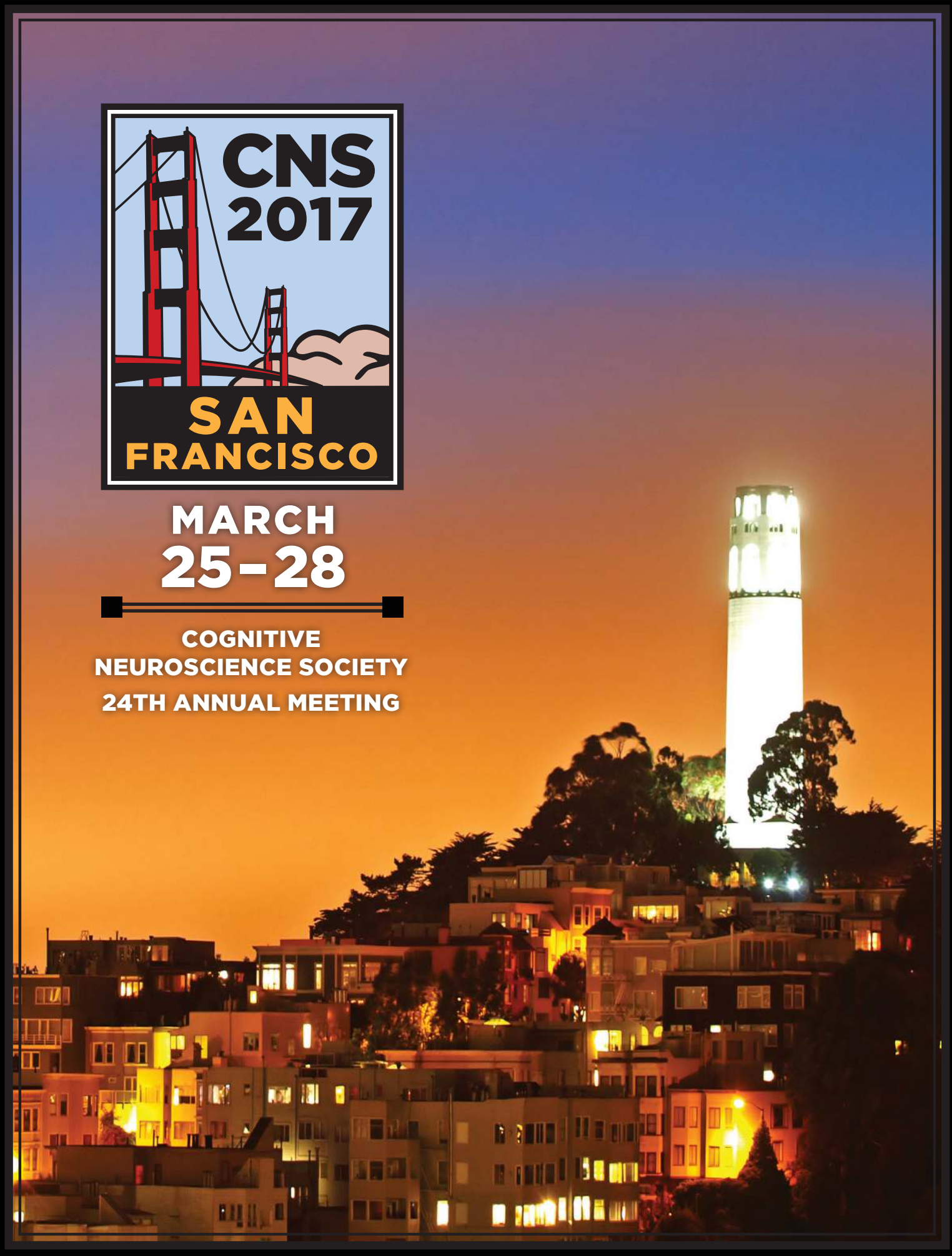
CNS
2017
SAN
FRANCISCO
MARCH
25–28
COGNITIVE
NEUROSCIENCE SOCIETY
24TH ANNUAL MEETING

The effects of attention modulation on sensory processing of spoken words in native-English and native-Polish listeners

Poster A1, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Monica Wagner[1], Jungmee Lee[2], Valerie L Shafer3; [1]St. John's University, [2]University of Wisconsin, Madison, [3]The Graduate Center, City University of New York

Wagner and colleagues (2016) demonstrated that the cortical sensory waveforms of the auditory evoked potentials (AEPs), the P1-N1-P2 and T-complex, reflect spectro-temporal feature changes within the spoken word and can be used to probe auditory processing deficits within auditory cortex. In the present study, we assessed whether sensory waveform morphology that reflects spectro-temporal feature changes within words remains unchanged for different listening conditions. Two groups of 24 adults (12 native-English and 12 native-Polish in each group) listened to nonsense word pairs within two experimental conditions designed to modulate attention. In one condition, participants performed a behavioral task to the second word in the word pairs and in the alternate condition participants were instructed to listen to the word pairs without performing a task. Conditions were counterbalanced so that one group performed the "without task" condition as the first testing session and performed the "with task" condition as the second testing session and the alternate group performed the tasks in reverse order. Two or more months separated each testing session. Analyses revealed that waveform morphology remained unchanged for different listening conditions and suggests that the P1-N1-P2 and T-complex can be used to probe spectro-temporal feature processing of spoken words in clinical populations without task performance. Negative waveform shifts reflected attention, which was influenced by language experience and allocation of attention resources differed for the language groups from the earliest cortical stages.

Topic Area: ATTENTION: Auditory

Prefrontal and parietal recruitment during the MSIT selective attention task predicts rTMS treatment outcome in patients with subjective tinnitus

Poster A2, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

George James[1], Jeff Thostenson[1], Ginger Brown[1], Gwendolyn Carter[1], Mark Mennemeier[1]; [1]University of Arkansas for Medical Sciences

Subjective idiopathic tinnitus is a disorder with no discernible etiology characterized by intrusive phantom perception of sound. Recent clinical trials suggest that repetitive transcranial magnetic stimulation (rTMS) can reduce tinnitus awareness. Based upon patients' anecdotal reports that rTMS reduced awareness of phantom sounds but not their intensity, we hypothesized that subjective idiopathic tinnitus may be a disorder of selective attention. To test this hypothesis, a subset of patients enrolled in a clinical trial using rTMS to treat tinnitus underwent functional magnetic resonance imaging (fMRI) while performing the Multi-Source Interference Task (MSIT) selective attention task. Twelve participants (mean(sd) age = 49(15); 3 female and 9 male) underwent fMRI at Baseline (prior to rTMS) and again after three rTMS treatment arms (one week of Sham, 1Hz, and 10Hz rTMS; with 3 week washout between treatments). Using a 200 region of interest (ROI) brain atlas, general linear modeling (GLM) estimated participants' change in brain activity for the MSIT contrast of Incongruent vs. Congruent stimuli at Baseline. Linear regression with bootstrap resampling then used these ROIs' Baseline GLM beta values to predict percent change in tinnitus awareness following rTMS treatment. After FDR correction for multiple comparisons, Baseline MSIT activity for 26 ROIs significantly predicted rTMS response. Greater recruitment of these regions at Baseline - which predominantly consisted of bilateral prefrontal and parietal cortices - corresponded to poorer treatment outcome. These findings support the use of functional neuroimaging to guide patient selection for rTMS treatment of tinnitus.

Topic Area: ATTENTION: Auditory

EEG Evidence of Covert Command Following and the Impact of State Fluctuations in Patients with Severe Brain Injury

Poster A3, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

William H. Curley[1], Jonathan D. Drover[1], Mary M. Conte[1], Nicholas D. Schiff[1,2,3]; [1]Feil Family Brain and Mind Research Institute, Weill Cornell Medicine, NY, [2]Department of Neurology, Weill Cornell Medicine, NY, [3]The Rockefeller University, NY

Patients with disorders of consciousness (DOC) following severe brain injury combine significant motor deficits with fluctuating arousal states, limiting their capacity for behavioral output and often leading to misdiagnosis. Multichannel video-EEG was recorded in 23 severely brain-injured patient subjects (PSs) and 15 healthy controls (HCs) during four distinct motor imagery tasks (tennis, swimming, open/close hand, and visuospatial navigation). We compared power spectral estimates of the EEG during task and rest (1-50 Hz, Two Group Test, $p \leq 0.05$) to identify differences in power between conditions, signifying task performance (Curley et al., 2016; Goldfine et al., 2011). Evidence of task performance was found for all tasks in all HCs and for one or more tasks in 16 of 23 PSs. Consistent and concordant spatiotemporal patterns of activation were observed in HCs and the patient responders, despite interpatient variability in extent of injury, etiology, and score on a standard behavioral assessment (CRS-R). However, both transient task performance within the allocated response period and baseline state fluctuations in patient subjects can confound our formal measures and potentially give rise to false negative results. Two methods examined the indeterminate responses to tennis imagery: 1) time-frequency analysis to resolve transient responses, and 2) analysis and grouping of individual trials based on background state reflected in power spectra. We identified previously

undetected capacity for command following using these methods. Our findings demonstrate the impact of state fluctuations on DOC patients' capacities to demonstrate awareness and the need to quantitatively assess state when testing for covert cognition.

