specific to the active perception of basic linguistic stimuli, or whether naturalistic listening to continuous speech, with much richer predictive structure, involves similar processes. In the present study, we tested whether articulatory representations are encoded during naturalistic speech comprehension. We re-analyzed previously obtained magnetoencephalography (MEG) data from 11 healthy participants listening to various TED talks (total listening time = 60.27 min). Using temporal response functions (TRF), we modelled continuous brain responses to acoustic, articulatory, and predictive features derived from the speech input. Comparing the accuracy of multi-feature TRFs to acoustic-only models revealed a subset of MEG sensors that encode incoming speech sounds' place of articulation. Crucially, articulatory encoding was strongest in frontal, central and parietal sensors, roughly corresponding to motor and somatosensory areas; and was spatially distinct from temporal sensors that preferentially tracked acoustics. In contrast, encoding of contextual predictions increased with acoustic sensitivity across MEG sensors. These findings expand our understanding of sensorimotor involvement in everyday listening and provide insight into the distinct features that drive neural speech processing.

Topic Area: LANGUAGE: Other

F56 - Prediction of Handedness and Language Hemispheric Dominance Using Homotopic Connectivity of Language Areas

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The development of language functions in the brain progresses from an initially interhemispheric control of the involved cortical regions to an intrahemispheric control, which is generally lateralized to the left hemisphere. Recent studies have shown that high interhemispheric connectivity between language areas is a relevant factor in understanding atypical patterns of lateralization (Labache et al., 2020; Andruyte et al., 2025). In this study, we analyzed 54 right-handers with typical language lateralization, 203 left-handers with typical language lateralization, and 58 left-handers with atypical language lateralization using resting-state fMRI. Language lateralization was assessed with a verb generation task during fMRI. Using the resting-state data, we computed the homotopic connectivity of the 18 language areas included in the SENAAS atlas (Labache et al., 2019). Discriminant analysis showed that this homotopic connectivity successfully classified 99% of the right- and left-handed participants (Wilk's $\lambda = .27$): values were higher in the superior temporal gyrus, SMA, and angular gyrus for right-handers, whereas left-handers showed higher values in the supramarginal gyrus, IFG_opercularis, medial superior frontal gyrus, and dorsal STG. To predict hemispheric language lateralization, a multiple regression analysis was conducted using the LI as the dependent variable and the homotopic connectivity of the 18 language areas as independent variables. A significant model was obtained ($R = .34$; $R^2 = .12$), in which lower connectivity in the superior temporal gyrus and higher connectivity in the IFG_opercularis and adjacent IFG areas were associated with atypical language lateralization. These results highlight the relevance of homotopic connectivity in both manual and hemispheric dominance.

Topic Area: LANGUAGE: Other

F57 - Investigating Task Modulation in Reading Through Large Language Models

SIJIE LING¹, Alona Fyshe¹, ¹University of Alberta

Task instructions influence human reading behaviour, producing task-specific patterns of attention allocation and brain activation. For instance, counting words in a sentence engages different brain processes than translating it. However, how the brain selectively encodes text to meet task demands remains unclear. In this study, we use large language models (LLMs) to study changes in information encoding driven by task demands, establishing methods for exploring similar task-related effects in humans with neurophysiological data. To simulate the same person reading identical stimuli sentences with diverse task instructions, we designed prompts for 6 language tasks. We provided the prompts along with sentences as input to several LLMs. We extracted model embeddings for the words of the sentences across each layer of the LLMs. Our analysis revealed four key findings. First, task-driven differences in representation geometry (quantified by participation ratio, a measure of dimensionality) emerged in lower LLM

layers. Second, despite task divergence, embeddings retained >60% shared information even in final layers. Third, probing classifiers successfully decoded task-irrelevant features, confirming retention of general linguistic information. Fourth, task-optimized soft prompts, compared to natural language instructions, amplified all effects: greater representational divergence, less information overlap, and reduced task-irrelevant decoding, indicating stronger task specialization. These findings from the simulation experiment demonstrate that while task-specific prompts direct the model to focus on relevant aspects of the input text, general information is still retained in the embeddings. In the future, we will use a similar framework to study task-related changes in human language processing.

Topic Area: LANGUAGE: Other

F59 - Effect of semantic contextual cues on listeners' semantic prediction in speech masking listening conditions: Evidence from eye-tracking measurements

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Semantic contextual cues aid word prediction in optimal listening conditions; however, it is unclear how adults predict words in sentences masked by background speech. This eye-tracking study used the Visual World Paradigm to investigate how semantic contextual cues impact participants' prediction of words when presented with speech masking in a language that either matched or did not match the target sentences. Native English speakers (N = 31) heard low predictability sentences (e.g., I sent her a new skirt) and highly predictable sentences (e.g., I ironed my new skirt) in the presence of English speech masking (linguistically matched listening condition) or French speech masking (linguistically mismatched listening condition). Analyses revealed that the effect of sentence predictability ($F(1, 30) = 41.27, p < .001, \eta^2 = .27$) was significant on predictive looking, indicating that participants could predict the upcoming words in the highly predictable sentences masked by speech. The interaction between sentence predictability and the language of speech masking ($F(1, 30) = 3.36, p = .077, \eta^2 = .02$) showed a trend towards significance that requires further testing. Therefore, future research could use cognitively more demanding sentences (e.g., longer target sentences or syntactically more difficult target sentences) and apply more diverse languages (English, Mandarin, or Persian) as the background speech to examine whether there is any significant interaction between the language of speech masking and sentence predictability. Keywords: Speech masking, semantic contextual cue, mismatched listening condition, matched listening condition

Topic Area: LANGUAGE: Semantic

F60 - Brain vocabulary: EEG-based semantic feature maps for verbs

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Neuroimaging studies show that different semantic categories, and even individual words, elicit distinct patterns of brain activity (e.g., Antoine et al., 2024; Grisoni et al., 2021). Furthermore, recent work demonstrates that semantically similar words further evoke more similar patterns of neural activity (e.g., Carota et al., 2023; Fernandino et al., 2022). However, previous research has focused on concrete nouns, leaving verbs and abstract domains relatively unexplored. This EEG study investigates how word-specific spatiotemporal patterns of brain activity reflect the semantic features of verbs across concrete and abstract categories. Fifty-two healthy native German speakers participated. Stimuli comprised 120 German verbs from four semantic categories: Actions-Face, Actions-Hand, Emotion, and Performative. Verbs were presented in a passive reading paradigm. A collapsed localizer approach identified time windows of interest in the grand-average ERP. Mixed-effects linear regression models were applied to each time window to assess category-related effects. ERP differences among semantic categories emerged around 200 ms post-stimulus. A significant interaction between semantic category and topographic gradient was observed in time windows centered around 250, 300, and 400 ms, with more positive amplitudes for Actions-Hand verbs at posterior sites. Concreteness effects emerged from ~200 ms, showing a significant interaction between concreteness and gradient within the same time windows. These findings indicate that neurophysiological differences between semantic verb categories emerge from ~200 ms post-onset, with pronounced effects for Actions-Hand verbs. Importantly, early ERP responses also reflect abstract-concrete distinctions. Ongoing work applies RSA to compare grounded semantic descriptions (35 rated dimensions) with EEG responses to single words.

Topic Area: LANGUAGE: Semantic

F61 - Intergenerational Impact of Maternal Traumatic Brain Injury: Distinct Prenatal and Postnatal Contributions and Pharmacological Rescue

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Traumatic brain injury (TBI), common among young adults, can cause neurocognitive decline, with emerging epidemiological evidence of psychiatric vulnerabilities in offspring, particularly sons. Mechanisms

remain unclear, and no treatments exist. We hypothesized that downregulating stress and inflammatory responses in TBI-affected mothers would mitigate abnormalities in both mothers and offspring, with maternal influence occurring prenatally and via postnatal interaction. Female rats (F0) received moderate TBI via midline fluid percussion injury on day 60 (P60) (F0F_T group). A subset received bumetanide (NKCC1 inhibitor; F0F_TB) before TBI. On P90, they were bred to produce F1 offspring. Half of each litter was reared by biological mothers and half by foster dams, either TBI-affected or unaffected. F0F_T rats showed elevated stress and inflammatory signaling without significant changes in weight, gut microbiome, or behavior. Male offspring of TBI mothers raised by their biological mothers had lower weight at birth and weaning, elevated stress and inflammatory signaling, gut microbiota dysbiosis, and behavioral impairments. Control-born offspring raised by TBI mothers were unaffected. TBI-born offspring raised by control mothers were rescued but still differed from controls in two measures, suggesting that TBI mothers' postnatal behavior is not abnormal enough to cause deficits in healthy pups, yet not normal enough to rescue TBI pups. Female offspring showed similar trends in weight and anxiety but were otherwise unaffected. Bumetanide prevented both F0 and F1 abnormalities. These findings suggest that maternal TBI influences offspring phenotype primarily through prenatal mechanisms, partially modifiable by postnatal interaction, and that maternal bumetanide mitigates abnormalities across generations.

Topic Area: LONG-TERM MEMORY: Development & aging

F62 - Rule and Exception Learning in Healthy Older Adults

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Healthy cognitive aging is associated with impaired memory specificity but relatively intact general memory. The extent to which age affects the active process of memory generalization, or extracting commonalities across experiences, is less clear. Prior research on concept learning demonstrates that older and younger adults are able to learn and generalize category structures. Yet, younger adults often outperform their older adult counterparts, putatively because they supplement their category knowledge by memorizing some category members. Here, we tested older and younger adult participants' abilities to learn unidimensional rules with or without the presence of exceptions. Young and older participants completed either a rule + exception learning task or rule-only learning task, using the same stimuli. Unidimensional rules in the rule-only learning task were learned just as well by both age groups. Rule + exception task showed not only impaired exception learning (specificity) but also impaired rule learning (generalization) in older adults. Findings indicate that tasks that concurrently rely on generalization and specificity may impact generalization in older adults. These results highlight the complex pattern of impairments in memory specificity and generalization in healthy cognitive aging.

Topic Area: LONG-TERM MEMORY: Development & aging

F63 - The Impact of Depression on Emotional Memory in Latinos and Non-Latinos

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Past research suggests Latinos are at greater risk for Alzheimer's disease. Mnemonic discrimination tasks (MDTs) provide a memory measure sensitive to age-related changes in memory. However, MDTs have yet to be examined in Latinos. Furthermore, how we remember emotional events is important, as Latinos exhibit heightened emotional engagement with positive and negative stimuli. Individuals with depression often show memory impairment and a negativity bias in memory. Thus, integrating emotional measures of memory and depressive symptoms is valuable when evaluating memory changes with aging, especially in Latino populations. In the current study, we used an emotional MDT, which taxes hippocampal pattern separation, providing a sensitive memory measure, during high-resolution fMRI to examine how depression impacts emotional memory performance in Latinos (N = 73) and non-Latinos (N = 73). Regions of interest included the hippocampal subfields dentate gyrus (DG)/CA3 and the basolateral amygdala (BLA), which are involved in the emotional modulation of memory. Participants also completed the Beck Depression Inventory to measure depressive symptomology. Preliminary results revealed those with greater depressive symptoms exhibiting enhanced memory for negative over positive images, with Latinos showing greater depressive symptoms. We also found different neurobiological profiles in Latinos and non-Latinos. Through behavioral and neurobiological investigation, this study advances understanding of cross-cultural differences in memory performance, focusing on emotional memory and differential impacts of depression in Latinos compared to non-Latinos. This study lays the groundwork for future research on cultural variability in emotional expression and perception and highlights the importance of recognizing cognitive diversity across ethnic groups.

Topic Area: LONG-TERM MEMORY: Development & aging

F64 - Subjective Cognitive Decline Is Associated with Impaired Memory for New Associations More Than for Gist

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We examined the extent to which subjective cognitive decline (SCD) in older adults was associated with impaired episodic memory. SCD has been proposed as an early indicator of Alzheimer's disease, and based on previous work, we hypothesized that SCD would be associated with more rapid forgetting in an episodic memory task (i.e., accelerated long-term forgetting; ALF). Importantly, prior evidence linking SCD to ALF has focused largely on episodic memory for verbal stimuli (e.g., individual words or short stories), leaving open the question of whether this pattern generalizes to other forms of episodic

memory. To address this, we compared memory performance between older adults with and without SCD across short (20 minutes) and long (24 hour) retention intervals. We used two memory tasks: a paired-associates task assessing episodic memory for newly formed associations, and a DRM false recognition task assessing episodic memory for semantically associated word categories. Results revealed increased forgetting at the longer delay, with lower performance in individuals with SCD, especially in high-confidence responding. However, an unexpected pattern emerged on the DRM task. Participants without SCD exhibited greater forgetting of gist-based information than those with SCD, inconsistent with the hypothesis that SCD would be associated with accelerated forgetting. These findings suggest that previously reported associations between SCD and ALF may be specific to episodic memory for individual words or details like newly learned associations and may not generalize to episodic memory for gist. This distinction has important implications for the development of sensitive cognitive markers of preclinical cognitive decline.

Topic Area: LONG-TERM MEMORY: Development & aging

F65 - Are my keys under the couch, or in my car? Enactment during learning benefits retrieval of object locations in forced-choice recognition memory.

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Research on the enactment effect suggests that performing an action during learning leads to better memory than solely listening to words. Previously, using pictures, we found an enactment boost when learning associations between objects and locations. Furthermore, participants remembered manipulable stimuli (tools) more accurately than nonmanipulable stimuli (animals). In the current research, we investigate whether enactment effects persist even when the retrieval task does not involve movements similar to those during learning. Forty participants completed two learning phases: Active, in which they used the mouse to place items in their assigned locations on a circle, and Passive, in which they watched as the items moved to their assigned locations. In both conditions, participants memorized the object's identity and its location. At test, participants saw two location targets. One target matched the learning phase location whereas the other was a lure positioned 40 degrees away. Participants chose which target was the correct location. After active learning, participants were more likely to select the correct location, made their choices faster, and reported higher confidence. Participants were more likely to select correct locations, and report higher confidence, for tools than for animals. Results suggest that motor information (through enactment and stimulus differences) improves memory for object-location associations even if the action is not reinstated during test. We theorize that the motor information retrieved through simulation can support these learning benefits even without physical reactivation (movement). Future work with EEG will assess whether motor simulation is the mechanism by which the enactment effect persists.

Topic Area: LONG-TERM MEMORY: Episodic

F66 - Visual exploration directionally modulates information flow between memory and visual brain systems

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Memory and gaze behavior are intricately linked, guiding one another to extract information and create mental representations of our environment for subsequent retrieval. Recent findings from functional neuroimaging and computational modeling suggest that reciprocal interactions between the extended hippocampal and visuo-oculomotor systems are functionally relevant for building these mental representations during visual exploration. Here, we expanded this work to investigate the directionality of information flow within this reciprocal architecture in humans. Specifically, we used dynamic causal modeling (DCM) for functional neuroimaging to provide a non-invasive account for the directional influences between these systems when new memories are created. By manipulating viewing instructions (free viewing versus maintaining fixation) during encoding, we demonstrated how unrestricted, naturalistic visual exploration enhances connectivity from lower-level visual regions to the medial temporal lobes, facilitating information flow for building memory representations. Subsequent memory retrieval performance was also predicted by the pattern of connectivity modulated by unrestricted visual exploration, identifying the mechanism underlying a rich history of previous work linking increased gaze behavior during encoding to later memory. Together, these findings suggest that gaze behavior shapes the ways in which brain dynamics within and between the hippocampal system and early visual cortex unfold during encoding in humans. Importantly, these directional interactions support the building of coherent, lasting mental representations.

Topic Area: LONG-TERM MEMORY: Episodic

F67 - Real-world encoding enhances whole-brain functional connectivity of recognized scenes

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Understanding the neural correlates of real-world episodic memory is a fundamental question in cognitive neuroscience. Prior work suggests that realism is important for context-driven episodic memory, but it remains unclear how fully real-world encoding influences delayed retrieval of naturalistic scenes. In this study, 75 healthy older adults (ages 55–75) completed a novel encoding paradigm. In the Real-world condition (n = 40), participants navigated a building while wearing a portable camera and viewed six live vignettes performed by actors. In the 2D condition (n = 35), participants viewed the same tours on a projector screen. Seven days later, all participants completed a

delayed recognition task during fMRI, where they viewed three previously encoded and three novel scenes. To identify whole-brain differences in functional connectivity (FC) during recognition as a function of encoding condition, we used functional connectivity multivariate pattern analysis (fc-MVPA) with post-hoc seed-based connectivity (SBC) analyses. Fc-MVPA revealed 11 regions of interest (ROIs) showing significantly different patterns of whole-brain FC between Real-world and 2D conditions, including nodes of the default mode network (precuneus, PCC, right angular gyrus), dorsal attention network (bilateral superior parietal lobule, right frontal eye fields), and limbic regions (orbitofrontal cortex, temporal pole, hippocampus). SBC from these ROIs showed widespread between-network differences based on encoding condition. Notably, the right limbic/hippocampal ROI exhibited greater connectivity with visual, attentional, and default-mode regions in the Real-world versus 2D condition for recognized scenes. These results indicate that embodied, context-rich encoding alters episodic retrieval network architecture at delayed recognition in older adults.

Topic Area: LONG-TERM MEMORY: Episodic

F68 - The Effect of Gaze Reinstatement Precision on Memory

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Eye movements during memory retrieval often recapitulate those made during encoding—a phenomenon known as gaze reinstatement. While previous research has observed a link between gaze reinstatement and memory performance, the direction and strength of this relationship remain unclear. The present study aimed to establish a causal connection between gaze reinstatement and memory retrieval by experimentally and parametrically manipulating gaze position during retrieval and assessing memory performance continuously. Young adults encoded sequences of coloured shapes while their eye movements were recorded. During retrieval, gaze was constrained to within 0-30 degrees of an encoded shape's location and participants were instructed to select the corresponding colour from a colour wheel. Consistent with our hypothesis, gaze position was positively predictive of memory performance. That is, fixating closer to the location of an encoded item was associated with more precise colour memory. These findings suggest that eye movements are tightly coupled to the encoding and retrieval of precise item features and support a functional role for gaze reinstatement in memory.

Topic Area: LONG-TERM MEMORY: Episodic

F69 - Memory Consolidation Processes of Emotionally Arousing Memories across a Stress Manipulation

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Memory is adaptable, allowing it to change and transform over time. To assess how a memory evolves through consolidation, researchers examine the reactivation of previously encoded traces during retrieval. This process provides information about the content and fidelity of a memory and how it is impacted by external factors such as acute stress. Our study investigates how memory reactivation highlights the effects of internal factors, like valence, and external factors, like stress, on memory. We conducted a two-day imaging experiment and found that stress influences item and associative memory. Participants learned pairs of negative words and neutral objects while rating their arousal and valence for each pair. They then completed item and paired associative recognition tasks 24 hours later. We used multivariate encoding-retrieval similarity analyses to assess how stress and valence impacted memory reinstatement over time. In preregistered analyses, stress impaired item recognition relative to baseline, whereas associative retrieval remained unaffected. When associative memory was divided into specific- and gist-item memory, participants identified specific items more accurately across all conditions, though post-encoding stress reduced this difference. Neuroimaging analyses showed that the match between encoding and retrieval patterns in the hippocampus was strongest in the no-stress condition, suggesting impaired reactivation under stress. In the medial prefrontal cortex, we observed impaired reactivation for highly arousing versus neutral memories, regardless of stress condition. Together, these findings, alongside planned analyses of reactivation during rest, will help us identify how stress influences memory consolidation in the context of emotional memory.

Topic Area: LONG-TERM MEMORY: Episodic

F70 - Independent and Joint Contributions of Mind-Wandering and Reactivation to Memory Consolidation

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Mind-wandering is often associated with impaired memory, but the potential benefits of mind-wandering when it occurs after learning are not well understood. Quiet rest after learning supports memory consolidation and provides an ideal environment for mind-wandering, but to date, it is unclear if and how the neural processes that underlie mind-wandering interact with those that support memory consolidation. Across two studies, we track neural signatures of each process on a moment-by-moment basis using an experience sampling approach. In Experiment 1, 39 participants learned object-scene associations before spending 40 minutes resting awake in an fMRI scanner. During rest, they reported mind-wandering levels through experience sampling every minute. Memory tests were administered immediately after the rest and after a 24-hour delay. Participants who reported more mind wandering after learning exhibited better memory performance. Multivoxel pattern analysis revealed that spontaneous memory reactivation in the hippocampus, as well as co-reactivation with cortex, increased after learning. Interestingly, greater reactivation

was linked to better immediate memory but poorer delayed memory, suggesting a tradeoff over time. Furthermore, mind-wandering in the 10-second window preceding experience-sampling probes was associated with elevated activity across the default mode network. We will also present preliminary findings from Experiment 2, an ongoing study examining the real-time connection between mind-wandering and hippocampal reactivation using a closed-loop fMRI design in which thought probes are triggered when a reactivation event is detected. Together, these experiments aim to directly link spontaneous reactivation with the subjective experience of thought, offering insights into how spontaneous cognition shapes memory consolidation.

Topic Area: LONG-TERM MEMORY: Episodic

F71 - Methamphetamine-use experience is associated with deficits in hippocampal-dependent spatial memory and navigation

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Methamphetamine is an addictive psychostimulant that remains a significant public health concern in the United States. Methamphetamine use has been associated with structural changes in the hippocampus, a region crucial for forming new spatial memories. While the effects of methamphetamine-use on spatial memory have been heavily investigated in rodents, these effects remain underinvestigated in humans. To address this gap, the current study recruited 26 community-dwelling individuals who have used methamphetamine regularly in the past 12 months, and 26 methamphetamine-naïve participants matched on sex and age. Participants completed two spatial memory assessments, a Virtual Morris Water Maze (VMWM) task and a Spatial Reconstruction task (SRT). In the VMWM, participants used a joystick to repeatedly navigate around a pool searching for a hidden platform. Total distance traveled and time spent searching for the platform was recorded on each trial. Across 15 search trials, individuals with methamphetamine-use experience were slower and traveled farther distances before finding the hidden platform. These findings suggest impaired spatial memory and navigation skills in individuals with methamphetamine-use experience. In the SRT task, participants studied the locations of 2-8 randomly placed objects and attempted to reconstruct the studied display after a short delay. At all set sizes, individuals with methamphetamine-use experience were significantly impaired, even when attempting to remember the location of only two objects. Together, these findings underscore the need to further characterize spatial memory deficits in individuals with methamphetamine-use experience, given that such impairments may have detrimental effects on everyday functioning and spatial navigation.

Topic Area: LONG-TERM MEMORY: Episodic

F72 - Using Unitization to Rescue Associative Memory

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Associative memory deficits are a common and debilitating aspect of healthy aging. While memory for individual items tends to remain relatively intact, older adults often struggle with remembering associations between items—like linking a face to a name. Research indicates that these age-related associative impairments are largely due to atrophy in the hippocampus, whereas preserved item memory is thought to rely more on the perirhinal cortex, a region less affected by aging. A growing body of evidence suggests that these deficits can be mitigated through ‘unitization’ — a process in which elements of an association are encoded as a single, cohesive unit. When unitization is successful, associative memory can be supported by item memory systems that are preserved in aging. Despite promising findings, the conditions under which unitization is most effective in rescuing associative memory in aging remain poorly understood. Identifying the factors that determine the effectiveness of unitization is critical for developing evidence-based interventions to improve associative memory in aging. The current experiments test a theory that unitized information may need to be novel to see the full benefit of familiarity-based processing that unitization can offer. Receiver operating characteristics are used to estimate the influence of familiarity and recollection for pre-experimental and experimental unitized information. The results lend initial support to the importance of novelty in familiarity-based unitized processing and will inform future work in narrowing down the neural substrates of this process in aging and in optimizing the effectiveness of this memory support.

Topic Area: LONG-TERM MEMORY: Episodic

F73 - Cognitive trade-offs between episodic autobiographical memory and abstract reasoning

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There is widespread variability across individuals in episodic memory and visual imagery, both of which are integral to autobiographical memory. While past work has typically emphasized the benefits of strong memory and imagery abilities, case studies suggest that individuals with congenitally low autobiographical memory can present with no functional impairment. How might these individuals be overcoming these putative deficits? We hypothesize that low memory/imagery can confer advantages on conceptual tasks that rely on abstraction of patterns across episodes, rather than specific details from single instances. We address this hypothesis across three independent studies from our research on episodic memory, all of which included objective cognitive tasks from the Croyos battery assessing abstract reasoning (Grammatical Reasoning), spatial

working memory (Rotations), visual deductive reasoning (Odd One Out), and visuospatial memory (Paired Associates). In 4,545 participants, lower memory/imagery was related to attaining more computational STEM professions. In 792 participants exposed to trauma, lower memory/imagery was related to fewer PTSD symptoms. In 93 participants, memory for structural sequences—but not details—of a naturalistic event was enhanced after sleep (vs. wake). Critically, across all three studies, the observed findings were related to objective performance on Grammatical Reasoning (but not other Croyos tasks). These findings suggest that abstract reasoning opposes episodic memory and visual imagery at the level of individual differences, to the extent that reasoning relies on the ability to learn and generalize rules across events. In turn, reasoning abilities can counteract low autobiographical memory and potentially confer resilience against negative outcomes.

Topic Area: LONG-TERM MEMORY: Episodic

F74 - Pre-trauma alertness enhances the development of intrusive traumatic memories

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Intrusive visual memories of traumatic events are central to maladaptive memory psychopathology, such as post-traumatic stress disorder (PTSD). To understand the mechanisms underlying intrusive memories, extensive research has been conducted focused on identifying individual traits associated with the risk of developing maladaptive memories. However, little is known about how mental states preceding the traumatic event influence trauma re-experiencing. To address this question, we developed a virtual reality paradigm enabling to study traumatic memories in naturalistic settings. Participants experienced a trauma analogue of a terror attack within an immersive and highly realistic environment, while performing tasks of a waiter in a restaurant. Importantly, to examine the influence of mental states on trauma re-experiencing, prior to the traumatic analogue half of the participants were informed that they are under threat of a terror attack, whereas the other half were not. In the following days, participants recorded their intrusive memories using a digitized online diary. Preliminary results indicate that participants who were under threat reported greater change in negative mood following the traumatic event compared to participants who were not under threat. Importantly, in the following days participants under threat experienced more intrusive visual memories and with greater persistence. These results suggest that elevated mental alertness before experiencing a traumatic event may increase the persistence of maladaptive visual memories, in line with evidence of elevated risk for PTSD among security personnel. This research sheds light on mental state-dependent mechanisms of traumatic memory formation and persistence.

Topic Area: LONG-TERM MEMORY: Episodic

F75 - Rapid formation of a memory engram for complex narratives in the posterior parietal cortex

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The standard model of systems memory consolidation postulates two interacting memory stores: A hippocampal storage that rapidly encodes new information and a neocortical store where enduring representations develop gradually over time. In the present study, we used functional and diffusion-weighted MRI to investigate where and when participants form content-specific cortical memory engrams for complex naturalistic stimulus material. 40 healthy participants repeatedly watched and freely recounted four movie clips that were set either at airports or at restaurants. We were able to decode the narrative setting from functional MRI data recorded in the posterior parietal cortex (PPC) and the hippocampus. Notably, we observed an increase in content discriminability over learning repetitions in the PPC, indicating a gradual strengthening of a stable neocortical mnemonic representation. Diffusion-weighted imaging revealed that a physical memory trace for the complex episodic narratives formed rapidly in the parietal cortex and was maintained for at least 24 hours after learning. Remarkably, we could discriminate the narrative setting of the watched movies based on these microstructural changes in the PPC. Both functional and structural brain changes were related to how many details participants remembered about the narratives. Our findings suggest that the PPC rapidly forms stable content-specific memory traces for complex narratives from the outset of learning fulfilling all criteria of a memory engram: they directly relate to the learned content, cause a change in the underlying neural substrate, predict memory retention at the behavioral level, and can be observed while lying dormant between times of active processing.