Topic Area: ATTENTION: Auditory

A resonator model predicts temporal orienting in rhythmic music

Poster A4, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Brian K. Hurley[1], Lauren K. Fink[1], Petr Janata[1]; [1]University of California, Davis

Evidence suggests that auditory stimuli with periodic temporal structure can entrain listeners' attention to recurring, salient time points, such as the beat in music. Metrically structured music contains multiple hierarchically nested periodicities that ostensibly entrain attention to multiple periods (Large & Jones, 1999). How well can a model comprised of damped oscillators predict the loci of dynamic attention in metrically structured music? We test this question by combining a resonator model (Tomic & Janata, 2008) with a novel psychophysical paradigm for mapping dynamic attention in auditory stimuli. In two experiments, participants detected transient intensity deviants embedded within continuously repeating (looped) percussion patterns. For each stimulus we probed time points representing moments of model-predicted high salience and low salience. We assessed task performance by concurrently tracking separate detection thresholds for each probed time point within each stimulus loop. We repeated this paradigm for intensity increment and intensity decrement targets. Results from both tasks indicate that probe times associated with high resonator amplitude (i.e. greater modeled salience) are associated with low detection thresholds (i.e. better performance) and vice versa for low resonator amplitude. That these results replicate across the currently described experiments and a number of preceding pilot experiments suggest that Tomic and Janata's resonator model reliably predicts temporal attending in rhythmic musical stimuli. These findings refine our understanding of temporal orienting of attention in realistic auditory scenes, such as music. Moreover, the paradigm developed here may be useful for probing temporal attention in other forms of auditory stimuli, such as speech.

Topic Area: ATTENTION: Auditory

Neural generators and fast dynamics of the task-relevant P3a ERP

Poster A5, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Lizzy Blundon[1], Lawrence Ward[1]; [1]University of British Columbia

The P300, an ERP response associated with context updating and attentional resource allocation to oddball stimuli, contains at least two subcomponents, the P3a and the P3b. The P3a is observed in response to rare, salient, task-irrelevant oddballs, and may indicate exogenous attention orienting toward novel stimuli. The P3b is associated with target identification, and may reflect stimulus encoding mechanisms associated with context updating. It is believed that every P300 contains a mix of both P3a and P3b subcomponents; the relative contribution of each depends on the stimulus context in which the P300 is observed. We recorded EEG during an oddball task that featured sequences of identical tone patterns that differed only by a single feature. The P300 response to rare, salient, oddball targets contained strong contributions from both P3a and P3b subcomponents, providing evidence for a task-relevant P3a. Using independent component analysis and single dipole fitting, we inferred the neural generators for each subcomponent from the scalp EEG. Among the primary neural generators of the P3a is the anterior cingulate cortex and, possibly, posterior parietal cortex, whereas the P3b is associated most with activity in posterior cingulate cortex and superior parietal lobules. Phase locking value and narrow band transfer entropy were used to characterize the timing of the functional and effective connectivity, respectively, within these networks with respect to timing of the P300. The connectivity dynamics were found to mirror the timing of each subcomponent, with connectivity in the P3a network occurring earlier than that in the P3b network.

Topic Area: ATTENTION: Auditory

Predicting attentional failures: the spatiotemporal neural dynamics of attention during sustained dual-task performance.

Poster A6, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

James Elliott[1], Barry Giesbrecht[1]; [1]University of California, Santa Barbara

Failures of attention are common both in everyday activities like listening to a lecture and in potentially life-threatening scenarios such as flying a jet. To investigate the temporal and spatial characteristics of neural activity that predicts failures of attention, 14 participants performed two versions of a continuous temporal expectancy task while both EEG and fMRI were recorded. In both versions participants monitored a stream of flickering faces and cars (15Hz) for 3.5 minutes. Standard images were presented for 800 ms while targets, requiring a face vs. car discrimination, were presented for 1100 ms.. Half of the auditory stimuli presented coincided with the visual target. During single task blocks participants only responded to the visual targets. Dual task blocks required responses to both auditory and visual targets. Single task visual detection (M=.51) was better than dual task detection (M=.39, $F(1,12)=10.8$, $p < .01$). There was a decline in performance as a function of time within block ($F(8,96)=44.9$, $p< .001$). Pre- and post-target classification of EEG alpha activity (8-14 Hz.) in occipital and parietal electrodes was significantly better than permutation tests in both conditions. Pre-target classification of fMRI BOLD activity was significant in error monitoring and whole cortex regions, but not in perceptual or default

mode regions. Pre-target whole cortex classification was significantly better than an auditory vs. visual stimuli control classification ($F(1,13) = 10.4$, $p < .001$), confirming that the classification reflected pre-target activity. Overall, these results suggest that both fMRI and EEG can be used to predict subsequent performance.

Topic Area: ATTENTION: Nonspatial

Feedback guided learning: prefeedback alpha modulates utilization of outcome information

Poster A7, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Berry van den Berg[1,2], Benjamin Geib[1], Rene San Martin[1,3], Monicque Lorist[2], Marty Woldorff[1]; [1]Duke University, [2]University of Groningen, Univ Med Ctr Groningen, The Netherlands, [3]Universidad Diego Portales, Santiago, Chile

Deciding about making changes to behavior to optimize outcomes is a crucial component of learning and for successful navigation in the world. Here, we used electrical brain recordings (EEG) to map the cascade of cortical processes underlying such learning. Participants were presented with miniblocks of 20 trials. On each trial, they had to choose between either a face or a house, which was followed by feedback consisting of either a loss or a gain. During each miniblock, either the face or the house was somewhat more likely to lead to a gain (62.5%/37.5%). Neurally, as participants learned whether house or face choices were more likely to lead to a reward in a particular miniblock, we observed increased prefeedback oscillatory alpha power (8-14Hz) marking decreased cortical activity, as well as decreased amplitude of the feedback-evoked, attention-related P3 component. Additionally, prefeedback alpha predicted the utilization of outcome information, based on whether participants would decide to switch their choice on the next trial. That is, if they received a loss, lower vs. higher pre-feedback alpha predicted a higher vs. lower probability of switching on the next trial, an effect essentially absent if the feedback was a gain. Finally, the feedback-related negativity (FRN), a rapid-latency feedback-elicited ERP component reflecting outcome-valence evaluation, did not change with learning. In sum, the present study mapped the neural processes by which prefeedback electrical brain activity (alpha power) modulates the utilization of outcome information to facilitate learning, even prior to post-feedback activity reflecting the detection of valence outcome.

Topic Area: ATTENTION: Nonspatial

Contributions of the Supplementary Motor Area to the interaction between phasic alerting and conscious perception

Poster A8, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Mar Martín-Signes[1], Carlos Pérez-Serrano[1], Ana B. Chica[1]; [1]University of Granada

Attention is considered as one of the pre-requisites of conscious perception. Phasic alerting facilitates conscious perception through a fronto-striatal network, including the anterior cingulate cortex, supplementary motor area, frontal eye fields, thalamus, and caudate nucleus (Chica et al., 2016). In the present study, we explored the causal implication of the Supplementary Motor Area (SMA) in the relationship between phasic alerting and conscious perception. A sample of 32 participants was tested using a 1Hz offline repetitive Transcranial Magnetic Stimulation (rTMS) protocol while participants discriminated a Gabor stimulus presented in the threshold of consciousness. An auditory alerting tone was presented in half of the trials to manipulate phasic alerting. Results were compared with a sham condition and an active control, where the Inferior Parietal Sulcus (IPS) was stimulated. rTMS over SMA, as compared to the sham condition, reduced the alerting effect on the percentage of consciously perceived stimuli, while rTMS over IPS did not modulate the alerting effect, proving that the rTMS-SMA modulation was region-specific. Our results highlight the causal implication of the SMA in the relationship between phasic alerting and conscious perception, providing new data for the understanding of how different attentional networks interact with conscious perception and about the neural mechanisms underlying these interactions.

Topic Area: ATTENTION: Nonspatial

Region-specific neural consequences of Biased-Competitional Heterogeneity of the Effects of Attentional Prioritization

Poster A9, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Andrew D Sheldon[1], Elyana Saad[1], Bradley R Postle[1]; [1]University of Wisconsin, Madison

A recent study applying multivariate analysis to whole-brain fMRI showed that attention to a single stimulus increased the strength of its representation in many regions, including occipital, intraparietal sulcus, and precentral sulcus (Ester et al., 2016). This was interpreted as blurring the distinction between “sources” and “sites” of attention. Here, we used a visual search task to study the effects of attention on the neural representation of two simultaneously presented items, one in each visual hemifield. After the brief presentation of a search target (face, doughnut, or abacus), then a delay, the search array comprised the target and a distractor, both flickering at 1 Hz and unpredictably changing state. Upon array offset, subjects reported the number of state changes the target had undergone. Next, the array reappeared, with the items in the same location and a cue indicating (with $p = .5$) which of the two was the target. Multivariate pattern analysis in occipital cortex revealed that the

effects of attention differed in the two hemispheres: contralateral to the target, target representation was boosted and distractor suppressed to baseline levels; ipsilateral to the target, both stimuli were represented above baseline, but at a level lower than the contralateral target. In frontal and parietal cortex, in contrast, no laterality was observed, and only the target was represented above baseline levels. Thus, attention biases the competition for representation in occipital cortex, whereas frontal and parietal activity is consistent with the representation of a search template.