Topic Area: LONG-TERM MEMORY: Episodic

F76 - Investigating the differential effects of narrativization and causal structure of stories on memory

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Narratives are an effective stimulus-type for studying memory, as they can closely replicate how we use our memories in daily life. A key feature of narratives is the cause-and-effect structure between events, and previous research has found that events that are part of a causal chain are more often remembered and rated as important compared to events that are not part of a causal chain. However, there has not been a systematic investigation of the effects of varying narrativity and causality across a stimulus yet. This study aimed to address this gap by manipulating two factors: 1) the narrative vs expository style of a text, and 2) the cause-and-effect structure of events within a text. Participants were introduced to four stories, and asked to freely recall

them. The stories were developed to follow a 2x2 factorial design, being high or low in narrativity, and high or low in causal structure. High narrativity, but not causality, significantly predicted increased recall word count and number of verified recollected details. Exploratory analysis investigating if causally or semantically central information was most frequently recalled did not find significant results. These results suggest that narrativized information benefits memory independently of causal structure. In future work, we intend to replicate this investigation with a new set of stories.

Topic Area: LONG-TERM MEMORY: Episodic

F77 - Episodic memory at midlife: The influence of peri-menopause

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Midlife (40-65 years of age) represents a critical period at which episodic memory begins to decline and female adults with ovaries undergo the transition from the pre-menopausal phase of reproductive aging to peri- and post-menopause. Previous studies have demonstrated reduced spatial context episodic memory performance in post-menopausal compared to pre-menopausal adults. However, there is little research examining differences in memory performance between pre-menopause and the transitional peri-menopause phase, despite greater report of subjective cognitive complaints during this phase. The current study aimed to address this literature gap, as well as examine whether chronological age within menopause group influences episodic memory performance. Middle-aged, pre- (N = 42; mean age = 44.72) and peri-menopausal participants (N = 33; mean age = 50.85) completed eight runs of a spatial context memory task, in which they were asked to remember the spatial locations of sequentially-presented face stimuli (one of four quadrants on a computer screen). Participants were later asked to recall the spatial locations of both previously seen (source memory) and novel faces (novelty detection). Outcome variables included response accuracy, reaction time, and intra-individual variability in these measures across task runs. Linear mixed-effects analyses demonstrated group differences in performance, such that peri-menopausal participants made slower and less accurate source memory responses compared to pre-menopausal participants. These findings suggest that episodic memory decline may arise as early as peri-menopause. Age more often predicted performance in pre-menopausal compared to peri-menopausal participants, suggesting that there may be other factors that drive changes in episodic memory during peri-menopause.

Topic Area: LONG-TERM MEMORY: Episodic

F78 - Causal role of the angular gyrus in imagination-guided memory distortions

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Exposure to misleading information after a witnessed event leads to memory distortion for that event (misinformation effect). Prior research has demonstrated that the misinformation effect involves faulty reconstructive processes during memory retrieval whereby misleading information is remembered as part of an original event. Recombinatory errors of this nature are perpetuated by attributing certain details in memory to incorrect contexts during reconstruction. Importantly, such errors can be exasperated when memories harbor perceptual, semantic, or contextual similarities with one another. Difficulties with disseminating between similar contexts in memory don't just occur for similar externally perceived memories, but can also be the result of internally generating similar contexts through imagination. For instance, the act of imagining can facilitate the erroneous recombination of information from non-occurring events when retrieving a memory causing individuals to make false endorsements about past experiences. Research suggests that the left angular gyrus plays a causal role in imagination-based integration of narratives. This project seeks to understand whether the left angular gyrus promotes the integration of source information from two conflicting narratives, perpetuating the misinformation effect, and whether the act of imagining (constructing vivid representations of the new information) facilitates the angular gyrus in this process. Using a behavioral misinformation paradigm, we plan to uncover whether inhibitory TMS to the left angular gyrus before imagining erroneous information about an experienced event reduces misinformation endorsement at retrieval. We will present initial findings and hope to benefit from feedback on our methods and preliminary analyses.

Topic Area: LONG-TERM MEMORY: Episodic

F79 - Accounting for experimental factors diminishes neural measures of subsequent memory

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Decades of work have shown that neural activity at the time of item study predicts subsequent memory performance. However, it is known that items at the beginnings and ends of lists are successfully recalled most often, that some items are more memorable than others, and that these effects vary widely across individuals. This raises the question of whether neural activity correlated with memory primarily reflects internal fluctuations in the brain relating to the ability to memorize new items (which should be targetable by interventions such as brain stimulation) or instead corresponds to the behavioral effects of experimental stimuli (which may be harder to modulate). Here we compare estimates of the subsequent memory effect computed with and without adjustments for experimental variables including study position and item identity in a sample of 375 patients recorded intracranially during a free recall task. After incorporating stimulus-related effects, neural activity remains a significant behavioral predictor but only explains an additional 3.9% of the variance in recall performance, suggesting the majority of the subsequent memory effect should be attributed to stimulus features rather than an

endogenous state of memory performance. We decompose the subsequent memory effect across stimulus features and anatomical regions to reveal the regions associated with variability in memory uniquely explained by item identity, study position, and the residual memory variability unexplained by stimulus features. Our findings indicate that isolating neural activity corresponding to an endogenous state of learning readiness requires careful consideration of experimental confounds.

Topic Area: LONG-TERM MEMORY: Episodic

F80 - Rest-related memory benefits cannot be explained by post-encoding rehearsal

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There is an active debate regarding the role of rehearsal on memory benefits due to awake post-encoding consolidation. In the current study, we directly manipulated rehearsal during post-encoding wakeful rest to characterize downstream effects on associative memory in the context of a reward-motivated memory paradigm. To manipulate rehearsal during the post-encoding period, participants in the rehearsal group were explicitly instructed to rehearse high-reward memoranda for 15 minutes and then completed an incentivized mini-retrieval test. In contrast, participants in the rest group completed an incentivized mini-retrieval test immediately, eliminating the need to rehearse, then were instructed to rest for 15 minutes. A surprise memory test occurred approximately 24 hours later. We found that reward significantly enhanced item memory, replicating a large body of work. Importantly, we found that neither encouraging post-encoding rehearsal nor self-reported time spent rehearsing high-reward stimuli during the post-encoding period were related to reward memory enhancements. These findings suggest that active rehearsal during post-encoding rest is not solely driving consolidation-related memory benefits, consistent with the notion that endogenous processes support reward memory benefits on long-term memory.

Topic Area: LONG-TERM MEMORY: Episodic

F81 - Physiological Signatures of Value-Directed Remembering: Evidence From Pupillometry and Blink Rate

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Value-directed remembering (VDR) prioritizes motivationally relevant information, yet its physiological signatures remain unclear. Pupil dilation and spontaneous blink rate offer noninvasive indices of phasic catecholaminergic activity, putatively reflecting arousal and reward processing, respectively. We used eye-tracking to examine whether

these measures index preparatory value-related processes that support selective memory encoding. Cognitively healthy young adult participants (n=37) performed a VDR task in which they encoded 120 pictures (unfamiliar landscape paintings) and 120 words presented in separate blocks. Each item was preceded by high or low value cues indicating how many points (linked to a bonus payout) could be earned by later remembering that item. Eye-tracking data captured pupil dilation and blink rate during the 4-second inter-stimulus interval that separated value cues and to-be-learned items. Memory was assessed the next day via a recognition test. Results revealed a notable congruence between behavioral and pupillometric data: for picture stimuli, participants showed a robust VDR effect, with greater recognition sensitivity (d') for high-value items accompanied by greater preparatory pupil dilation. In contrast, word stimuli produced a smaller behavioral VDR effect and no reliable modulation of pupil dilation by value. Blink rate did not differ as a function of item value for either stimulus type. Together, these findings suggest that preparatory pupil-linked arousal, driven by the locus coeruleus-norepinephrine system, may track value-based memory prioritization in a stimulus-dependent manner, whereas spontaneous blink rate may be less sensitive to value-related encoding processes under these task conditions.

Topic Area: LONG-TERM MEMORY: Episodic

F82 - EEG evidence that negative images generate increased neural recapitulation early during memory retrieval

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Behavioral evidence suggests that negative memories are often particularly vivid and characterized by increased sensory specificity. fMRI studies show greater neural recapitulation (overlap between activation patterns at encoding and retrieval) for memories of negative images vs. positive and neutral images. However, fMRI gives little information about the timing of these processes. One possibility is that this increased recapitulation occurs early in retrieval, coinciding with early ERP signatures of recollection (starting around 500 ms) and before the initial old/new decision. In this case, differences in recapitulation may influence the nature and success of ongoing retrieval. Alternatively, increased recapitulation may be a result of the way a memory is processed or attended after initial retrieval. In the present study, we used EEG to test the timing of the effects of valence on neural recapitulation. Participants viewed an abstract line drawing of an image followed by the full image. The line drawing was used as a retrieval cue during memory testing. We measured similarity in the neural response to the full image at encoding and the retrieval cue during memory testing. Initial results suggest that, consistent with previous fMRI studies, encoding-retrieval similarity was greater for negative images than for positive or neutral images. This increase in similarity for negative images began within 500 ms after the

presentation of the retrieval cue and overlapped with early ERP old-new effects, suggesting rapid effects of valence on recapitulation.

Topic Area: LONG-TERM MEMORY: Episodic

F83 - Are Neural Signatures of Familiarity Domain-General? Evidence from an Exploratory Meta-Analysis of Familiar Face Processing

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Neural responses to familiar stimuli have been extensively studied, yet whether such effects converge across sensory domains remains unclear. We conducted an activation likelihood estimation (ALE) meta-analysis of 17 neuroimaging contrasts comparing familiar versus unfamiliar faces in healthy adults. Convergent activation was observed in medial prefrontal regions, including the anterior cingulate cortex and the medial and superior frontal gyri, consistent with person knowledge, evaluative, and self-referential processing. These clusters did not overlap with prior findings for familiar music (Vuong et al., 2023), which predominantly involve sensorimotor and insular regions, suggesting that familiarity engages domain-specific neural networks. While auditory familiarity may rely on predictive coding and temporal-motor circuits, visual face familiarity appears to preferentially recruit higher-order prefrontal systems supporting identity retrieval. These results offer a foundation for future studies investigating cross-modal representation of familiarity.

Topic Area: LONG-TERM MEMORY: Other

F84 - Accessing Meaning During Encoding Shapes Subsequent Memory Reactivation in the Brain

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Semantic access can occur in many forms, ranging from retrieving specific exemplars to linking concepts with related meanings. We hypothesized that accessing meaning at different levels during encoding would lead to distinct neural reactivation patterns during later memory retrieval. Human participants learned novel word-image associations through prompts that queried item-specific, categorical, or thematic features, while undergoing fMRI. Multivariate pattern analysis shows that encoding histories leave distinct neural signatures even when behavioral performances are equivalent. Encoding history could be decoded by classifiers from recognition activity across the ventral visual stream and higher-order regions. Category-based encoding reduced item-specific reinstatement in perceptual regions, while item-based encoding modified cross-phase item-level similarity in the anterior temporal lobe, suggesting a transition from detailed to integrative conceptual representations. Together, these findings demonstrate that semantic access during encoding shapes how memories are neurally reinstated to integrate perceptual and

conceptual information across systems supporting semantic and episodic memory.

Topic Area: LONG-TERM MEMORY: Semantic

F85 - Examining the neural dynamics of semantic memory integration using noninvasive brain stimulation with concurrent EEG

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Previous studies have shown that the left Angular Gyrus (AG) plays a significant role in semantic integration, modulating the processing time of meaningful vs. nonmeaningful two-word pairs. The primary goal of this study was to evaluate how stimulation of the left AG causally contributes to semantic restructuring dynamics and connect them to the N400, a neural marker for these dynamics. While undergoing EEG recording using 32 active electrodes, participants performed a relatedness judgment task (RJT) for pairwise combinations of 20 concepts. Concepts spanned from common categories including animals, food, and home/kitchen items. Participants also completed a conceptual combination task in which they evaluated the meaningfulness of ambiguous noun-noun combinations. Stimuli included four of the five concepts from each category used in the RJT as modifier nouns as well as novel concepts. During the conceptual combination task, participants received tDCS using high-definition montage with the active electrodes CP5, C3, T7, P7, and P3. Each participant received anodal, cathodal, and sham stimulation during separate experimental sessions. Participant-specific semantic memory networks were estimated using a 20x20 matrix of each pairwise RJT rating from both pre and post stimulation. ERP analyses focused on the N400 potential and revealed differential effects of stimulation type (anodal vs. cathodal), with a negative effect following cathodal stimulation. These results can be tentatively interpreted as a reflection of less efficient semantic integration during cathodal stimulation of the left AG implicating it in this process.

Topic Area: LONG-TERM MEMORY: Semantic

F86 - Altered stimulus-response learning and striatal responses in posttraumatic stress disorder

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Posttraumatic stress disorder (PTSD) is a debilitating psychiatric illness related to alterations in learning and memory. Although PTSD studies largely investigate hippocampal and amygdala-dependent learning, evidence suggests that stress can enhance dorsolateral striatal-dependent stimulus-response (SR) learning. We hypothesize that individuals with PTSD would have enhanced and rigid SR learning. fMRI data was collected in participants (N = 35 PTSD, N =

35 trauma without PTSD) while they completed a probabilistic learning task. Participants were presented 6 unique stimuli where one of two actions was probabilistically reinforced for each. After learning (300 trials), the correct action reversed for some stimuli. Importantly, because stimuli were randomly interleaved, participants should not apply feedback over consecutive trials (trial-level), but rather over trials of the same stimulus (stimulus-level). Contrary to our expectations, the PTSD group was significantly slower to learn probabilistic associations. Participants in both groups were best fit by a computational reinforcement learning model with both stimulus and trial-level learning, although the PTSD group relied more on maladaptive trial-level learning. Consistent with our expectations, the PTSD group had greater difficulty updating learned responses, with significantly worse performance following reversal due to increased levels of perseveration. Supporting the role of the dorsolateral striatum, participants in only the PTSD group had larger putamen responses when learning to update behavior. These results suggest that while individuals with PTSD have difficulty learning probabilistic associations, when formed, they become rigid and difficult to update. This may be related to erroneously applying feedback, and greater reliance on striatal encoding strategies.