Topic Area: ATTENTION: Nonspatial

Attentional blink to alcohol cues in binge drinkers versus non-binge drinkers

Poster A10, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Francesco DePalma[1], Natalie Ceballos[1], Reiko Graham[1]; [1]Texas State University

Previous studies have shown alcohol-related attentional biases in social drinkers, however, the temporal dynamics of these biases are not well understood. The current study examined this issue in 99 participants (30 male) categorized as binge drinkers (BD) or non-binge drinkers (NBD). Two versions of an alcohol-related attentional blink (AB) paradigm were used: one with words and one with images. It was predicted that BDs (versus NBDs) would exhibit reduced AB for alcohol cues, which would be enhanced for the pictorial version of the task (versus words). The relationships between AB and alcohol craving, quantity and frequency of alcohol consumption, symptoms of alcohol use disorder, and family history of alcohol use disorder were also examined. While an AB was observed for both alcohol and non-alcohol targets in the NBD group, no AB was found for alcohol targets in the BD group. Furthermore, the magnitude of the AB was related to drinking, such that higher self-reported hazardous drinking was associated with smaller ABs to alcohol-related targets. These results suggest that alcohol-related stimuli are processed more efficiently by BDs, especially those with hazardous alcohol consumption patterns. These results may help to inform treatment and prevention efforts targeting binge drinkers.

Topic Area: ATTENTION: Other

The Children's Brain Activation in Discriminating Faces along the Morphed Continuum of Happy and Fearful Expressions

Poster A11, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Ming-Chun Lee[1], SHIH-TSENG HUANG[1]; [1]Department of Psychology and Center for research in Cognitive Science, National Chung-Cheng University, Taiwan

The study used morphed faces to investigate the perceptual advantage of between-categorical compared with within-categorical facial expressions. Twenty-nine participants including 15 males and 14 females (aged from 19-24) were recruited from a University of southern Taiwan. Three sets of male happy and fearful expressions were selected from the natural facial expressions of the Taiwanese standard emotional stimuli database. We then morphed the two kinds of emotions of each set into one hundred equal scaling combined facial expressions. Results found the peak amplitudes(PAs) of P120 and N170 of second faces were higher than those of the first faces on PO8. Children were found higher at PO7 and PO8. Adults, on the other hand, were higher of their P120, N170, P3, and LPP at the Fz, Cz and Pz. The mean amplitudes(MAs) at F4 than F3 of adults were found higher activation in the Between than in the Same and Within conditions. The difference of children and adults of brain activation in processing faces related to the developing ability in children especially in their emotional perceptual categorization.

Topic Area: EMOTION & SOCIAL: Development & aging

The effects of aging on gaze biases for faces

Poster A12, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Toshiki Saito[1], Rui Nouchi[1], Hikari Kinjo[2], Ryuta Kawashima[1]; [1]Tohoku University, [2]Meiji Gakuin University

Eye movement suggests one's choice. For example, people facing a choice between multiple stimuli tend to look longer at stimulus that are finally chosen than others. This tendency is called the gaze bias effect. This is one of key aspects of visual decision making. However, little is known about if aging affects the gaze bias effect. Here, we used 2 Alternative Forced Choice Task (2AFC) to compare looking behavior that indicate different stages of decision process between young (n = 18) and older adults (n = 20). We monitored eye movements with eye tracker (Tobii-T60) during 2AFC with four prompts: Like, Dislike, Similar and Dissimilar. The results showed that the gaze bias effect occurred under all conditions in both age groups. However, we found the following age differences. First, in the dislike condition, the first dwell duration (the amount of time that item is looked at when first encountered) of young adults was shorter than older adults. Second, until decision processes, older adults shifted their gaze toward chosen stimuli earlier than young adults. Our results firstly showed that there is an aging effect on the looking behavior during decision making but the gaze bias effect persist through lifetime.

Topic Area: EMOTION & SOCIAL: Development & aging

Sexually dimorphic cerebellar findings in children with ADHD

Poster A13, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Jina Pakpoor[1,2], Deana Crocetti[1], Stewart Mostofsky[1,2]; [1]Kennedy Krieger Institute, Baltimore, MD, USA, [2]Johns Hopkins School of Medicine

Cerebellar differences have been found in children with Attention Deficit Hyperactivity Disorder (ADHD) and are increasingly thought to play a role in their presentation, as well as in other neurodevelopmental disorders. However, despite the presence of well-established sex-based differences in the clinical presentation and developmental trajectory of the disorder, the existing imaging literature is limited in examining sex differences due to heavy under-representation of girls in the ADHD literature. We aimed to examine such sex-based differences in the cerebellums of 47 ADHD children (27 girls, 20 boys) and 43 Typically Developing (TD) controls (23 girls, 20 boys) of school-age (9-12 years old). All children were imaged using a 3T Philips-Achieva MRI scanner to acquire MPRAGE images. A high-resolution spatially unbiased atlas template of the cerebellum was used to isolate cerebellar structures for quantification of regional volumes. Statistical outliers were excluded at 3 SD beyond the mean. Multiple cerebellar volumes were significantly ($p<0.05$) reduced between ADHD girls and TD girls (Grey Matter: left crus 1, left crus 2/7b, vermis 1-5; White Matter: right lobule 6, left lobule 9, left lobule 10; Total Tissue: right lobule 10, left crus 1, left lobule 10). These regions differed from the statistically significant cerebellar structural discrepancies identified between ADHD boys and TD boys ($p<0.05$) (Grey Matter: left lobule 10; White Matter: right lobule 8). These sexually dimorphic cerebellar findings speak to the importance of considerations of sex-based differences in understanding the mechanisms underlying ADHD, the differing clinical presentations between girls and boys, and therapeutic targets.

Topic Area: EMOTION & SOCIAL: Development & aging

The aging mirror neuron system: EEG activation during biological motion observation

Poster A14, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Victoria, E. A. Brunsdon[1], Elisabeth, E. F. Bradford[1], Heather Ferguson[1]; [1]University of Kent

The human mirror neuron system may be an important mechanism for social cognition, such as for understanding other's actions and intentions. Healthy aging is associated with general cognitive declines and difficulties with these social cognitive abilities. However, the mirror neuron system has not yet been investigated in healthy aging. Sensorimotor mu desynchronization, composed of alpha and low beta activity, has been used as an EEG marker of the human mirror neuron system. We examined age-related differences in sensorimotor alpha and low beta activation across the pre-motor cortex, motor cortex and supplementary motor area during hand movement observation. Younger (18-35 years-old) and older adults (65+ years-old) completed a hand movement observation task. Initially, participants performed a 2-minute resting-state EEG as a reference period. Subsequently, participants watched different video clips (3s in duration) depicting either a static hand or various hand actions, such as locking a door or clicking fingers. For younger adults, we replicated previous findings of greater alpha and low beta desychronization across the sensorimotor cortex during hand movement observation compared to static hand observation. Interestingly, we found that this sensorimotor desynchronization was significantly greater for older adults compared to younger adults. Therefore, older adults activated their pre-motor cortex, motor cortex and supplementary motor area more than younger adults when they observed a hand action compared to when they observed a static hand. This study therefore suggests increased activation of the human mirror neuron system in older life.

Topic Area: EMOTION & SOCIAL: Development & aging

Ponies proliferate positive affect: The effectiveness of equine therapy on positive affect in adolescents with serious emotional disturbances

Poster A15, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Hanna Roberts[1], Nikki Honzel[1]; [1]Carroll College

Adolescence is an important neurological developmental period that remains sensitive to harmful events such as Post-Traumatic Stress Disorder (PTSD). Specifically, trauma can decrease orbitofrontal cortex (OFC) gray matter and abate emotional affect regulation (Thomaes et al., 2010). Previous studies have correlated positive (PA) and negative affect (NA) to prefrontal cortex volume (Davidson, 2004; Thomaes et al., 2010). The current study compared the effectiveness of equine-facilitated psychotherapy (EFP) and traditional group therapy (TGT) on measurements of PA and NA in adolescents with serious emotional disturbances (SED) and high PTSD comorbidity rates. Participants (N=37) consisted of adolescents admitted in therapeutic youth group home treatment participated in EFP and TGT sessions once a week over an eight week period in addition to normative treatment. The Positive and Negative Affect Scale (PANAS) questionnaire was administered immediately before and after EFP and TGT sessions. Statistical analyses revealed that EFP was just as effective as TGT in increasing PA and decreasing NA. More importantly, participants had significantly higher PA before and after EFP compared to TGT. Even though PA scores improved in both therapies, participants arrived to and left EFP with significantly higher PA scores than TGT. Previous studies have found that PA is implicated in prefrontal areas such as the OFC (Davidson, 2004). In conclusion, PTSD populations could greatly benefit from EFP by significantly ameliorating PA which is chronically decreased due to neurological affect dysregulation. Results from this study suggest that EFP may improve OFC functioning and overall affect regulation.

Topic Area: EMOTION & SOCIAL: Development & aging

Observing model-based control of emotion-triggered attention with steady-state visual evoked potentials

Poster A16, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

deborah talmi[1], Matthias Wieser, Martina Slapkova; [1]University of Manchester, [2]University of Rotterdam, [3]University of Manchester

The investigation of distinctions between model-based and model-free learning has benefitted greatly from an innovative paradigm where the two processes can be distinguished (Daw et all. 2011). Here we describe a novel paradigm that targets underlying differences between these two modes of learning. Through aversive classical conditioning, participants learned to fear some Navon figures. During learning, the local and global dimensions of the figures was consistent. At test, novel figures were presented crossing the local and global dimensions of threatening and safe figures. While a model-free system cannot distinguish between the aversive value of these figures, the model-based system could, in principle, utilise the verbal instruction participants received just before test, stating which dimension was relevant to the conditioning contingency (e.g. 'shape'). We asked whether we could see differences between instructed threatening and safe novel shapes in the steady-state visual evoked potential, an EEG signal known to be modulated by visual attention to threat. Replicating previous work, the SSVEP was modulated by model-free learning; its amplitude was higher for learned threatening figures compared to learned safe figures. The SSVEP was also modulated by model-based learning, with a higher amplitude for instructed threatening compared to instructed safe figures, but only when the global dimension of the figure was the relevant dimension for the conditioning contingency. These results point to a previously unknown constraint on the ability of the model-based system to modulate attention.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

Stress prior to learning affects resting state functional connectivity and emotional memory at retrieval

Poster A17, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Stephanie Sherman[1], Sarah M. Kark[1], Ryan T. Daley[1], Jessica D. Payne[2], Elizabeth A. Kensinger[1]; [1]Boston College, [2]University of Notre Dame

Stress prior to learning often enhances the retrieval of emotionally arousing items after long delays (e.g. Payne et al., 2007). However, in spite of these behavioral improvements in emotional memory that follow stress exposure, little is known about how this occurs, and specifically how consolidation and retrieval-related neural processes are affected. The purpose of this project was to examine whether a psychosocial stressor administered before encoding would influence subsequent emotional memory retrieval through changes in the functional coupling of the ventral medial prefrontal cortex (vmPFC) and medial temporal lobe regions. Participants underwent either the Trier Social Stress Test or a control task prior to viewing a series of negative, positive and neutral scenes. Following an overnight in-lab sleep recording session, participants completed an incidental recognition task. Functional magnetic resonance imaging (fMRI) was collected during incidental encoding and retrieval sessions. Resting state fMRI data collected shortly before the recognition task revealed that greater functional coupling between the amygdala and the vmPFC was associated with negative memory enhancement (negative d' minus neutral d') in participants who underwent the psychosocial stressor, $\beta = .53$, $p = .04$. Baseline resting state data demonstrated that this relationship did not exist prior to the stress condition, $\beta = .25$, $p = .38$. These preliminary results illustrate that stress before learning affects brain networks important for emotional memory function.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

Neural Correlates of Immediate and Long-term Effects of Emotion Regulation: A fMRI Study of Explicit and Implicit Emotional Suppression

Poster A18, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Yuta Katsumi[1], Florin Dolcos[1], Sanda Dolcos[1]; [1]University of Illinois at Urbana-Champaign

Successful emotion regulation (ER) allows adaptive coping with emotional challenges, which is vital for psychological well-being. Available evidence suggests that ER can modulate both immediate (emotional experience) and long-term (emotional memory) effects of emotion, and that both explicit and implicit forms of ER may be effective. However, most brain imaging studies have focused on immediate effects of ER, and thus the neural mechanisms by which various ER strategies affect the long-term memory for emotional material remain unclear. Following explicit instructions or implicit priming to suppress emotional responses, in the present study participants (N=18) rated the emotional content of negative and neutral pictures (immediate effect), while brain activity was recorded using fMRI. Then, one week later, participants' memory for the pictures was also tested in a recognition memory task (long-term effect). Behaviorally, the engagement of explicit and implicit ER resulted in reduced emotional ratings and impaired emotional memory. At the neural level, reduced emotional ratings linked to the engagement of explicit and implicit ER were associated with greater response in the dorsolateral prefrontal cortex (dlPFC). Also, impaired emotional memory linked to explicit and implicit ER during encoding was associated with diminished response in the amygdala (AMY) and hippocampus (HC). Overall, these findings demonstrate that explicit and implicit emotional suppression is effective in decreasing both the immediate experience and the long-term memory for negative emotional stimuli, and that these effects are linked to modulation of both top-down (dlPFC) and bottom-up (AMY-HC) mechanisms involved in emotion-cognition interactions.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

Influence of acute stress throughout the memory cycle on associative memory

Poster A19, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Elizabeth Goldfarb[1], Alexa Tompary[1], WenXi Zhou[1], Lila Davachi[1], Elizabeth Phelps[1,2]; [1]New York University, [2]Nathan Kline Institute

Acute stress can enhance and impair hippocampal memory. One factor that is critical for the direction of these effects is when the stressor occurs: before learning, after learning, or before a later memory test. Due to differences in stressors and memory tests across studies, it is difficult to compare these effects. Here we use a within-subjects design to investigate the effects of a physiological stressor administered pre-encoding, post-encoding, and pre-retrieval on item-level recognition and associative memory. Participants (N = 30) encoded pairs of emotionally negative words (from a normed list) and neutral images of objects, and provided ratings of valence and arousal. Twenty-four hours after encoding, they were tested on recognition memory for the words, and associative memory for the objects paired with each word. Despite the fact that the same stressor (cold pressor task) was used for each condition, the timing led to distinct effects on recognition and associative memory. Pre-retrieval stress led to worse recognition. By contrast, post-encoding stress enhanced recognition (but not associative memory), specifically for material rated as highly arousing. Finally, pre-encoding stress enhanced gist-level recall for negatively valenced information. Future analyses will incorporate the magnitude of the stress response (salivary cortisol) to explore different mechanisms by which stressor timing modulates memory.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

Brain Mechanisms for Processing Natural Dynamic Facial Expressions of Emotion

Poster A20, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Shih-Tseng T. Huang[1], Yen-Ju Lu[1]; [1]Department of Psychology and Center for research in Cognitive Science, National Chung-Cheng University, Taiwan

Spontaneous emotional expressions are related to the person's real emotions and are important in understanding the meaning and effects of emotions in social interactions. Recent research has supported an interdependence view based on neural models of face processing (Lander & Butcher, 2015). The present study attempts to further test the hypothesis of interdependence of processing dynamic natural facial expressions by measuring the brain activation in performing tasks involving processing facial emotional expressions. 27 young adults were recruited and completed an experiment to view dynamic facial expressions and objects in motion in an er-fMRI paradigm. We found that emotional faces were having higher activities than the processing objects (non-face) with motion at right middle temporal gyrus, left fusiform, right superior temporal gyrus, left middle occipital gyrus, right thalamus, and right middle frontal gyrus. It was also found difference in between processing emotional expressions and neutral faces at the right fusiform, right amygdala, right insula, right middle temporal gyrus, right inferior frontal gyrus, and right superior temporal gyrus. Furthermore, it was found that the fearful faces were higher than the happy faces at left superior temporal gyrus, right middle frontal gyrus, and right thalamus. And, it was also found that fearful faces were higher than the angry faces at right superior temporal gyrus, right transverse temporal gyrus, left fusiform, and left middle occipital gyrus. These findings may help to elucidate the nature of processing dynamic facial expressions.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

The Association of Skin Conductance Level with Emotional Memory Performance Over Time

Poster A21, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Tony Cunningham[1], Elaina Bolinger[2], Jan Born[2], Jessica Payne[1]; [1]University of Notre Dame, [2]University of Tübingen

Increased arousal at encoding as measured by multiple forms of psychophysiological response (e.g. heart rate, skin conductance) is associated with enhanced memory for emotional stimuli (Abercrombie et al., 2008; Cunningham et al., 2014). In the present study, we explored the relationship between skin conductance during the recognition stage of memory and performance on a recognition test. Participants had previously encoded 80 negative and 80 neutral scenes before 12-hour and week-long delays, each followed by recognition tests of 80 original scenes and 80 lures not previously viewed (half negative, half neutral). After the delay, Skin Conductance Level (SCL; the amplitude of the tonic EDA signal at the time of stimulus onset) was lower for correctly remembered negative pictures compared to forgotten negative pictures [$t(402)=2.0$, $p=0.048$], while no difference in SCL emerged between correctly remembered and forgotten neutral scenes. Additionally, SCL was lower for correctly rejected lures compared to false alarms for both negative [$t(466)=2.9$, $p=0.004$] and neutral [$t(304)=2.1$, $p=0.04$] scenes. After the week delay, this relationship reversed such that correctly remembered negative pictures had higher SCLs compared to forgotten negative pictures [$t(402)=2.0$, $p=0.04$; no difference in lure or neutral scene responses]. These results suggest that after a short delay, higher levels of arousal at stimulus onset may impede memory, but once memory traces transition to long-term storage, recognition may benefit from increased arousal, a psychophysiological signal that might correspond to better and more detailed memory for past emotional events.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

Simple arithmetic: Not so simple for highly math anxious individuals

Poster A22, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Hyesang Chang[1], Lisa Sprute[1], Erin A. Maloney[1], Sian L. Beilock[1], Marc G. Berman[1]; [1]The University of Chicago

Fluency with simple arithmetic, typically achieved in early elementary school, is thought to be one of the building blocks of mathematical competence. Behavioral studies with adults indicate that math anxiety (a fear or apprehension about math) is associated with poor performance on cognitively demanding math problems. However, it remains unclear whether there are fundamental differences in how high and low math anxious individuals approach overlearned simple arithmetic problems that are less reliant on cognitive resources. The current study examined the neural representations underlying simple arithmetic performance across high and low math anxious individuals. Participants indicated whether single-digit addition or subtraction problems presented with various types of solutions were correct while undergoing functional MRI scans. We implemented a partial least squares (PLS) analysis, a data-driven, multivariate analysis method (McIntosh & Lobaugh, 2004) to measure distributed patterns of activity associated with performance across the whole brain. Despite overall high performance across high and low math anxious individuals, we provide evidence that simple arithmetic performance depends on the fronto-parietal attentional network (inferior frontal gyrus and superior parietal lobule) differently as a function of math anxiety. Specifically, the low – compared to high – math anxious individuals perform better when they activate this network less – a potential indication of more automatic problem solving in less math anxious individuals. These findings point to the possibility that performance differences on cognitively demanding math problems between high and low math anxious individuals may arise from the way that these individuals approach the most fundamental math problems.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