Topic Area: LONG-TERM MEMORY: Skill Learning

F87 - Temporal interference stimulation of the hippocampus modulates fast motor memory consolidation

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Motor memory consolidation was long thought to be a slow process spanning hours to days but recent studies have shown evidence for a faster consolidation process occurring during short rest blocks interleaved with task practice during initial motor learning. Converging neuroimaging evidence links these different consolidation processes to hippocampal responses, however, causal evidence remains limited. Here, we addressed this knowledge gap using temporal interference stimulation (TIS), a novel noninvasive transcranial electrical stimulation approach capable of targeting deep brain regions. Twenty-three young healthy participants received hippocampus-targeted TIS with a 5-Hz envelope ($\Delta f=5\text{Hz}$) or sham ($\Delta f=0\text{Hz}$) during motor sequence learning in a counterbalanced order. Participants were distributed in two groups according to whether TIS was applied during online task practice (online-TIS, $N = 12$) or during short rest periods interleaved with task practice (offline-TIS, $N = 11$). Motor memory retention was assessed with a 24-h retest. Micro-online and micro-offline changes in performance during initial learning were computed as changes within task practice and across inter-practice rest intervals, respectively. Macro-offline changes in performance reflecting slower consolidation processes were computed across the 24h interval. We

found that hippocampal - as compared to sham - stimulation applied during inter-practice rest intervals, but not during task practice, significantly increased micro-offline gains at the expense of micro-online gains ($F(1,10)=7.30$, $p=.022$, $\eta^2 = .42$). Online-TIS showed a trend toward reduced 24h macro-offline gains in performance ($t(11)=2.02$, $p=.068$, Cohen's $d=0.58$). These findings provide causal evidence that the hippocampus is involved in motor memory consolidation at different timescales.

Topic Area: LONG-TERM MEMORY: Skill Learning

F88 - Allies, Rivals, or Strangers? Exploring the Relationship Between Statistical Learning and Executive Functions

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Human behavior relies on the interaction between automatic and controlled processes. Statistical learning (SL) is often considered an automatic mechanism supporting the extraction of environmental regularities, whereas executive functions (EFs) are associated with controlled, goal-directed processing. However, their functional relationship remains debated: SL and EFs may operate independently, cooperate, or compete during learning. In the present study, we investigated the interplay between SL and EFs in a large young adult sample ($N = 192$) using a multi-task, data-driven approach. Participants completed seven SL tasks, including measures of learning during ongoing performance (online reaction time tasks) and after learning (offline two-alternative forced-choice paradigms), alongside a battery of EF tasks. Factor analysis of EF measures revealed two latent factors: a working-memory-dominant EF factor and a verbal fluency factor. These factors were entered into a structural equation model (SEM) to examine their associations with SL performance. Results showed that the working-memory-dominant EF

factor was positively associated with performance on two-alternative forced-choice SL tasks and the Weather Prediction task. In contrast, the same EF factor showed a trend-level negative association with the Alternating Serial Reaction time task which captures learning online during continuous performance. The verbal fluency factor was not related to SL performance in any task. These findings suggest that the relationship between executive functions and statistical learning depends on how learning is expressed and measured. Executive control may support performance when learning is assessed offline, while potentially interfering with online learning processes.

Topic Area: LONG-TERM MEMORY: Skill Learning

F89 - SuperEEG: A Gaussian Process Model of Human Electrographic Data Revisited and Optimized

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Understanding how cognition emerges from distributed neural systems requires methods that capture the brain's fast, large-scale coordination during tasks. Direct measurement at this scale is limited in humans because ECoG offers millisecond precision but sparse spatial coverage. Our method, SuperEEG, addresses this by learning a population-level covariance model that relates activity across cortical locations and then using Gaussian process regression to reconstruct full-brain field potentials from a patient's limited electrodes. Here we reposition SuperEEG as a general tool for studying cognition—spanning attention, decision-making, language, and motor control—and describe extensions that make the model more neurobiologically grounded and task-general. First, we (i) systematically tune the radial-basis function length-scale (λ) to balance spatial smoothness and local specificity and (ii) incorporate neuroanatomically and functionally informed priors into the covariance (e.g., volume conductance, inter-regional distance, structural connectivity from diffusion imaging, and functional connectivity constraints). We benchmark reconstructions with cross-validation at held-out electrodes and quantify how training within versus across patients and tasks affects accuracy and interpretability. We further evaluate whether anatomically informed priors improve identification of transient, task-evoked network states on tens-of-milliseconds timescales using the multi-task Kai Miller ECoG dataset. Together, these advances provide a practical pipeline for estimating fast, whole-brain dynamics from sparse recordings, enabling individualized tests of how distributed coordination supports cognition.

Topic Area: METHODS: Electrophysiology

F90 - EEG signal complexity after repeated mild traumatic brain injury in a mouse model of Alzheimer's disease.

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Multiscale entropy (MSE) is a measure of neural signal complexity and correlates with cognitive status in healthy aging and dementia. Traumatic brain injuries (TBI) can alter cognitive function and increase the risk of some dementias, such as Alzheimer's disease (AD). However, whether repetitive TBI affect MSE remains unknown. Here, using a mouse model of AD, we investigate whether repetitive mild TBI (rmTBI) is associated with MSE alterations in the context of AD. Using the closed-head injury model of engineering rotational acceleration (CHIMERA), we delivered three rmTBI 48 hours apart to female and male APPNL-F transgenic mice (n=44) at either 6 or 12 months of age. At 15 months of age, we implanted intracortical EEG electrodes and recorded 72 continuous hours of EEG/EMG. MSE was calculated for each vigilance state: NREM, REM, and wake. Mice receiving rmTBI at 12 months exhibited significantly altered MSE patterns in parietal cortex three months post-injury compared to sham controls. Specifically, the rmTBI group showed reduced MSE at finer timescales and elevated MSE at coarser timescales across all vigilance states. This bidirectional pattern mirrors the shifts in MSE associated with AD and other neurodegenerative diseases in humans. These findings demonstrate that rmTBI produces chronic alterations in neural signal complexity. While these MSE changes may relate to post-TBI cognitive impairments observed clinically, further research is needed to establish direct links between MSE patterns and specific cognitive deficits following TBI.

Topic Area: METHODS: Electrophysiology

F91 - Changes in EEG Complexity Following Trazodone Administration in a Mouse Model of Alzheimer's Disease

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Neural complexity, an indicator of information processing capacity in brain networks, is associated with cognitive function and can be indexed formally by measures of entropy of brain signals. Here, we evaluate changes in neural complexity to assess treatment effectiveness in a mouse model of Alzheimer's disease (AD). Trazodone is an antidepressant being explored as a novel therapeutic for AD, with beneficial effects on sleep and cognition demonstrated in both humans and mouse models of disease. Trazodone's effect on neural complexity has not been studied to our knowledge. We administered trazodone (60mg/kg) to the APPNL-F transgenic mouse model at 9 months (nTotal=12, nTreatment=6) or 14 months (nTotal=15, nTreatment=10) of age for 60 days. Intracranially implanted EEG was recorded at baseline and every ~15 days during the 60 days of treatment. Vigilance state was scored using Sirenia Sleep software (Pinnacle) and multiscale entropy (MSE) was

computed using a custom MATLAB function. To assess whether trazodone alters brain signal complexity, we used mean-centered partial least squares (PLS) analysis. The first pattern from PLS revealed significant treatment effects across both cohorts, with trazodone increasing complexity at finer temporal scales and decreasing complexity at coarser scales. This effect was significant across all vigilance stages for both cohorts. Our results demonstrate that trazodone alters brain signal complexity as measured by MSE. The MSE curve morphology in the trazodone group resembles that of healthy aging, suggesting a beneficial effect.

Topic Area: METHODS: Electrophysiology

F92 - Electrophysiological network (in)stability: The impact of connectivity metric choice and sample size

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Numerous studies of electrophysiological functional connectivity (FC) have revealed large-scale, often frequency-specific coordination across brain regions during many cognitive functions, including episodic memory, cognitive control, motor planning, and vision. However, the field uses a large variety of connectivity measures that are rarely compared head-to-head. Given these measures differ substantially in terms of properties such as sensitivity to zero-lag mixing and sample-size bias, the network one observes may depend heavily on the chosen metric, limiting comparability across studies. Here we compare several popular electrophysiological FC measures including coherence, PLV, PPC, ciPLV, PLI, wPLI, dPLI and AEC across the theta band (3-8 Hz) in a large free recall experiment conducted in 383 patients recorded intracranially for epilepsy treatment. All measures indicate stronger overall connectivity across the brain during successful retrieval than during successful encoding. Measure by measure network correlations show high agreement across measures and cluster into phase-synchrony (coherence/PLV/PPC), lagged-phase (PLI/wPLI/ciPLV), amplitude-envelope (AEC), and directed (dPLI) groups, with higher agreement during encoding than retrieval. Reliability analyses demonstrate that population FC matrices depend strongly on sample size: at typical sample sizes for intracranial studies (5-25 subjects), connectivity matrices for population subsamples correlate only weakly with the full-sample matrix for all FC measures (Pearson $r = 0.2$ to 0.3), with reliability increasing steadily with sample size up through hundreds of subjects. These findings suggest that future studies of electrophysiological FC would benefit from substantially larger samples alongside detailed multiverse comparisons to ensure reliable network inference.

Topic Area: METHODS: Electrophysiology

F93 - Associations between peripheral mitochondrial energetics and cortical neurophysiological alterations in Alzheimer's disease

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Alzheimer's disease is associated with both mitochondrial dysfunction and altered neurophysiological signalling. Peripheral measures of mitochondrial function have been established as effective predictors of mitochondrial performance in the healthy brain, and more recently, altered neurophysiological signalling has been associated with aberrant mitochondrial function. This indicates that peripheral mitochondrial energetics and altered neural signalling in Alzheimer's disease may be related, but to date, no studies have directly tested their relationship. We collected neuroimaging and mitochondrial energetics data from biomarker-confirmed patients on the Alzheimer's disease continuum (69.21 [6.91] years; $n = 38$) and healthy older adults (72.20 [4.73] years; $n = 20$). Each participant provided a blood sample for analysis of mitochondrial respiration using Seahorse Analyzer and task-free neurophysiological data using magnetoencephalography. We used region-wise linear models to test the relationship between ATP-linked respiration and neurophysiological changes in patients relative to controls, finding that mitochondrial respiration linked to ATP production is associated with altered alpha and theta band cortical rhythms in Alzheimer's disease (α : $pFDR < 0.05$, $r = -0.7$; θ : $pFDR < 0.05$, $r = -0.6$). We then tested colocalization of mitochondria-neurophysiological relationships with a human brain atlas of respiratory capacity and found that brain regions with greater mitochondrial respiratory capacity exhibited a stronger relationship between aperiodic signalling and peripheral ATP-linked respiration ($pFDR = 0.003$, $r = 0.35$). Our findings suggest that peripheral blood measures of mitochondrial function can offer insight into the neurophysiological alterations associated with energetic changes in Alzheimer's disease.

Topic Area: METHODS: Neuroimaging

F94 - Structural Segmentation with Freesurfer and MUSE for use in fMRI Data in Healthy Young and Older Adults

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Cognitive[BC1.1] neuroscientists often compute functional analyses within predefined anatomical regions of interest (ROIs). Defining anatomical brain boundaries in different age groups is challenging due to age-related structural changes in older age.[BC2.1] An earlier version of one commonly used tool, Freesurfer (v6), has been shown to have differences across age groups in the segmentation of the hippocampus. Multi-atlas segmentation protocols have been developed that may help with this issue by taking the consensus label across multiple different segmentation protocols. To test differences in the suitability of different anatomy labeling approaches for use in fMRI studies of age differences, we compared two tools for automated labeling of brain anatomy (Freesurfer, v.8.1.0 and Nihart DLMUSE,

v.0.1.7) in terms of the strength and variability of univariate activation elicited in several cortical and subcortical ROIs. Participants were cognitively healthy young (aged 18-30, $n = 20$) and older (aged 60-80, $n = 16$) adults, and their structural and functional images were collected while performing a task that involves viewing and remembering scene images. We did not find a significant overall effect of segmentation method or any significant interactions with segmentation method. The variability was also comparable, with slightly higher variability for multi-atlas segmentation in older adults. Thus, we found that single (freesurfer) vs. multi-atlas (Nichart DLMUSE) segmentation tools resulted in very similar estimates of functional activation in young and older adults, suggesting that researchers can use either tool when testing age differences in functional activation.

Topic Area: METHODS: Neuroimaging

F95 - Neurotransmitter Influence on Frequency-Defined Neurophysiological Connectivity Supports Cognitive Reserve in Aging

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Neuronal oscillations exhibit temporal dependencies between cortical regions within distinct frequency bands, indicating frequency-resolved functional connectivity. However, the neurochemical influence on the connectivity patterns between distant brain regions remains largely unexplored. Drawing upon open MEG and cognitive testing data from the Cambridge Center for Aging and Neuroscience (Cam-CAN; $N = 569$) and cortical neurotransmitter receptor and transporter atlases from neuromaps, we examine whether neurochemical similarity profiles across cortical regions contributed to their frequency-resolved connectivity. We derived neurochemical similarity matrices from 19 distinct neurotransmitter systems across cortical regions using Pearson correlation, and computed band-limited functional connectivity using orthogonalized amplitude-envelope correlations. Linear mixed-effects models predicted neurochemical similarity from connectivity, controlling for age, sex, and inter-regional distance. Leave-one-out analyses isolated the contributions of specific regions and neurotransmitters. Findings provide evidence that inter-regional neurochemical similarity aligns with frequency-specific connectivity profiles, suggesting that neurochemical gradients shape long-distance electrophysiological communication in the brain. Slow neuromodulators such as norepinephrine (NET) and serotonin (5-HTT) appear to play an outsized role in this inter-regional coherence. Prefrontal cortical regions were identified to exert stronger contributions to the neurochemical-connectivity alignment, indicating a spatial hierarchy. These associations were moderated by age,

highlighting how neurochemical constraints on connectivity shift across the lifespan. Older adults with increased neurochemical-connectivity alignment also exhibit better performance on fluid intelligence tests, potentially indicating cognitive resilience. Together, these results offer new insights into the mechanistic bases of commonly reported alterations in frequency-defined brain signaling across both healthy and pathological aging, with implications for emerging pharmacotherapies and early-stage disease monitoring.