Who Cares About Feelings? An ERP Study of Emotional Face Processing, Psychopathic Traits, and Empathy

Poster A23, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Danielle diFilipo[1,2], Taylor Valentin[2], Kayla Talbot[2], Jill Grose-Fifer[1,2]; [1]The Graduate Center, City University of New York, [2]John Jay College of Criminal Justice, City University of New York

Psychopathy is a personality-based construct that is characterized at least in part by a lack of empathy. Adults with high psychopathic traits have been shown to be worse than those with low traits at accurately identifying positive and negative facial expressions, and high psychopathic traits have also been associated with reduced neural activity in the face fusiform gyrus. In this study, we used ERPs to investigate how the neural correlates of emotional face processing varied with different levels of psychopathic traits in undergraduates. EEGs were recorded using 64 scalp electrodes while participants viewed photos of happy, fearful, and sad faces from the NimStim set of emotional faces. Psychopathic traits were measured using scores from the Psychopathic Personality Inventory-Revised (PPI-R) and empathic traits were measured using the Interpersonal Reactivity Index (IRI). We found that IRI Perspective-Taking scores were negatively correlated with PPI-R Fearless Dominance and Coldheartedness scores. PPI-R Fearless Dominance and Coldheartedness scores were also correlated with significantly smaller LPP amplitudes (600-800 ms) in response to sad faces. IRI Perspective-Taking scores were correlated with significantly larger LPP amplitudes in response to sad faces. These results suggest that while happy and fearful faces sustained attention in participants with high levels of psychopathic traits, sad faces were less effective in maintaining attention. Furthermore, participants who were better at taking the perspective of others found sad faces particularly salient. These results support previous findings of atypical emotional face processing in psychopathy.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

Seeing what we want to see: Motivation shapes perceptual judgments and category-selective activity in the ventral visual stream

Poster A24, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Yuan Chang Leong[1], Brent Hughes[2], Jamil Zaki[1]; [1]Stanford University, [2]University of California, Riverside

People often trust their visual system to construct an objective representation of the physical world. Yet, previous work suggests that goals, desires and wants can influence what people see. In this study, we explored the neural mechanisms underlying motivational influences on visual perception. Human participants were presented with images comprising a mixture of a face and a scene in different proportions while we measured their BOLD response using fMRI. Participants were tasked to categorize whether each image predominantly displayed a face or a scene, and were rewarded for each correct categorization. We manipulated the category participants were motivated to see by instructing them that they would win or lose extra money if the upcoming image was of a particular category. Even though the reward maximizing strategy was to perform the classification as accurately as possible, the additional financial incentive shifted participants' sensitivity to the motivation-consistent category - for the same face to scene ratio, participants were more likely to categorize an image as belonging to a category if they were motivated to see that category. We then applied multi-voxel pattern analysis methods to participants' BOLD response to quantify the level of face-selective and scene-selective activity in the ventral visual stream, and found evidence for enhanced category-selective activity for the motivation-consistent category during presentation of the ambiguous composite images. Our results suggest that motivation influence perceptual judgments via gain control mechanisms that increase the neural sensitivity to motivation-consistent perceptual features.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

Which coping strategies predict better outcomes after a stroke?

Poster A25, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Marie-Christine Nizzi[1]; [1]Harvard University

Objectives: In the United States, where 795,000 people have a stroke every year, stroke is the leading cause of paralysis, affecting nearly 1.8 million persons. Yet we have no rehabilitation protocol aiming to optimize coping and resilience in these patients, in part because we don't know which coping strategies best support their quality of life. Patients in a locked-in syndrome (LIS) experience a full-body paralysis with no cognitive impairments. They present a unique opportunity to identify optimal coping strategies. Methods: In this study, we used the Brief COPE (Carver, 1997) and the Self Continuity Questionnaire (Nizzi et al., 2012) to investigate how different coping strategies relate to multiple outcomes such as preserved sense of self, suicide ideation and quality of life. We surveyed 44 chronic LIS patients in 2010 and 2016. At follow up, 9 patients had died and 18 responded. Results: In line with previous literature, we parsed coping strategies into active vs avoidant coping. Active coping was correlated with quality of life, sense of self and body representation, but negatively correlated with depression (r=-0.3). Avoidant coping was negatively correlated with body representation (r=-0.5), sense of self (r=-0.5) and quality of life (r=-0.3). Importantly, avoidant coping was correlated with suicide ideation in the past 6 months (r=0.5) and with depression (r=0.6). Conclusions: In our sample, active coping strategies were optimal to support post-stroke quality of life as measured by multiple indices. Practice implications: Training in the relevant coping strategies could be integrated in clinical care to improve post-stroke resilience.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

Disturbed Emotional Processing in Post-traumatic Stress: Evidence from the Late Positive Potential

Poster A26, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Brian Albanese[1], Richard Macatee[1], Nicholas Allan[2], Edward Bernat[3], Norman Schmidt[1]; [1]Florida State University, [2]Ohio University, [3]University of Maryland

Background: Despite a breadth of evidence for disturbed emotional processing in post-traumatic stress (PTS), few studies have investigated associations between PTS symptom clusters and the late positive potential (LPP), a well-validated neural marker of emotional processing. The current study addressed this gap by evaluating the unique associations between the PTS clusters and the LPP during a picture viewing and regulation paradigm. Methods: Trauma-exposed participants (n = 198) completed an emotional picture paradigm during which participants were asked to either passively view (view-unpleasant, view-neutral) or down-regulate (regulate-unpleasant) their emotional reactions during the presentation of unpleasant and neutral images from the International Affective Picture System (IAPS). Results: The view-negative LPP was significantly associated with hyperarousal (β = .39, p = .002) and negative cognition (β = -.31, p = .007) but not re-experiencing (p = .11) and avoidance (p = .39). The view-neutral LPP was significantly associated with hyperarousal (β = .31, p = .012) and marginally significantly associated with negative cognition (β = -.20, p = .09) but not re-experiencing (p = .27) or avoidance (p = .54). Lastly, the regulate-unpleasant LPP was negatively associated with re-experiencing (β = -.26, p = .03) and positively associated with hyperarousal (β = .28, p = .03), but not with avoidance (p = .78) or negative cognitions (p = .55). Discussion: These findings indicate that PTS symptom clusters have unique and sometimes opposing influences on processing of emotional information, underscoring the importance of evaluating PTS clusters as distinct, but related, constructs.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

My rubbery neck: Attentional stickiness for self-relevant objects

Poster A27, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

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

How does an attentional bias towards self-relevant stimuli alter the cognitive processing of other stimuli? Previous research shows people may hold implicit attentional sets for objects that have been made self-relevant through ownership. The current study investigated whether such attentional prioritization for self-owned objects reduces limited attentional resources available for other stimuli. The attentional rubbernecking effect is characterized by an attenuated ability to report a second target (T2) in a rapidly presented series of stimuli when it closely follows an emotionally salient (relative to neutral) first target (T1), indicating greater capture of resources by T1 at the expense of T2. Here participants memorized arbitrarily assigned ownership statuses of 24 objects (belonging to self or the experimenter), then performed an attentional rubbernecking task. In each trial, a series of pictures was rapidly presented with each containing one (self-owned or other-owned) owned object (T1) followed (at one of two possible lags) by a target picture that was rotated to the left or to the right (T2). Participants were probed about the identity of T1 and the rotation of T2. Accuracy for T2 rotation following correct T1 identification was assessed. Performance was higher for the longer lag relative to the shorter lag. Crucially, preliminary evidence showed that self-ownership impaired performance on T2 rotation accuracy at the shorter lag. This evidence suggests that self-relevance rapidly captures and holds attention to the detriment of other elements in the environment. The current work highlights the unique position self-relevance holds in the hierarchy of sources of prioritization.

Topic Area: EMOTION & SOCIAL: Self perception

A dual piano performance EEG study: the effect of the partner's animacy and melodic content on alpha-band oscillations

Poster A28, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Iran Roman[1], Madeline Huberth[1], Nick Gang[1], Tysen Dauer[1], Wisam Reid[1], Chryssie Nanou[1], Matthew Wright[1], Takako Fujioka[1]; [1]Stanford University

In musical ensembles players perform different roles, such as leader or followers, thus ensuring coordinated actions. Social interaction research demonstrates systematic communication between leaders and followers with behavioral and electrophysiological measures. Alpha-band oscillations are typically associated with visual processing and movement. Previous reports have found that frontal alpha oscillations desynchronize differently among leaders and followers in joint finger tapping tasks. Furthermore, hearing one's own name leads to larger alpha desynchronization compared to hearing other names. In this study we asked: Will alpha-band activity be systematically affected by whether one's partner in a piano duet is a real human or a computer, or by whether the partner plays the same or a different melodic motif? We recorded EEG from four pairs of subjects playing two versions of a piano duet, both sharing an identical ending but with different preceding content. In version 1, the content preceding the ending consisted of both players performing the same motif alternatingly (A1, A2, A1, A2), whereas in version 2 there were two different motifs, one assigned to each player (B1, C2, B1, C2). The ending phrase required the leader to play three notes alone before the follower joined in unison. Before the start of unison playing, the leader showed a larger alpha-band desynchronization playing with the computer partner compared to the human partner, but only when the preceding motifs were shared. This suggests that a leader playing the same melody with a computer internalizes the computer's actions as if they were self actions.

Topic Area: EMOTION & SOCIAL: Self perception

Self-esteem and the brain: structural correlates in the prefrontal cortex

Poster A29, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Igor Nenadic[1,2], Katharina Frisch[1], Bianca Besteher[1], Robert Spalthoff[1], Christian Gaser[1,3]; [1]Department of Psychiatry and Psychotherapy, Jena University Hospital, Jena, Germany, [2]Department of Psychiatry and Psychotherapy, Philipps University Marburg and Marburg University Hospital (UKGM), Marburg, Germany, [3]Department of Neurology, Jena University Hospital, Jena, Germany

Self-esteem has been shown to modulate functional activation and functional connectivity in fronto-limbic circuits relevant to the emotional and cognitive processing of salient information. We addressed the hypothesis that self-esteem is associated with variation in brain structure as well by analyzing high-resolution MRI scans (3T, 1mm slice thickness) in n=78 young adult healthy subjects (25 male, 53 female; mean age 24.6yrs, range 19.6-38.7yrs; all without psychiatric or CNS conditions). Individual scores from the Rosenberg Self-Esteem Scale (RSES) were correlated positively with cortical thickness across the entire neocortex (using the CAT12 toolbox algorithms). There was a significant correlation ($p<0.05$ FWE-corrected) in the left posterior middle prefrontal gyrus cluster (k=463). Our findings suggest a putative structural correlate of subjective self-esteem in young healthy adults, which might serve as a link for integrating concepts of self-awareness and emotional regulation, with a broad range of clinical conditions affecting self-esteem evaluation.

Topic Area: EMOTION & SOCIAL: Self perception

Neuropsychological Correlates of Self-Kindness on Late Adolescence: Increased Cognitive Flexibility and Emotional Regulation.

Poster A30, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Nayara Mota[1], Elenilda Chaves[1], Marina Antunes[1], Vanessa Daudt[1], Rudi Borges[1]; [1]University of the State of Rio de Janeiro

Self-kindness involves care and non-judgmental understanding towards oneself in response to situations of inadequacy/suffering. As it implies positive response upon situations that trigger negative emotion, it is hypothesized that kindness is a self-regulatory process, that requires cognitive flexibility and emotional regulation, both dependent on the medial frontal cortical and subcortical activation, still under development during late adolescence. Forty six healthy students (18 - 21 years-old) from the University of the State of Rio de Janeiro attended a clinical interview and a comprehensive neuropsychological assessment, which included the Wisconsin Card Sorting Task (WCST) and the Stroop (measures of cognitive flexibility), as well as the Emotional Regulation Task. Partial correlations (2-tailed) were performed, controlling for social desirability (Marlowe-Crowne Social Desirability Scale). Higher self-kindness increased the possibility of higher adaptive choices according to the circumstances (WCST % Conceptual Level Responses, $r = .352$, $p = .021$; WCST% Errors, $r= -.329$, $p = .031$), and was not related to the inhibition of the response to predominant but irrelevant information (STROOP Interference Score, $r = -.203$, $p = .198$). When exposed to emotionally negative images, although participants who reported more self-kindness didn't present differentiated levels of negative emotional activation, $r = -.294$ $p = .115$, they were more prone to effectively diminish it deliberately $r=-.412$, $p=.024$. Self-kindness on late adolescence might increase proneness to goals achievement, through a favorable interaction with the environmental unforeseen or unpleasant circumstances, and might be considered as a potential protective factor against the neurocognitive manifestation of neuropathologic processes.

Topic Area: EMOTION & SOCIAL: Self perception

Development of the error-monitoring system from ages 9-35: unique insight provided by MRI-constrained source localization of EEG

Poster A31, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

George A. Buzzell[1], John E. Richards[2], Lauren K. White[3], Daniel S. Pine[4], Nathan A. Fox[1]; [1]University of Maryland, College Park, [2]University of South Carolina, [3]Children's Hospital of Pennsylvania, [4]National Institute of Mental Health

The ability to identify mistakes and dynamically adapt behavior is a cornerstone of higher-level cognition, requiring coordinated activity from a network of neural regions. However, a detailed account of how the error-monitoring system develops throughout adolescence and early adulthood remains absent from the literature. The present report leveraged MRI-constrained EEG source localization in order to detail the normative development of the error-monitoring system in a sample of 9-35 year-olds. In order to elicit errors, participants performed a flanker task while high-density EEG was recorded; structural MRIs were also acquired for all participants. Analysis of the scalp-recorded EEG data revealed a frontocentral negativity (error-related negativity; ERN) immediately following errors for all participants, although the topography of the ERN effect varied with age. Source localization of the ERN time range revealed maximal activity within the posterior cingulate cortex (PCC) for all ages, consistent with recent evidence that the PCC provides a substantial contribution to the scalp-recorded ERN. Activity within a network of brain regions, including dorsal anterior cingulate, PCC, and parietal cortex, were predictive of improved performance following errors, regardless of age. However, additional activity within insula, orbiotfronal cortex and inferior frontal gyrus linearly increased with age. Together, these data suggest that the core error-monitoring system is online by early adolescence and remains relatively stable throughout adolescence and early adulthood. However, maturity leads to additional brain regions becoming embedded within this core network. These results can serve as a model of neurotypical development of the error-monitoring system throughout adolescence and early adulthood.

Topic Area: EXECUTIVE PROCESSES: Development & aging

Functional neural correlates of selective attention deficits in Cerebral Small Vessel Disease: a multi-modal approach to exploring variability in vascular cognitive impairment

Poster A32, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Ayan Dey[1,2,3], Vessela Stamenova[2,3], Alissa Papadopoulos[2], Laura Oliva[2], Laryssa Levesque[2], Gary Turner[1,4], Sandra E. Black[1,2,3,5], Brian Levine[1,2,3]; [1]University of Toronto, Canada, [2]Rotman Research Institute at Baycrest, Toronto, Canada, [3]Canadian Partnership for Stroke Recovery, [4]York University, Toronto, Canada, [5]Sunnybrook Health Sciences Center, Toronto, Canada

Background: Cerebral small vessel disease (CSVD) on imaging is characterized by the presence of white matter hyperintensities and lacunes and manifests behaviourally as deficits in executive function and speed of processing. Structural neuroimaging measures however only partially account for the heterogeneity of behavioural outcomes observed in CSVD, with many patients showing no impairment despite significant lesion burden. Objective: The purpose of this study is to investigate whether better cognitive performance within the CSVD population is associated with greater frontal activation, preserved attention network functional connectivity and more robust selective feature processing. Methods: Neuropsychological measures were decomposed into factors scores for executive dysfunction and processing speed. Volumetric measures of lesion burden were obtained using Fuzzy Lesion Extractor (FLEX). Following a 6 minute resting scan, participants were asked to complete a visual N-back task involving faces and scenes while electroencephalogram (EEG) and functional magnetic resonance imaging (fMRI) data was recorded simultaneously. Amplitude of the selection negativity, a marker of selective feature processing, was extracted from EEG data, whereas for the fMRI data, brain-behaviour relationships were analyzed using Partial Least Square (PLS) analysis. Results: Behavioural data confirm the presence of a subgroup of high performing adults with clinically significant levels of lesion burden. EEG data provide evidence of attenuated selection negativity among adults with CSVD suggesting that attention deficits may be rooted in failure to promote perceptual enhancement. Analysis of the fMRI data also suggest that CSVD is associated with reduced connectivity between anterior and posterior hubs of the default mode network (DMN).

Topic Area: EXECUTIVE PROCESSES: Development & aging

How do relational integration deficits contribute to older adults' associative memory impairments?

Poster A33, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Taylor James[1], Audrey Duarte[1]; [1]Georgia Institute of Technology

The rostrolateral prefrontal cortex (RLPFC) is believed to play a critical role in integrating the outputs of lower-order processes, such as evaluations of item or inter-item properties. The high-order integration functions attributed to the RLPFC have been shown to support complex reasoning. but the region's role in episodic memory is less well understood. Emerging data suggest high-order PFC functions may be particularly susceptible to the effects of age and may contribute to older adults' associative memory impairments. It is currently unknown how aging interferes with RLPFC operations necessary for integrating multiple relations for episodic encoding and retrieval. We investigated this issue in the current fMRI study. Young and older adults were presented with an occupation and an object and were asked to judge

how likely the two were to interact, either in general or within the context of a given scene. When provided with a scene, participants needed to consider and integrate the distinct relations between the three items to reach a decision: a task dependent on RLPFC functions. fMRI data were collected during encoding and associative memory for object-occupation pairings was tested outside of the scanner. fMRI results indicated greater RLPFC activity for subsequent correct integrative than correct non-integrative trials. RLPFC recruitment was reduced in older adults, which was reflected in their poorer memory performance relative to the young. This reduced recruitment could indicate that older adults had difficulty engaging the necessary operations to encode associations as an integrated whole.

Topic Area: EXECUTIVE PROCESSES: Development & aging

Real-time strategy game training effects white matter integrity in older adults

Poster A34, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Nicholas Ray[1], Kaoru Nashiro[2], Margaret O'Connell[1], Shuo Qin[1], Evan Smith[1], Chandramallika Basak[1]; [1]University of Texas at Dallas, [2]University of Southern California

Video games are increasingly used as a potential tool for cognitive training in older adults (Toril et al., 2014). Training in a real-time strategy (RTS) game has been shown to improve attentional control in older adults (Basak, 2008). The goal of the current study is to determine whether RTS video game training can attenuate age-related declines in white matter integrity, particularly in fronto-parietal and hippocampal regions. Older adults were trained for 20 hours on either of the two conditions: RTS video game training (VGT; n = 22) and semantic knowledge training (SKT; n =17). The VGT group showed post-training increases in white matter FA in several areas, including the left uncinate fasciculus, left cingulum and hippocampus, and right superior longitudinal fasciculus. The increase in FA in the uncinate fasciculus is significantly greater in VGT than in SKT.