Topic Area: METHODS: Neuroimaging

F96 - Validation of a Region-Specific Approach to CSF Artifact Correction in Subcortical 7T fMRI

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Distinguishing neural signals from physiological noise remains a challenge in neuroimaging, particularly in subcortical regions. Traditional CSF correction pools signals into a single global regressor applied uniformly across the brain, overlooking spatial heterogeneity in CSF-noise and potentially leaving residual contamination. To address this limitation, we developed a local CSF correction procedure that models CSF adjacent to each subcortical ROI. Here, we present a comprehensive validation across task and rest data, comparing local CSF correction with whole-brain regression approaches across thresholds and assessing the impact of motion. We demonstrated that CSF time-series exhibit a cortical-to-subcortical gradient and that local CSF regression (60% threshold) yields stronger resting-state functional connectivity ($N=83$). We further showed that local CSF regression yields stronger emotion task-based activations in subcortex compared with aCompCor ($N=43$). To assess robustness, we applied a more stringent 80% CSF threshold and regressed six head-motion parameters from the CSF time-series, then re-computed voxel-wise correlations between CSF voxels and the weighted global CSF average to quantify the contribution of motion to the observed gradient. Motion-corrected and uncorrected CSF signals were highly correlated ($r = .94$), suggesting that the gradient reflects physiological variability rather than motion artifacts. To evaluate spatial stability, we extracted the top 20% of CSF voxels across maps, and calculated a Dice coefficient, revealing strong agreement (Dice = 0.85). Finally, voxel-wise correlations between CSF and motion parameters clustered near zero, indicating negligible CSF-motion coupling. Overall, these results support that local CSF correction captures meaningful physiological variability and enhances subcortical fMRI signal fidelity.

Topic Area: METHODS: Neuroimaging

F97 - Developing a Rigorous Method for Detecting Power-Law Scaling and Critical Dynamics in fMRI Brain Signals

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The Critical Brain Theory suggests the brain evolved to operate in a critical state, balanced between order and disorder. Critical systems show scale-invariance and long-range temporal correlations. Accurately measuring these scale-free dynamics can deepen our understanding of brain function and health; however, current estimation methods are often inconsistent, sensitive to preprocessing choices, and insufficiently rigorous. This project aimed to create a Python-based signal-processing tool to (1) test for power-law distributions (scale-invariance), (2) classify signals as fractional Gaussian noise (fGn) or fractional Brownian motion (fBm), and (3) estimate the Hurst exponent (H), which quantifies long-range temporal correlations, in both simulated and fMRI brain signals. Simulated time series with known H values were used to benchmark and validate estimation accuracy, preprocessing strategies, and classification performance. Power spectral density (PSD) analysis and log-log regression extracted scaling exponents, while automated frequency-window selection and Monte Carlo testing validated power-law fits and robustness. Results show that preprocessing has a substantial impact on power-law detection and parameter estimation. In particular, "Bridge Window Detrend" preprocessing combined with PSD-based slope estimation most accurately classified fGn versus fBm, achieving over 90% classification accuracy and stable H estimates across signal lengths. Application of the validated pipeline to voxel-wise resting-state fMRI data revealed reproducible detection of region-specific temporal dynamics consistent with scale-free behavior. Future work will extend this framework to study spatial correlations, brain-state transitions, and their links to neural criticality. Together, these results establish a robust and validated framework for detecting power-law scaling and long-range temporal correlations in fMRI brain signals.

Topic Area: METHODS: Neuroimaging

F98 - Well-known and Lesser-known logos: Evaluation for Brand Logos Using Covert Eye Tracking (CovET) Combined with a Go/No-go Task

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Eye tracking can be used to evaluate brand logos, but it has conventionally focused only on the overt attention to logos. However, focus should also be on covert attention, given its role in visual processing. Covert attention can relate to the selection of information before giving fixation and contribute to better performance. When this selection process is influenced by prior information, the eye-movement pattern with covert attention can be altered. Revealing the relation in selecting information can lead to efficient design evaluation. In this Sketchpad presentation, we performed gaze analysis based on fixations in the central visual field regions corresponding to the fovea and foveola. Real logos of Japanese convenience stores categorized

as well-known or lesser-known were used as visual stimuli. A Go/No-go task was used to examine whether the target logo was detected behaviorally either within or outside the fixation area. We compared the difference between the tendency to distinguish the logo correctly within the fixation area and those outside for each logo. The results showed a significant trend between well-known and lesser-known categories in the foveola condition. This indicates that higher visual recognizability logos can be efficiently recognized even when they are presented outside the fixation area through covert attention in selection processing. This finding of the covert eye-tracking (CovET) system could suggest an effective approach to evaluate the visual recognizability of logos and potentially other marketing stimuli. This method could serve as a valuable neuromarketing tool for assessing consumer interest.

Topic Area: METHODS: Other

F99 - Evaluating virtual reality therapy for phantom limb pain: functional connectivity and pain outcomes

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Phantom limb pain (PLP) is a common disorder among amputees yet remains poorly understood. Existing theories emphasize somatomotor cortical plasticity without considering broader pain-related networks which may influence treatment outcomes. Virtual reality (VR) is a promising treatment for PLP, but it remains unclear whether its analgesic effects are related to PLP-specific neural mechanisms. We collected 7T fMRI data from 11 lower-limb amputees undergoing either active or distractor VR treatment. Pain was assessed pre- and post-treatment using the McGill Visual Analog Scale Pain Questionnaire, and functional connectivity was calculated as the median correlation among sensorimotor, insular, cingulate, and thalamic regions. We hypothesized that functional connectivity would positively predict pain across timepoints and that pain would decrease more in the active VR group than in distractor VR. A bivariate linear regression model showed that functional connectivity did not significantly predict pain score at both timepoints, $\beta = -0.303, t(94) = -1.344, p = .182$. To test whether active VR reduced pain relative to the distractor condition, we fit a linear regression including treatment, timepoint, and their interaction ($R^2 = .32, F(3,92) = 14.23, p < .001$). Pain significantly decreased over time in both groups, $\beta = -2.25, t(92) = -4.641, p < .001$, with limited evidence for a difference between treatment groups, $\beta = 1.125, t(92) = 1.895, p = .061$. The interaction effect was also near significant, $\beta = 1.5, t(92) = 1.786, p = .077$. Overall, PLP decreased following VR intervention, but active treatment was not significantly different from the distractor. While pain was not significantly related to functional connectivity, this preliminary sample is underpowered for neuroimaging analyses. Future work in larger samples will better

characterize the relationship between pain, functional connectivity, and VR treatment effects with PLP.

Topic Area: NEUROANATOMY

F100 - EEG evidence for shared and distinct neural activity during auditory and visual imagery in musicians

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There is substantial evidence supporting shared neural mechanisms between imagery and perception. However, the psychophysiological exploration of modality-independent mental imagery and its potential reliance on other cognitive processes—such as attention and memory—remains limited. We aimed to investigate the shared and specific EEG activity patterns associated with auditory (musical) and visual imagery. Twelve trained musicians completed perception and imagery tasks for auditory and visual stimuli, each with two levels of complexity. Mean power differences were calculated across tasks and conditions for the alpha, beta, and gamma bands. For the alpha band, increased mean relative power was observed in occipital and parietal regions throughout the paradigm. Regarding the complexity of the imagery tasks, within-modality contrasts (auditory simple vs. auditory complex) showed small-magnitude power differences significant only at a few midline locations. In contrast, cross-modality comparisons (auditory simple vs. visual simple) revealed a greater number of significant locations, mainly in central and occipital regions, with positive differences for mean alpha power and negative for beta and gamma bands. Relative to baseline, the main effects were broader beta power increases associated with visual imagery and shared patterns for both imagery modalities, including enhanced gamma power in right frontal sites, increased beta activity in frontal and prefrontal regions, and bilateral parietal beta increases. These findings support the hypothesis that mental imagery engages not only modality-specific sensory areas but also regions related to memory retrieval, attention, semantic processing, and motor preparation.

Topic Area: OTHER

F101 - Baseline neurophysiological markers predict clinical response to HD-tDCS in schizophrenia: A randomized clinical trial

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Schizophrenia is a severe neuropsychiatric disorder affecting about 0.45% of adults, with negative symptoms often resistant to antipsychotic medications. Transcranial magnetic stimulation combined with electroencephalography (TMS-EEG) enables direct assessment of cortical excitability and inhibition. High-definition transcranial direct current stimulation (HD-tDCS) has shown potential in improving schizophrenia symptoms. This study examined whether baseline TMS-EEG markers could predict the therapeutic effects of HD-tDCS on clinical symptoms. A total of 104 patients with schizophrenia and 90 healthy controls underwent single-pulse TMS-EEG targeting the left dorsolateral prefrontal cortex (DLPFC). Patients then participated in a randomized, double-blind, controlled trial of anodal HD-tDCS over the DLPFC (1.5 mA, 20 min/session, 10 sessions). Primary outcomes were changes in Positive and Negative Syndrome Scale (PANSS) and Scale for the Assessment of Negative Symptoms (SANS) scores from baseline to post-treatment. Compared with healthy controls, patients showed reduced N100 amplitude, lower theta and alpha power, and increased gamma power. HD-tDCS significantly decreased PANSS ($F = 41.40$, $p < 0.001$, $\eta^2 = 0.321$) and SANS ($F = 25.15$, $p < 0.001$, $\eta^2 = 0.224$) scores compared with sham stimulation. Baseline N100 amplitude positively correlated with SANS improvement, whereas beta and gamma power were negatively correlated with PANSS positive and negative symptom improvements, respectively. TMS-EEG findings indicate that cortical excitation–inhibition imbalance contributes to schizophrenia symptom severity. HD-tDCS may be an effective adjunctive treatment, and TMS-EEG markers such as N100 amplitude and beta/gamma power may predict treatment response.

Topic Area: OTHER

F102 - The IL-10 -872 Polymorphism Differentially Modulates the Relationship Between Serum IL-10 and Cognitive Performance in Methamphetamine Use Disorder

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Growing evidence indicates that immune dysregulation contributes to neurocognitive impairment in individuals with methamphetamine use disorder (MAUD). Interleukin-10 (IL-10), an anti-inflammatory cytokine, exerts neuroprotective and helps maintain neuronal functions; however, its relationship with cognitive deficits in MAUD remains unclear. Genetic variations, such as IL-10 -872 G/T polymorphism, may influence cytokine production. This study aimed to investigate whether this polymorphism modulate this association between IL-10 and cognitive performance in MAUD. We recruited 568 male MAUD patients from a drug rehabilitation center and 210 male healthy controls (HCs) from the local community in China. Cognitive function was assessed using the Repeatable Battery for the Assessment of Neuropsychological Status (RBANS), and serum IL-10 levels and IL-10-872 G/T genotype were determined. Compared to

HCS, MAUD patients exhibited widespread cognitive impairment across multiple RBANS domains and had significantly elevated serum IL-10 levels. Although The IL-10 -872 G/T genotype was not associated with IL-10 levels, but it differentially influenced cognitive function between group. Among MAUD patients, TT homozygotes showed better attention domain performance compared to G-allele carriers, whereas no such genotypic difference was observed in HCS. Moreover, higher IL-10 levels negatively correlated with performance in language, delayed memory, and total cognitive score only in HCS with TT genotype. No significant correlations were detected in MAUD patients. These results suggest that the IL-10 -872 G/T polymorphism moderates the association between IL-10 and cognitive in healthy individuals, but this regulatory relationship is disrupted in MAUD, providing new insights into the role of IL-10 in substance-related cognitive dysfunction.

Topic Area: OTHER

F103 - Sleep spindles as indicator of preserved consciousness in Disorders of Consciousness patients

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Disorders of consciousness (DoC) is a broad term that encompasses various clinical conditions, including coma, unresponsive wakefulness syndrome (UWS) and the minimally conscious state (MCS). As diagnosis currently relies on clinical scales, the identification of additional biomarkers of preserved consciousness is still needed. One of the crucial aspects of consciousness is the integrity of the thalamo-cortical connections. It can be reflected in the occurrence of sleep spindles during sleep. This study aims to explore which spindle parameters could serve as reliable diagnostic markers in patients with DoC. We analysed 72 overnight polysomnographic recordings from 22 patients. The Multivariate Matching Pursuit algorithm, a technique that enables multivariate time-frequency parameterisation, was applied to detect and parametrise sleep spindles. The findings revealed that several spindle parameters were correlated with patients' clinical assessments (CRS-R), specifically spindle density ($R(71) = .32$, $p = .012$) and duration ($R(71) = .42$, $p < .001$), consistent with previous research. In contrast, spindle amplitude and energy showed no significant correlation with diagnosis. Moreover, the spatial distribution of sleep spindles appeared to be associated with the level of preserved consciousness ($R(71) = .38$, $p = .005$). These results suggest that the re-emergence of typical spindle activity patterns may indicate the restoration of thalamo-cortical connectivity and reflect a more favourable clinical condition.

Topic Area: OTHER

F104 - How children differ in structuring continuous experience: Insights from individualized neural state boundaries

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To deal with the onslaught of continuous information that we experience moment to moment, humans carve up our experience into smaller, discrete, chunks (e.g. events)—via a process called event segmentation. Discretizing our experience in this way matters greatly for our cognition, shaping what we remember, determining what information is accessible, and even affecting the predictions we generate. However, little research has explored event segmentation in children, and much existing work contradicts Event Segmentation Theory (EST). Functional MRI (fMRI) evidence suggests children divide information into fewer events than adults, yet EST predicts children should divide information into more. We propose this discrepancy between theory and data arises from the current methodology's reliance on modelling group-averaged data. Children's fMRI data is more variable than adults due to greater motion profiles and individual differences, and more variability systematically biases models towards less events, possibly, resulting in the observed discrepancy. By adapting an individualized, neural, event segmentation measure for children that accounts for their increased variability, this study will resolve the discrepancy between theory and data while enabling the investigation of individual differences in children's segmentation. After adapting this measure, we will examine how segmentation changes across development and how the magnitude of individual differences shifts with age. We will first examine how the number of events changes with age and then assess how the magnitude of individual differences in the number and timing of events evolves across development.

Topic Area: OTHER

F105 - The Influence of Event Boundaries on Working Memory Updating

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How do readers update their working event models? Two distinct mechanisms have been proposed: incremental updating, where people selectively update only changed dimensions, and global updating, in which any change triggers a complete model reconstruction. Across two experimental paradigms, we tested the hypothesis that people update incrementally within events and globally across events. In Experiment 1, participants read narratives with systematic changes in spatial, object, and goal dimensions. Intermittently, they answered recognition memory questions that followed (1) no shift, (2) a shift in the same dimension, (3) a shift in one different dimension, or (4) shifts in two different dimensions. Afterward, participants performed the segmentation task. Bayesian analysis of reaction times provided inconclusive evidence that people update incrementally within events and globally across events. Experiment 2 employed a novel implicit reading-time paradigm to examine updating mechanisms during natural reading without interruption. Participants

read narratives of everyday activities in which the target dimension (space, object, or goal) either matched or mismatched previously established information, while non-target dimensions either repeated or shifted. Afterward, they again performed the segmentation task. Pilot data supported our hypothesis: readers showed evidence of global updating across event boundaries, reflected in reduced processing time for target mismatches when preceded by non-target switches. Preliminary data from both experiments are inconclusive, though some patterns tentatively support incremental updating within events and global updating across boundaries. This shift from incremental to global updating demonstrates the stability–flexibility balance that people engage to understand the world around them.

Topic Area: OTHER

F106 - Metabolic health risk worsens the impact of residential air pollution exposure on the two-year decline in perceptual speed across the adult lifespan

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Exposure to air pollutants is a modifiable risk factor for dementia, and its mitigation may significantly improve late-life health. However, the individual contributions of different species of air pollution to pre-clinical cognitive decline across the lifespan remain unclear. We examined the effects of air pollution exposure over approximately two years on memory, perceptual speed, and inhibition in a community-based sample of adults (N = 137, ages 19-78 years). Annual average exposure to PM2.5, NO, NO2, and O3 was estimated from an offline 3-D chemical transport model applied to residential histories. Exposure during the calendar year preceding baseline was examined as a predictor of baseline and 2-year changes in cognition, with false discovery rate correction. Metabolic health risk was modeled as a composite of waist-to-hip ratio, systolic and diastolic blood pressure, fasting glucose, triglycerides, and high-density lipoprotein cholesterol. Accounting for age and baseline task performance, greater metabolic health risk exacerbated the effects of PM2.5 exposure on declines in perceptual speed ($q = 0.0002$). In contrast, persons with lower metabolic health risk experienced greater effects of NO2 on declines in working memory ($q = 0.03$). All other effects of pollutants on cognitive performance were below the corrected significance level. These findings suggest that a common age-related metabolic health risk can modify the effects of air pollutant exposure, especially from PM2.5, on cognitive changes across the adult lifespan. The planned future analyses will examine the interactions of metabolic health factors, age, and PM2.5 pollution that may affect brain structure and cognition.

Topic Area: OTHER

F107 - Impaired Perceptual Discrimination Despite Intact Mismatch Negativity Following Selective Lesions to the Dentate Gyrus

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The hippocampal dentate gyrus (DG) is implicated in pattern separation of overlapping representations at encoding, with emerging evidence suggesting its role in perceptual discrimination. BL, an individual with selective bilateral DG lesions, has shown impairments in complex perceptual discrimination of highly similar objects. The current research investigates the extent to which BL shows a neural signature of perceptual discrimination of complex auditory stimuli and its relationship to perceptual discrimination and subsequent memory discrimination. The mismatch negativity (MMN), an event-related potential of auditory sensory memory, was measured in BL and 25 controls (51–68 years, 14 females) using a passive oddball paradigm of tone sequences differing in pitch contour. Participants then completed a subsequent memory test for targets against similar lure sequences (differing in contour) and dissimilar foil sequences (differing in frequency and contour). Finally, participants completed a back-to-back perceptual discrimination task for identical, similar, and dissimilar tone sequence pairs. Single-case analyses were conducted using Bayesian tests of deficit. On the perceptual discrimination task, BL showed a selective deficit in discriminating between similar pairs (3rd percentile) despite showing comparable MMN amplitudes to controls. On the subsequent memory test, BL showed greater response thresholds (i.e., more likely to endorse lures as old) than controls (4th percentile). Results suggest that DG damage impairs the transformation of sensory traces into accessible representations for explicit behavioural discrimination, despite neural evidence for incidental discrimination of similar stimuli. Findings reinforce the role of the DG extending beyond mnemonic discrimination to perceptual discrimination, and from vision to audition.

Topic Area: PERCEPTION & ACTION: Audition

F108 - Neural measures of spectral modulation detection

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The ability to recognize the shape of the speech spectrum is critical to online speech processing and to the acquisition of language, especially phonological representations. For this reason, there is clinical utility – especially for patients with hearing loss who use cochlear implants – in being able to assess sensitivity to spectral shape. This is usually accomplished by measuring thresholds for spectral modulation depth detection. Behavioral thresholds, however, cannot be obtained before roughly five years of age, well past the critical period of auditory development. Thus, there is urgent need to develop other methods for assessing spectral modulation depth detection. This study examined the potential utility of electrophysiologic measures to do so. Fourteen adults with normal

hearing were examined using an electroencephalographic (EEG) measure, the acoustic change complex (ACC), to 600-ms sounds that were unmodulated for the first 300 ms and then were modulated for 300 ms at a rate of 0.5 cycles per octave. Four modulation depths were used: 5 dB, 12 dB, 19 dB, and 26 dB. The first of these has shallow modulation, rarely detected by listeners with normal hearing; depth increased across the stimuli. Results revealed a clear P1-N1 ACC for all stimuli except the one with 5-dB depth, and ACC amplitude increased with increasing modulation depth. These findings match behavioral outcomes, which show 70.7% thresholds close to 7 dB. These findings are promising in suggesting that the ACC to spectral modulation will serve to more accurately quantify sensitivity to spectral structure in acoustic signals.

Topic Area: PERCEPTION & ACTION: Audition

F109 - Age-Related Neural Dedifferentiation is Driven by Reduced Reliability

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The distinctiveness of neural activation patterns in response to different stimulus categories (e.g., faces vs. houses) is typically reduced in older vs. younger adults. Such so-called age-related neural dedifferentiation has been observed across multiple brain regions and been associated with cognitive declines. Neural distinctiveness is often measured as the difference between within-category similarity (reliability) and between-category similarity (confusability) of neural activation patterns. Our previous cross-sectional work suggested that age differences in both within- and between-category similarity contribute to dedifferentiation (Simmonite & Polk, 2022), but cohort effects could not be ruled out because the analysis was cross-sectional. Here, we extended this analysis using longitudinal data. Sixty young adults (18-29 years) and 156 older adults (65-87 years) completed auditory (speech vs. music), visual (faces vs. houses), and motor (left vs. right hand) fMRI tasks. We estimated cross-sectional age differences in within-category similarity, between-category similarity, and neural distinctiveness within individualized ROIs in task-relevant cortical areas. Fifty-one older adults returned 3-5 years later to complete the same tasks, enabling longitudinal analysis. Cross-sectionally, older adults showed significantly reduced within-category similarity compared with the young adults across all three ROIs and reduced neural distinctiveness in the motor and visual ROIs. Between-category similarity showed no significant age differences in any ROI. Longitudinally, only within-category similarity declined significantly with age, most prominently in visual cortex, with no significant effects on distinctiveness or between-category similarity. These findings suggest age-related neural dedifferentiation is primarily driven by reduced reliability of neural activation patterns rather than increased confusability between categories.

Topic Area: PERCEPTION & ACTION: Development & aging

F110 - Dual Mediation of Cognitive Function by Prefrontal Cortical Thickness and Vowel Articulation in Healthy Adult Women

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Cortical morphology and speech articulation both exhibit age-related decline, yet their interdependence and contributions to cognitive performance remain generally unexplored. This study tested whether prefrontal cortical thickness and vowel space area (VSA) jointly mediate the association between precuneus morphology and cognition in healthy adult women. Seventy-five participants (ages 20–78) from the ABC study completed speech production, MRI, and cognitive testing. Participants produced "hot," "hoot," "heat," "hat," and "hub" fifteen times each in a sound-attenuated booth. Acoustic formants (F1, F2) were extracted in Praat, and VSA was ascertained using elliptical modeling and k-means clustering in R. Cognitive ability was indexed by the Montreal Cognitive Assessment (MoCA). Spearman correlations revealed positive associations between MoCA and cortical thickness in the superior frontal gyrus ($p = 0.24-0.28$, $p < .05$) and precuneus ($p = 0.22-0.26$, $p < .05$), and between VSA and prefrontal thickness ($p = 0.23$, $p = .048$). Dual mediation analyses indicated significant indirect effects of precuneus thickness on MoCA via both prefrontal cortical thickness ($\beta = 0.09$, 95% CI [0.04, 0.16]) and VSA ($\beta = 0.06$, 95% CI [0.02, 0.10]), supporting integrated structural and behavioral pathways for cognitive maintenance. Exploratory analyses showed a marked reduction in VSA after age 50, suggesting that menopause-related hormonal changes may contribute to reduced articulatory precision and cortical thinning. Collectively, these findings provide novel insight into how speech articulation, quantified through vowel space, serves as a sensitive behavioral indicator of neural integrity and cognitive function across the adult lifespan.

Topic Area: PERCEPTION & ACTION: Development & aging

F111 - Flexible invisible-body embodiment in childhood: Reduced sensitivity to visuomotor delay and limb scrambling

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Children gradually acquire stable internal models of body structure and learn how sensorimotor contingencies support body ownership. We tested whether children and adults differ in how body configuration and visuomotor synchrony shape embodiment toward an invisible avatar interpolated between virtual hands and feet (Kondo et al., Scientific Reports 2018). Twenty-four adults (> 18 years old) and twenty-six children (4-5 years old) performed a ball-reaching task while viewing virtual hands and feet rendered at life size on a large screen like a mirror. Hands and feet motion was tracked with wearable trackers and mapped to the avatar either synchronously or with a 1-s delay. Body configuration was either congruent with the participant's real limb

locations (Normal) or spatially rearranged (Scramble). Each participant completed four counterbalanced conditions (Sync/Delay x Normal/Scramble). After each condition, participants rated body ownership (Q1), the sensation of having an invisible body between the limbs (Q2), and agency over the avatar limbs (Q3) on 5-point Likert scales. Three-way mixed ANOVAs were performed. Subjective embodiment showed clear developmental differences. For ownership (Q1), synchrony significantly increased ratings in adults, whereas children showed little or no synchrony benefit. For invisible-body sensation (Q2) and agency (Q3), the scramble configuration and synchrony significantly reduced ratings in adults, but these reductions were absent in children. These results suggest that children maintain relatively high embodiment even when temporal contingencies or body-structure cues are degraded, indicating greater flexibility or lower precision in integrating body configuration and sensorimotor timing when constructing a coherent bodily self-consciousness.

Topic Area: PERCEPTION & ACTION: Development & aging

F112 - What does the Speech-to-Speech Synchronization Test actually measure?

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The speech-to-speech synchronization test (SSS-test) is a brief behavioral protocol in which participants continuously whisper the syllable /tha/ while listening to a rhythmic sequence of syllables. This simple paradigm can identify two distinct subgroups within the general population, low/high synchronizers. However, the cognitive processes measured remain unclear, and this study aimed to clarify the relationship between SSS-test performance and rhythmic production abilities. Using an online paradigm, 103 participants were classified as low/high synchronizers with the SSS-test. A subsample (n = 68; 35 low, 33 high) completed the production part of the Battery for the Assessment of Auditory Sensorimotor and Timing Abilities (BAASTA), a validated tool for assessing individual differences in auditory-motor synchronization. We performed a PCA to the 40 BAASTA measures, which revealed that high synchronizers outperformed low synchronizers on the first component, which accounted for 25% of the variance and reflected general rhythmic production performance. To further explore group differences, we performed an EFA on the 16 variables identified to significantly differ between groups to determine whether a smaller set of cognitive mechanisms underlay the observed differences. Three latent factors emerged: one associated with the ability to adapt tapping rhythm to a perceived rhythm, another with conscious perception of rhythmic differences, and a third with motor-rhythm stability. Importantly, only the first factor distinguished between groups. These results provide strong evidence that the SSS-test reflects enhanced auditory-motor synchronization ability rather than perceptual differences, resolving a key debate and clarifying the cognitive processes that this widely used test actually assesses.