Topic Area: EXECUTIVE PROCESSES: Development & aging

The neuroanatomy of working memory training: A quantitative meta-analysis of fMRI studies

Poster A35, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Oshin Vartanian[1,2], Vladyslava Replete[1], Quan Lam[1]; [1]Defence Research and Development Canada, [2]University of Toronto

Recently there has been great interest in the prospects of working memory (WM) training for improving cognition. Neuroimaging data can elucidate systems targeted by WM training, thus contributing to a more complete understanding of how this specific type of training can improve cognition. Toward this end, we conducted a quantitative meta-analysis of fMRI studies of WM training using the Activation Likelihood Estimation approach, employing the latest analytic recommendations (Eickhoff et al., 2016). We hypothesized that WM training would target the fronto-parietal system in the brain. Indeed, the omnibus analysis involving 29 studies and 606 subjects revealed that WM training reliably activated right middle and medial frontal gyrus, bilateral inferior parietal lobule, and right insula. The unexpected involvement of insula in WM training may be related to its role in detecting and allocating neural resources to behaviorally relevant stimuli. Next, we tested the hypothesis that training intensity—defined separately in terms of duration or frequency—would be reflected in dissociable patterns of neural activity. Training for longer durations (i.e., 40 minutes or more) was associated with activations in right middle frontal gyrus and insula; training for shorter durations was not associated with any reliable pattern of activation. In turn, training for a single session was associated with activation in left inferior parietal lobule, whereas training for multiple sessions was associated with activation in right dorsolateral prefrontal cortex. These results demonstrate that variations in frequency vs. duration of training are reflected in dissociable patterns of neural activation in the fronto-parietal system.

Topic Area: EXECUTIVE PROCESSES: Working memory

Stress Interactions with Working Memory in Adolescence

Poster A36, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Alana Campbell[1,2], Mae Nicopolis[1,2], Louis Murphy[1], Aysenil Belger[1,2]; [1]University of North Carolina at Chapel Hill, [2]Carolina Institute for Developmental Disablities

Adolescence is a crucial developmental window for stress responses and transitions to higher order cognition. Stress plays a role in the etiology of psychological diseases, including psychosis, modulates working memory, and mediates cortical plasticity in development. Power and phase locking in the electroencephalography (EEG) theta frequency range (4-8Hz) has been linked to frontal-sub-cortical connectivity associated with working memory. The goal of the current study is to investigate the influence of stress on working memory, specifically the EEG measures of the theta range, in adolescents. Fifteen adolescents (aged 11-16) participated in an EEG session recorded with a 64-channel BioSemi Active2 system. The participants completed a fractal n-back task (n = 0,1,2) before and after the Trier Social Stress Test (TSST). The TSST reliably elicits a stress response, measured via hear-rate variability and cortisol. Results show that before stress there is typical theta modulation with working memory load, such that the 2-back elicits greater theta power than the 1-back ($p < .025$). There is an interaction between load and pre-/post- stress condition ($p < .025$). Post-stress, there is diminished theta power in both the low and higher load conditions, with the post-stress setting showing a smaller increase in

theta power as load increases. Further, there is a marked decrease in inter-trial phase coherence (ITC) in the theta range following stress. These results suggest that stress could disrupt working memory by diminishing synchronous firing in neuronal assemblies and by reducing the strength of the signal.

Topic Area: EXECUTIVE PROCESSES: Working memory

Working memory and speech perception: evidence from transcranial magnetic stimulation and brain morphometry

Poster A37, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Isabelle Deschamps[1,2], Melody Courson[1,2], Pascale Tremblay[1,2]; [1]Faculty of Medicine, Laval University, QC, Canada, [2]Centre de Recherche de l'Institut Universitaire en Santé Mentale de Québec, QC, Canada

Many psycholinguistic models posit that during spoken language comprehension, phonological units are processed and kept in verbal working memory (WM) before meaning can be extracted. Verbal WM mechanisms have been associated with the left supramarginal gyrus (SMG) and inferior frontal gyrus (IFG). The SMG is thought to be involved in the maintenance of phonological information (i.e. phonological short-term store) whereas the IFG would refresh the information within the short-term store through articulatory rehearsal mechanisms. However, these two regions have also been implicated during non-verbal auditory WM tasks. It is therefore unclear whether a distinct system exists for verbal WM. The objective of the current study was to determine whether the SMG and the IFG are recruited by auditory verbal and non-verbal working memory processes using single-pulse transcranial magnetic stimulation (TMS) combined to a delayed auditory discrimination task with verbal (i.e. syllables) and non-verbal (bird songs) sequences. 18 healthy right-handed adults participated in the study. TMS was delivered during the delay between the sequences to either the IFG or SMG. For each region, reaction times and accuracy were calculated. The results demonstrate that TMS applied to the IFG and SMG disrupts performance only during the (more difficult) auditory non-verbal discrimination task. The results suggest that auditory verbal and non-verbal WM share domain-general WM mechanisms. To gain further insights into the neurobiological foundation of WM mechanisms, we are currently investigating the relationship between auditory verbal and non-verbal WM and the structure of the SMG and IFG using MRI-based brain morphometry.

Topic Area: EXECUTIVE PROCESSES: Working memory

Ventromedial prefrontal cortex plays a critical role in schematic support of short-term memory

Poster A38, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Liz Race[1,2], Hope Tobin[1,2], Mieke Verfaellie[2,3]; [1]Tufts University, [2]VA Boston Healthcare System, [3]Boston University School of Medicine

The ability to integrate novel information with stored knowledge (schemas) can facilitate both short-term memory (STM) and long-term memory (LTM). Evidence suggests that the ability to leverage stored knowledge in support of LTM involves a hippocampal-ventromedial prefrontal (vmPFC) circuit (Schlichting & Preston, 2015), but whether these structures are also involved in the schematic facilitation of STM is unknown. Recently, we demonstrated that the hippocampus is not necessary for the schematic facilitation of STM (Race et al., 2015). The current study was designed to investigate whether vmPFC supports STM-LTM integration, and if so, to elucidate its role. One possibility is that vmPFC supports schema reinstatement or representation (Ghosh et al., 2014). Alternatively, vmPFC may support the integration of to-be-remembered information with activated schema representations (Spalding et al., 2015). To investigate these possibilities, patients with lesions to vmPFC (n=8) and healthy controls (n=19) performed two tasks that examined schema representation and memory integration, respectively. In the schema representation task, participants entered digits as quickly as possible into a keypad that had either a familiar visuospatial layout (typical keypad) or unfamiliar visuospatial layout (atypical keypad). In the STM-LTM integration task, participants performed immediate serial recall of digits that were presented in either the familiar or unfamiliar keypad layouts. Patients showed a typical keypad advantage of the same magnitude as controls in the schema representation task, but not in STM-LTM integration task. These results reveal that vmPFC plays a critical role in STM-LTM integration, but not in schema representation.

Topic Area: EXECUTIVE PROCESSES: Working memory

Neuroimaging, Neurostimulation, and Neuropsychological Evidence for Different States of Representation in Working Memory

Poster A39, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Nathan Rose[1], Bradley R Postle[2]; [1]University of Notre Dame, [2]University of Wisconsin-Madison

Previous fMRI and EEG research has supported the idea that dynamic attention processes enable the retention of items in working memory (WM) at varying levels of priority. Specifically, it has been suggested that information in WM, but outside of focal attention (FA), may be retained either by short-term, synaptic plasticity mechanisms or long-term potentiation/episodic-retrieval processes. Here, we consider causal investigations of this idea. In Study 1, multivariate pattern analysis (MVPA) of fMRI data from an individual with developmental amnesia and healthy controls performing WM tasks with either one item, or for two items with prioritization cues,

revealed that items held in FA could be decoded from a classifier using data from the whole brain, but not the hippocampus. In contrast, passively retained items could not be decoded. For both the amnesic and controls, subsequent long-term memory (LTM) tests showed that word-stem completion priming was relatively insensitive to the amount of time an item was held in FA; moreover, subsequent cued recall and recognition was not better for passively retained items. In Experiment 2, we administered TMS to participants and recorded EEG while they performed the two-item WM task with prioritization cues. TMS transiently reactivated neural patterns associated with passively retained items, and induced greater connectivity within frontoparietal cortex than sensory cortex. Collectively, these results are both consistent with the hypothesis that short-term plasticity mechanisms underlie the prioritized state of information in WM but outside FA, and inconsistent with the idea that these items in WM are processed with LTM mechanisms.

Topic Area: EXECUTIVE PROCESSES: Working memory

Hippocampal Activity Predicts High-resolution Visual Working Memory

Poster A40, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Alyssa Borders[1], Andrew Yonelinas[1]; [1]University of California, Davis

The hippocampus and medial temporal lobe (MTL) structures are known to play a role in long-term memory, but their role in visual working memory (VWM) function is poorly understood. Recent work has suggested that the hippocampus is involved in working memory tasks that require the binding of high-resolution information. To test this possibility, we used fMRI to assess hippocampal involvement in a VWM task that required memory for high-resolution information and used a test procedure to measure memory precision. In the current study, participants studied an array of colored squares and were asked to maintain the information over a one second delay until one location of the study array was cued. Participants were then asked to report the exact color of the cued location using a continuous color wheel, and accuracy was measured in degrees between the response and the correct color. Preliminary results suggest that hippocampal and perirhinal activity predict successful VWM performance and that hippocampal activity levels predicts VWM precision. This finding supports the prediction that the hippocampus is involved in accurate discriminations in VWM tasks requiring high-resolution discriminations.