Topic Area: PERCEPTION & ACTION: Motor control

F113 - Differential patterns of audiovisual integration in autistic and neurotypical adults: A mismatch negativity study

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Real-world perception requires integrating information across modalities, yet how brains process semantically incongruent bimodal inputs remains unclear. This study examined early multisensory processing in cognitively able autistic (n = 16; mean age = 22.56 years old) and neurotypical (n = 22, mean age = 19.78 years old) adults using EEG in a modified bimodal oddball task. Mismatch negativity (MMN), a negative-going ERP, offers a window into preattentive change detection and can reveal whether multisensory integration differences emerge at early, automatic processing stages. Participants viewed and heard meaningful animal pairings simultaneously: a standard ("meow-cat," 70%) and three deviants (10% each): meow-frog (visual deviant), rabbit-cat (auditory deviant), and rabbit-frog (audiovisual deviant yet semantically congruent). Mean amplitudes of difference waves (deviant – standard) quantified auditory, visual, and audiovisual mismatch responses, and fractional latencies characterized temporal dynamics. Both groups showed similar patterns for auditory and visual deviants. The autistic group exhibited attenuated visual MMN (mean = -0.98 uv) amplitude relative to neurotypical participants (mean = -1.44 uv). Temporal analyses indicated visual dominance (Colavita-like effect) across groups, with auditory difference waves peaking later in an N2-like window in 200 - 300 ms. Critically, neurotypical participants showed a clear audiovisual MMN, whereas autistic participants showed no reliable audiovisual MMN (t = -2.28, p = .028). Subsequent N400 analysis revealed semantic processing in neurotypical but not autistic participants, highlighting differential sensory integration mechanisms. Neurotypical adults' responses were driven by both stimulus frequency and cross-modal semantic relationships, whereas autistic participants showed sensitivity primarily to audiovisual semantic incongruence.

Topic Area: PERCEPTION & ACTION: Multisensory

F114 - Neural integration of syntactic and visual temporal information in sentence comprehension

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During sentence processing, the brain continuously tracks the temporal structure of unfolding speech. Prior work suggests that higher-level linguistic information, such as syntactic structure, provides top-down temporal predictions that help organize incoming speech, whereas visual speech (lip and articulator movements) provides bottom-up temporal cues that reflect moment-to-moment acoustic dynamics. However, how these two sources of temporal information interact remains unclear. Here, we tested whether syntactic and visual

timing cues contribute independently to neural encoding of speech or interact during audiovisual sentence comprehension. Intracranial EEG (iEEG) was recorded from nine patients listening to 100 English sentences in five conditions: a visual-only baseline and four auditory-present conditions varying modality (auditory-alone vs. audiovisual) and acoustic degradation (temporal vs. spectral; AM vs. FM). Analyses focused on the auditory-present conditions. For each condition, neural activity was modeled using multivariate temporal response functions (mTRFs) from the acoustic features, with or without additional syntactic predictors. Syntax-related improvement was quantified as the increase in predictive accuracy relative to the acoustic-only models. Results showed greater syntax-related improvements for audiovisual compared to auditory-alone speech, indicating that visual speech enhances syntactic temporal predictions. In addition, improvements were larger for AM- than FM-degraded speech, suggesting that syntactic structure primarily compensates for disrupted temporal acoustic cues. Together, these findings indicate that syntactic and visual temporal cues interact during continuous speech comprehension, supporting a cross-modal temporal scaffolding account.

Topic Area: PERCEPTION & ACTION: Multisensory

F115 - Exogenously-driven interhemispheric functional synchrony in the split-brain

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Large-scale functional networks in the human brain follow a well-characterized interhemispheric organization, with the topography of individual systems appearing as near mirror images across the left and right cerebral hemispheres. The corpus callosum (CC) is thought to provide the essential scaffolding upon which information may be efficiently exchanged and integrated between specialized processing nodes in each hemisphere. We recently reported on a new cohort of adult corpus callosotomy patients who underwent resting-state fMRI, demonstrating that full transection of the CC broadly obliterated typical patterns of interhemispheric functional connectivity (FC); however, some sensorimotor networks appeared to remain integrated, despite evidence for behavioral disconnection effects. The present study therefore sought to determine how synchronized exogenous inputs may produce apparent interhemispheric FC in the absence of direct lines of communication between the left/right hemispheres. Eight adult split-brain patients (2 partial, 6 complete) completed resting-state fMRI in addition to 15 minutes of passive movie-watching (using a stimulus set from the Human Connectome Project). We employed multiple network neuroscience methods, including whole-brain analyses of FC,

data-driven community detection, and an edge time series approach for analyzing functional network dynamics, to assess differences between intrinsic (resting) and extrinsic (movie-watching) network states. Results highlight distributed increases in interhemispheric FC beyond mere sensorimotor systems. These findings may inform cross-cueing and other behavioral strategies split-brain patients use to coordinate behavior 'outside the brain', given myriad synchronized perceptual inputs to each disconnected hemisphere.

Topic Area: PERCEPTION & ACTION: Other

F116 - Brain oscillations during naturalistic tutoring of science concepts using metaphors

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Metaphors in science help students grasp abstract ideas by linking them to familiar concepts (e.g. enzymes as "lock and key"), but neural correlates of live metaphoric learning remain unexplored. This study compared metaphoric and literal learning using EEG and behavioral measures (a science test in which participants rated concept familiarity, concreteness, and answered free-response and multiple-choice questions). Based on word learning and metaphor literature, we expected condition differences in theta (novel word learning; Bakker-Marshall et al., 2018) or/and gamma (complex and figurative meaning; Wang et al. 2012; Rommers et al. 2012). Forty-six high school students (14-17 yo) learned 40 biological concepts, half metaphorically (e.g., The cilia form a broom that sweeps mucus...) and half literally (e.g., The cilia move back and forth you clear mucus...), in one-on-one scripted tutoring, while their EEG was recorded. Before and after tutoring, participants took the science pre- and post- tests. Behaviorally, tutoring facilitated learning equally between conditions. In an EEG power spectral density analysis during the student's explanation of what they learned. There was no significant effects for theta or gamma effect. We then conducted an exploratory analysis of power in frequencies ranging from delta through low gamma (1 to 70 Hz). Concepts taught via metaphors showed decreased power in the frontocentral region beta band (15-21Hz) compared to concepts taught literally. This finding is consistent with beta activities for abstract-metaphoric action sentences (Schaller et al., 2017), complex metaphors (Lachaud, 2013), and naturalistic reading of Wikipedia articles with metaphors (Mao et al., 2025).

Topic Area: PERCEPTION & ACTION: Other

F117 - Probabilistic reinforcement learning enhances processes supporting conscious perception of rewarding stimuli

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Conscious perception allows people to subjectively experience sensory input, but it is unclear what stimuli will be consciously perceived and by what mechanisms. Probabilistic reinforcement

learning allows people to incrementally learn which stimuli are likely to be rewarding, thereby offering a possible mechanism through which the visual system prioritizes such inputs for conscious perception. Participants completed ten iterations of combined 'learning+perception' study blocks while electroencephalography (EEG) was recorded. During learning, participants made choices as to which stimulus type (face or house) was more likely to yield a reward. During perception, participants localized a briefly presented, perceptually masked face or house stimulus and rated how clearly they saw it (perceptual ratings). The findings showed that participants successfully learned which stimulus type was more likely to be rewarded. Importantly, during the perception block, more (vs. less) rewarding stimuli from the previous learning block elicited enhanced event-related-potential (ERP) responses that have been previously associated with conscious visual perception, namely a greater occipito-parietal visual awareness negativity (VAN; ~200-300 ms) and a greater centroparietal late positivity (LP; > 400 ms). However, subjective perceptual ratings did not differ for previously more rewarding stimuli. These findings suggest that neural processing was enhanced for the more rewarding stimuli but that this enhancement did not translate into changes in reported awareness. This study provides initial evidence that reinforcement learning can influence the neural correlates often associated with conscious perception, but which under certain circumstances may or may not ramify into enhanced reportable subjective experience of perceptual inputs.

Topic Area: PERCEPTION & ACTION: Vision

F118 - Revisiting body topography in lateral occipitotemporal cortex

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Lateral occipitotemporal cortex (LOTc) is well-known to exhibit adjacent clustering of selectivity for face and body stimuli. Often these focal points of selectivity are characterized as reflecting activation of distinct face- and body-selective brain regions, the occipital face area (OFA) and extrastriate body area (EBA). However, previous studies have provided some evidence that they may form components of a larger topographic organization that either reflect the adjacency of body parts to each other, or a radial organization relative to motion-selective V5/hMT. We sought to revisit this issue using ultrahigh field 7T fMRI and DTI to more conclusively test these hypotheses. Data was collected for participants (N = 5, data collection on going) across three sessions. In Session 1, participants viewed videos of moving body parts (heads, arms, hands, stomachs, legs, and feet) with both event-related (4 runs) and block designs (4 runs). In Session 2, localizer scans were performed to isolate both motion-selective and category-selective (faces, bodies, scenes, and objects) regions of interest (4 runs each). In Session 3, data was collected for population

receptive field mapping (4 runs) using body part stimuli, as well as resting state, functional connectivity (while watching a video of contemporary dance), and DTI. Preliminary analysis of the data from Session 1 suggests the topography of responses in LOTc for different body parts varies markedly across individuals, with different individuals showing loci of selectivity for some body parts, but not others.

Topic Area: PERCEPTION & ACTION: Vision

F119 - Driving after Stroke: Left and Right Hemisphere Strokes Create Different Problems

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Driving is a complex task that involves several cognitive and sensorimotor processes. Strokes can create a range of impairments depending on the size and location of the affected brain tissue. While many neuroimaging studies have focused on brain regions that are important for different cognitive functions, few have targeted the specific problems that can arise when driving after stroke. We investigated driving after stroke using a fully interactive driving simulator which captured driving performance in terms of the different types of errors that were committed during a simulated driving assessment. We assessed 30 individuals with left hemisphere stroke and 28 with right hemisphere stroke. We then used available MRI scans to reconstruct stroke-related tissue damage, resulting in over thirty reconstructed brain lesions. Driving errors involving speed management, lane positioning, vehicle collisions, and stop signs were then analyzed as a function of lesion load, cerebral hemisphere, and proportion of white matter damage. Results revealed that problems in speed management were more prominent following damage to the left hemisphere. In contrast, greater problems maintaining lane position were significantly associated with overall lesion load, particularly within the right hemisphere, and with a greater degree of white matter involvement. Preliminary results additionally suggest that the right insular region may be important for monitoring lane position. Together, these results suggest that driving rehabilitation programs for stroke survivors should be tailored according to the cerebral hemisphere affected as well as the proportion of white matter involved.

Topic Area: PERCEPTION & ACTION: Vision

F120 - Modeling human attentional priorities improves event boundary predictions in a computational model of event perception

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Humans naturally form representations of ongoing events that help predict upcoming perceptual states. When prediction quality decreases, this may trigger updating of these representations—a

process known as event segmentation. Forming and evaluating predictions depends importantly on attention, but current computational models do not well capture the human attentional priorities during event viewing. To address this limitation, we augmented the Structured Event Memory (SEM) model, (Nguyen et al., 2025, PNAS Nexus) with ground truth information about human attention using eye-tracked fixation data from naturalistic videos. We trained SEM with and without fixation information and assessed two measures central to event comprehension: detecting boundary points between events where prediction quality decreases (event segmentation) and forming event categories that support ongoing prediction and comprehension (event categorization). We quantified segmentation agreement as the alignment between each model's predicted boundaries and human-marked boundaries, and categorization as the agreement between each model's labeled event categories with human event categories. Attention weighting significantly improved agreement with human segmentation relative to the original model, while effects on categorization were inconsistent. These results highlight the importance of incorporating human attentional priorities in modeling event comprehension.

Topic Area: PERCEPTION & ACTION: Vision

F121 - Neurobehavioral Dynamics of Numerical Change: Directional and Numerical Distance Processing

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This study reanalyzes spatiotemporal and behavioral data from a numerical change detection task, where arrays of 1–6 dots were shown in habituation and change trials using a 128-channel EEG system. Twenty-four adults viewed sequential dot arrays and pressed a key upon detecting numerical changes; reaction time (RT) and accuracy were recorded. Both change and no-change trials were included for comparison. The original goal was to examine whether N1 deflections for Small (1–3) versus Large (4–6) numerosities in the Parietal-Occipital-Temporal (POT) montage follow the same scaling pattern reported by Hyde and Spelke (2009). Differences between small and large set sizes were consistent with prior findings (Tang et al., 2025). We extended the analysis to include No-Change (baseline) and Change conditions, numerical distance (1, 2, or 3), and change direction (Increasing vs. Decreasing). Unlike Hyde and Spelke's passive task, participants in our study actively responded to numerical changes. RTs decreased with larger numerical distances, and accuracy was higher for Decreasing trials and greater distances. Because numerosity changes were actively monitored, we also analyzed midline frontal (Fz) activity to assess Mismatch Negativity (MMN) as a neural index of change detection. MMN was measured at 100–120 ms post-stimulus, while P1 (80–120 ms) and N1 (125–200 ms) were analyzed over bilateral POT regions. Stronger MMN

amplitudes were found for Decreasing versus Increasing changes, scaling with numerical distance. MMN amplitude increased with greater differences, and latency was shorter for Increasing trials. P1–N1 differences in POT regions similarly grew with numerical distance in both directions.

Topic Area: PERCEPTION & ACTION: Vision

F122 - Watching chaos unfold: Asymmetries in attentional effort when moving towards order versus chaos

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In perception, visual processing strives towards order, both in space (via object segmentation) and in time (via event segmentation). In physics, however, systems strive towards chaos, and the reverse—maintaining order—costs energy. Here we asked how this fundamental law of entropy manifests in visual processing, especially in how we attend to unfolding order or chaos. We turned to a curious phenomenon: the pendulum wave. It consists of a row of pendulums, swinging with identical amplitudes but monotonically increasing frequencies. The pendulums synchronize and desynchronize over time, resulting in momentary percepts of “order” (motion appearing as a coherent wave) and “chaos” (where coherent motion seems to disappear). We tracked attentional effort across continuously transitioning pendulum waves using a multiple object tracking task. The transitions went from order to chaos or chaos to order, and we presented sliding windows of the full transition with probes in the early, middle, or late parts of each window to capture performance over time. We found that tracking performance decreased over time, but this was influenced by the progression and direction of the transition. The transition from order-to-chaos disrupted performance early (compared to its chaos-to-order counterpart—and the unfolding chaos showed a stabilizing effect on performance as the animation progressed (which was not true for unfolding order). Thus, in perception, as in physics, the law of entropy seems to structure visual processing: while the loss of order can be disruptive, the resulting chaos may free up attentional resources, allowing for more flexible attention allocation.

Topic Area: PERCEPTION & ACTION: Vision

F123 - Longitudinal biometric analysis of student competency and expertise development

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Validity evidence from written tests is essential for supporting decisions about student competency in health professions education. Multiple-choice question (MCQ) tests are often used to assess clinical reasoning, assuming test-taking thought processes mirror those in real-world practice. Response process validity examines the cognitive processes individuals use when answering test questions, relying on

indirect measures (e.g., self-report) to assess cognitive processes. Biometric data, specifically brain activity and eye-tracking data, could complement these measures and contribute valuable validity evidence. Event-related potential components (i.e., P300) derived from electroencephalography (EEG) can differentiate experts from novices in domain-specific declarative knowledge, yet the mechanisms underlying progression from novice to expert remain unexplored. This longitudinal study is the first to integrate brain activity and behavioural data to examine test-takers' response processes. Our aims are to (1) determine the neural and behavioural correlates of response processes during MCQ test-taking, and (2) establish a dataset illustrating the neural progression from novice to expert. Participants are students in undergraduate and health professions programs. Once per program year, we collect EEG, eye-tracking, and facial expression data as they complete cognitive tasks (pre- and post-test) and a program-relevant MCQ test. The cognitive tasks assess default functional connectivity (resting state), cognitive fatigue (oddball), working memory (n-back), and spatial skills (mental rotation). Preliminary data show significant relationships between MCQ test duration and oddball P300 latency (pre-test; $r_s = 0.408$, $p = .006$) and amplitude (post-test; $r_s = -0.313$, $p = .047$), suggesting relatively stable within-participant processing speeds and greater cognitive fatigue among slower test-takers.

Topic Area: THINKING: Decision making

F124 - Temporal dynamics of boredom during slot machine gambling

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Boredom is a powerful cognitive-affective state that motivates action, signaling us to disengage from the current task and to switch to another task instead (Danckert & Elpidorou, 2023). People may gamble to alleviate boredom, and both boredom and gambling intensity may fluctuate with time-on-task. An ideal environment for studying these effects is within slot machine gambling, as a session-based form of gambling wherein players, on a continuous basis, choose their bet configuration and place a bet. We invited undergraduates to a "Casino Lab" (66 participants; 12,532 bets), where they freely played a slot machine task for 25 minutes. We used a simulated slot machine housed in a real slot machine case, and the modified game allowed us to collect boredom probes every 5 minutes. Despite monetary incentives and intense sensory feedback, boredom ratings increased as the session progressed ($b = .17$, $p < .001$); boredom increased when win percentages were low ($b = .02$, $p = .004$). Boredom was associated with a faster response latency. The association between boredom and response latency was positively moderated by time-on-task (interaction $b = .16$, $p < .001$) such that boredom early in the session was associated with a faster response, but boredom late in the session was associated with a slower response. Similar results were observed in a pilot sample that played on an authentic (i.e., real) slot machine (58 participants; 11,271 bets).

Our findings illustrate the dynamic behavioral correlates of boredom during gambling in a peculiar environment engineered to be highly stimulating.

Topic Area: THINKING: Decision making

F125 - Stress impairs selective attention during complex decisions: an EEG study

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Understanding how acute stress affects decision-making, particularly in high-stakes contexts such as aviation and emergency situations, remains unclear. The literature reports mixed results on how acute stress influences attentional control during decision-making. To address this issue, the present study investigates how stress modulates the processing of task-relevant information in complex decisions. Sixty participants (22 males; aged 18–40 years) underwent either a stressful or a control induction task, before performing a complex decision-making task. This simulated an aviation scenario in which participants had to decide, under time pressure, whether to land or perform a go around. Visual and auditory information were presented simultaneously, but decisions were finally always based on one modality. The relevance of auditory cues was manipulated: in some trials, they were task-irrelevant and had to be ignored, whereas in others they became task-relevant because the visual information was unreliable. Stress indicators were measured through heart rate variability and subjective stress ratings. Results showed that the stress induction was effective, as subjective stress ratings were higher in the stress group compared to controls. Preliminary behavioural analyses ($N=53$) showed that accuracy decreased in the stress group compared to the control, but only when auditory information was relevant to the decision. This result suggests that stress impairs selective attention during decision-making, leading participants to rely more heavily on visual information, even when it was unreliable, and to ignore task-relevant auditory cues. Ongoing EEG analyses and mixed-model approaches will further characterize how acute stress alters attentional control during complex decision-making.

Topic Area: THINKING: Decision making

F126 - Prefrontal Neuromodulation Restores Model-Based Control in Obsessive-Compulsive Disorder

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Reinforcement learning (RL) is often described in terms of model-free (MF) strategies that incrementally update action values based on reward history, and model-based (MB) strategies that rely on an

internal model of the environment to plan future actions. Obsessive-compulsive disorder (OCD) has been associated with altered RL, particularly reduced expression of MB control. However, it remains unclear whether this reflects impairment of MB mechanisms or dysfunction in the arbitration between these systems. Here, we address this question using a modified version of the two-step decision task combined with transcranial direct current stimulation (tDCS) targeting the inferior lateral prefrontal cortex (ilPFC), a region implicated in the arbitration between MF and MB control. Individuals with OCD (N=32) and healthy controls (N=30) performed the task under baseline, sham, inhibitory, and excitatory stimulation conditions. Consistent with prior work, OCD participants showed reduced MB behavior relative to controls during baseline and sham sessions. Critically, excitatory stimulation of the ilPFC selectively enhanced MB control in the OCD group, while inhibitory stimulation produced no significant change in either group. No effect of excitatory stimulation was observed in healthy controls. Computational modeling within an RL framework further supported these findings. Moreover, excitatory stimulation improved behavioral flexibility following reward revaluation in the OCD group, whereas inhibition induced perseveration. Healthy controls showed the opposite pattern. Together, these results suggest that enhancing activity in the ilPFC promotes model-based behavior and improves adaptive flexibility in OCD. Consequently, individuals with OCD may exhibit dysfunction in the arbitration between MF and MB decision systems.

Topic Area: THINKING: Decision making

F127 - Splitting Mental Imagery: A Divided Visual Field Adaptation of the Mental Imagery fMRI Paradigm for future Split-Brain Application

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Mental imagery tasks in fMRI, such as imagining playing tennis or navigating through one's home, have been used to detect volitional brain activity in non-communicative patients, including those in vegetative states. Spatial navigation and motor imagery were shown to be the most robust paradigms for this purpose. Building on this established approach, we developed a lateralized adaptation specifically designed for future investigation of split-brain patients whose disconnected hemispheres offer a rare experimental window into the nature of consciousness. In this task, we replaced auditory cues with lateralized visual stimuli to probe the content of the imagery. A tennis racket or a house image was flashed for 120 ms to either the left or right visual field, followed by an imagery period requiring sustained motor (tennis) or spatial navigation (house) imagery. As a validation step, we scanned 25 neurologically healthy participants to determine whether this modified paradigm reliably evokes activity in expected brain regions of interest in a subject-specific manner. Here we present results from this validation study in healthy controls, showing expected activation patterns within canonical regions of

interest during motor and spatial imagery, though the strength and extent of these effects varied across participants and visual field conditions. This approach opens an exciting avenue for probing the nature of consciousness in the divided brain by investigating whether a lateralized cue can effectively engage the contralateral hemisphere in the mental imagery task and whether the hemispheres will correlate in their activation patterns following the same probe.

Topic Area: THINKING: Other

F128 - Mitigating Brain Fog Through Cognitive Training: A 3-Arm RCT in Breast Cancer Survivors

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One in three breast cancer survivors experience persistent “chemo brain,” with difficulties often undetected by standard cognitive tests. This highlights the need for sensitive metrics and scalable solutions. Intervention studies have largely focused on bottom-up approaches because of their scalability, while strategy-based and psychoeducational models remain less examined. This study moves the field forward by directly comparing these approaches to show how each may support cognitive health and quality of life after breast cancer. This study compared three online interventions: Top-Down (SMART+), Bottom-Up (BrainHQ), and self-directed Psychoeducation. Prior to randomization, participants were stratified by age, time since chemotherapy, education, and degree of cognitive complaint. Female breast cancer survivors (N = 134) completed assessments at pre-, post-, and delayed post-training. The primary outcome was the BrainHealth Index, with associated factor scores of Clarity, Connectedness, and Emotional Balance. Secondary outcomes included processing speed, memory, attention, and self-reported cognitive complaints. Group × time effects emerged only for processing speed: Bottom-Up participants showed strong practice-related gains ($p < .001$), and Top-Down participants demonstrated delayed improvements on this untrained measure versus Psychoeducation ($p = .04$). BrainHealth Index gains appeared at post-training for Top-Down and Psychoeducation ($p \leq .01$) and at delayed for Bottom-Up ($p = .02$). Attention and self-report improvements occurred across all groups; memory did not change. Overall, findings reveal distinct yet complementary routes to recovery. Top-Down produced cross-domain improvements, Bottom-Up yielded dose-linked cognitive gains, and Psychoeducation enhanced holistic well-being. Results demonstrate the utility of scalable interventions to mitigate cognitive deficits in cancer survivors.

Topic Area: THINKING: Other

F129 - Manipulating the Heart, Revealing the Mind: Cardiac Signal Processing Induced Self-Related Thought

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We frequently experience mind-wandering (MW), in which our thoughts drift away from the task at hand. Previous studies have mainly focused on external factors, such as changes in the environment, as triggers of MW. However, approximately half of MW episodes cannot be explained by external causes, suggesting that unconscious processing of bodily signals may contribute to the spontaneous emergence of thought. To address this possibility, we investigated how individual differences in interoceptive accuracy (IA) and the neural processing of visceral signals relate to the occurrence and content of MW. IA was measured using the heartbeat counting task. We experimentally manipulated cardiac signal processing by randomly omitting heart-synchronous tones (cardiac-manipulation), which resulted in a significant heart-rate deceleration and enhanced heartbeat-evoked potentials (HEPs). Participants performed a simple attention task while heartbeats were manipulated and reported their ongoing thoughts using thought probes presented at random intervals. Results showed that participants with higher IA reported a greater frequency of self-related thoughts (i.e., past episodes and future plans) specifically during the cardiac-manipulation block. Moreover, higher IA was associated with a larger HEP amplitude during self-related thoughts, and this association was significantly enhanced under the cardiac-manipulation condition. These findings suggest that as individuals more precisely detect and neurally amplify cardiac signals, internally focused, self-referential thought is selectively facilitated. This provides a body-centric mechanism for the generation of MW content, indicating that the conscious experience of the self is fundamentally rooted in the processing of internal bodily states.

Topic Area: THINKING: Other

F130 - Neural mechanism underlying the construction of self-generated compositional imagery

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Mental imagery enables us to flexibly generate internal representations that are not directly perceived by the visual system. Growing evidence indicates that mental imagery is a voluntary and generative process involving the prefrontal cortex (PFC), rather than simply “reverse perception.” However, the specific functional role of the PFC in self-generated imagery remains unclear. Here we investigated how the brain self-generates imagery content with a compositional structure. Participants played a Tetris-like game with fMRI recordings. They were asked to either mentally combine two specific shape features into an object with a predetermined contour (cue-induced imagery), or to volitionally decide which shapes and/or objects to imagine (self-generated imagery). This design allowed us to examine whether self-generated imagery signals in the PFC are feature-like, object-like, or both. Whole-brain activation analyses revealed clusters showing increasing activity that scaled with increasing self-generation demands in the frontoparietal network and default mode network, implicating the role of these networks in self-

generated imagery. Moreover, whole-brain searchlight analyses (multivariate decoding and representational similarity analysis) provided converging evidence for representational differences between self-generated and cue-induced imagery. Superior representation of self-generated objects was observed in brain regions including the dorsomedial (dmPFC) and anterior lateral (alPFC) PFC. In contrast, feature representations engaged a distributed cortical network that remained comparable regardless of self-generation demand. This dissociation suggests that voluntary construction of self-generated compositional imagery relies primarily on PFC subregions to assemble high-level object representations, whereas the manipulation of detailed compositional features recruits a common imagery network.

Topic Area: THINKING: Other

F131 - Does anterior lateral prefrontal cortex play a domain-general role in reasoning?

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The capacity to jointly consider multiple structured mental representations, or relations, is foundational to reasoning. An anterior portion of lateral prefrontal cortex (LPFC) has been consistently implicated in higher-order relational thinking (i.e., comparing relations between sets of items), and has been theorized to sit atop a rostro-caudal abstraction hierarchy within LPFC. However, this hypothesis has not been extensively vetted. Here, we explore (1) whether any anterior LPFC Glasser parcels exhibit domain-generalty in relational thinking across sensory modalities and types of stimuli and relations, and (2) whether there exists a gradient towards greater abstraction from stimulus characteristics moving rostrally in lateral PFC. To these ends, we designed a relational matching fMRI paradigm with a 2x2x2 design: sensory modality (visual, auditory) × relation type (spatial (“where”) and featural (“what”) relational judgments) × relational complexity (1st-order, 2nd-order relations). Univariate contrasts (2nd-order > 1st-order conditions) showed robust overlap across all four tasks in bilateral anterior and posterior LPFC (N=59 young adults). However, multivariate pattern analyses revealed more fine-grained patterns of sensitivity to relational complexity, sensory modality, and relation type within LPFC parcels. Representational dimensionality increased along a caudal-to-rostral axis – inconsistent with the theorized gradient of increasing abstraction. Additionally, across LPFC, neural similarity among tasks is higher for 2nd-order than 1st-order relations, suggesting greater cross-task overlap when the tasks invite abstraction. These findings refine our understanding of anterior LPFC: rather than encoding abstract relations uniformly, it may house flexible, high-dimensional representations that enable reasoning and other higher cognitive functions.

Topic Area: THINKING: Reasoning