Topic Area: EXECUTIVE PROCESSES: Working memory

Reward's role in memory-based visual search

Poster A41, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Daniel Schneider[1], Claudia Bonmassar[2], Clayton Hickey[2]; [1]Leibniz Research Centre for Working Environment and Human Factors, TU Dortmund, [2]Center for Mind/Brain Sciences, University of Trento

A cue indicating the possibility of cash reward will cause participants to perform memory-based visual search more efficiently. Thus if participants know there is money to be earned, they will be fast and accurate in finding a remembered object in a search display. Recent results suggest that this performance benefit might reflect the use of multiple memory systems: when needed, participants can maintain the to-be-remembered object in both long-term memory and visual working memory. This redundancy leads to better identification during search (Reinhart, McClenahan & Woodman, Psychological Science 2016, 27(6), 790-798). Here we test this compelling hypothesis. We had participants complete a memory-based visual search task where a cue informing them of the possibility of reward either preceded presentation of the to-be-remembered target (pre-cue) or followed it (retro-cue). If the reward cue impacts the maintenance of objects in memory, our expectation was that both cue types would enhance representation of the object in visual memory. We tracked memory representation using two components of the ERP: contralateral delay activity (CDA), reflecting visual working memory, and anterior P1, reflecting long-term storage. Results show that only the pre-cue impacted memory. Importantly, both cue types elicited equivalent frontal ERP components associated with reward processing and impacted visual search behavior and associated ERP components in the same way. These results suggest that reward's impact on memory-based visual search is not solely mediated by a refining of memory representations, but also through the motivation of a broad investment of effort and cognitive resources.

Topic Area: EXECUTIVE PROCESSES: Working memory

Use-dependent coding for working memory

Poster A42, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Nicholas E. Myers[1], Maryann A. P. Noonan[1], Anna C. Nobre[1], Mark G. Stokes[1]; [1]University of Oxford

Theoretical models of visual working memory (WM) generally assume that information is maintained in a WM store independent of how it will be used to guide behavior during readout. For instance, results from delayed estimation, forced choice discrimination, and change detection, are often used interchangeably to make inferences about the underlying WM architecture. However, optimizing WM storage for the required mode of recall could confer advantages to behavior by allowing observers to prepare for the specific upcoming recall task. Similar task preparation benefits have been observed in cued task switching, but the issue has not been addressed in the domain of working memory. We used a precision WM task with varying response demands while recording brain activity using electroencephalography (EEG) in human observers. Readout demands were varied by alternating between blocks of delayed estimation and two-alternative forced choice change discrimination. Importantly, the two tasks were identical during encoding and maintenance: Each trial began with the sequential presentation of two oriented gratings, followed by a retrospective cue indicating which of the two items was task-relevant. We found that EEG signatures of updating in WM during encoding of the second item, and sustained oscillations

during the maintenance delay, differed depending on readout demands. Our findings illustrate that WM encoding and maintenance may already reflect preparation for readout.

Topic Area: EXECUTIVE PROCESSES: Working memory

Evaluating Moderators in the Use of Transcranial Direct Current Stimulation with Working Memory Training

Poster A43, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Jacky Au[1], Benjamin Katz[3], Sheebani Talati[3], Seung-Min Moon[1], Kimberly Bunarjo[1], Benjamin Gibson[1], Martin Buschkuehl[2], Tessa Abagis[3], Chelsea Zabel[3], Susanne Jaeggi[1], John Jonides[3]; [1]University of California, Irvine, [2]MIND Research Institute - Irvine, CA, [3]University of Michigan, Ann Arbor

There has been significant interest in the use of non-invasive brain stimulation, and in particular transcranial direct current stimulation (tDCS), to improve the outcome of computerized working memory (WM) training. The findings across these recent studies, including meta-analytic work, is mixed, however. This is unsurprising given the heterogeneity across studies, both in terms of methods as well as participant cohorts. Herein, we report the results of several experiments evaluating the impact of several important moderators of the tDCS effect over the course of one week of computerized training on the n-back WM task. These moderators include baseline WM ability, timing of stimulation delivery (online with task performance vs. offline immediately before or after task), and EEG spectral parameters. Although our results showed enhanced WM training performance in groups receiving tDCS relative to sham stimulation, we demonstrate important interactions with baseline ability such that lower baseline abilities predicted greater tDCS effects (Beta = -.47), while high-baseline individuals all showed strong gains irrespective of tDCS. We conclude that tDCS holds promise as a tool to enhance the benefits of cognitive training, and can be particularly useful in increasing the utility of such interventions for a broader range of individuals, especially those starting with lower abilities who may otherwise have difficulty accessing the benefits of training.

Topic Area: EXECUTIVE PROCESSES: Working memory

Sustained Attention and Working Memory Are Improved by Attention Regulation Training with Guided Experiential Skill Application

Poster A44, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Sahar M. Yousef[1], Anthony J.-W. Chen[1,2,3], Omid Rhezaii[1], Fred Loya[2,3], Deborah Binder[2,3], Michael A. Silver[1]; [1]University of California, Berkeley, [2]Veterans Administration Northern California Health Care System, [3]University of California, San Francisco

While prior studies have documented improvements in attention and working memory following various forms of training, evidence for transfer of gains to non-trained tasks has been limited. Moreover, when transfer of learning has been observed, it has often been unclear which components of training contributed to transfer. To address this issue, we examined the contributions of different components of attention regulation training to skill learning and transfer in a sample of healthy undergraduate students. Specifically, we compared the effects of guided experiential training of attention regulation, which combined didactic instruction with intensive skill practice and coaching on skill application in game scenarios and personal life, with three control conditions containing isolated components of this training: (1) a game-only condition, matched for gameplay experiences but lacking didactics and guided skill application; (2) a conceptual-learning condition, involving didactics but without game play, skill practice, or guided skill application; and (3) test-retest condition, matched on academic course load. Evidence of transfer effects were observed as improvements on untrained tasks of sustained attention, complex working memory, and verbal working memory (all ps<.001) following guided experiential training (n=83) but not game-only (n=25) or test-retest conditions (n=25). Participants in the conceptual-learning group (n=36) also improved on tasks of sustained attention (p=.02) and verbal working memory (p=.003), albeit to a lesser degree than those receiving guided experiential training. These results indicate that attention regulation training can generalize and improve cognitive performance on untrained tasks, especially when it is integrated with guided and personalized skill application and practice.

Topic Area: EXECUTIVE PROCESSES: Other

Left-lateralized reading network illustrated by causal effective connectivity

Poster A45, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Chotiga Pattamadilok[1], Samuel Planton[1], Deirdre Bolger[2], Mireille Bonnard[3]; [1]Aix Marseille Université, CNRS, LPL UMR 7309, 13100, Aix-en-Provence, France, [2]Labex Brain and Language Research Institute, [3]Aix Marseille Université, Institut de Neurosciences des Systèmes, INSERM, UMR 1106, Marseille, France

Left lateralization of the reading network has been explained by the specialization of the left hemisphere for spoken language processing. Findings from connectivity analyses of neuro-imaging data raise the issue of whether the left-lateralization results from reduced activation in the right hemisphere or an increased activation in left hemisphere. Here, we applied a causal intervention approach to examine the effective connectivity between the ventral occipito-temporal cortex (vOT), a key area in the reading network, to other cortical areas when participants processed non-linguistic vs. linguistic stimuli and tasks. Transcranial magnetic stimulation (TMS) was

applied to the left-vOT while the participants performed color (non-linguistic stimulus and task), symbol (linguistic stimulus/non-linguistic task) and animal name detection tasks (linguistic stimulus and task). EEG was recorded to track stimulus and task-dependent changes in regional activation (ERP) and in effective connectivity (TMS-induced ERP or TEP). The results showed that, on no-TMS trials, linguistic stimuli led to increased ERP activity in the occipito-temporal regions in both hemispheres around 170ms compared to non-linguistic stimuli. However, TEP showed a different activation pattern, with a stronger propagation of activity to the right occipito-temporal region when participants processed non-linguistic stimuli. When only linguistic materials were involved, performing a linguistic task reduced the TEP in inter-hemispheric regions, suggesting that brain activity is more restricted to the left hemisphere. The causal evidence reported here suggests that reduced effective connectivity between the left-vOT and the right hemisphere during language processing provides an explanation for the left-lateralization of the reading network.

Topic Area: LANGUAGE: Other

Subliminal Speech Priming on Emirati verbs: an MEG investigation

Poster A46, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Meera AlKaabi[1], Kevin Schluter[2], Alec Marantz[3]; [1]United Arab Emirates University, [2]New York University Abu Dhabi, [3]New York University

Several behavioral studies on Modern Standard Arabic and Hebrew morphological processing employ psycholinguistic tasks that require determining whether a sequence of letters makes up a word or not. Most of the findings obtained from these studies provide evidence in support of the sensitivity of the processing system to the root and in some cases templates morphemes in these two Semitic languages. However, no evidence with such strength and consistency has been reported for root effects in spoken Arabic and even less so for template effects (Schluter, 2013). In this study we combine MEG (Magnetoencephalography) recordings with the subliminal speech priming technique (Kouider and Dupoux, 2005) that tests the earliest stages of auditory word recognition in Emirati Arabic (EA) verbal forms. In our design, we manipulate one experimental word target with four different prime types in auditory lexical decision: semantically-related, morphologically-related, identity, and control primes. In ROI analyses, the MEG results showed a significant identity priming effect in BAs 22 and 42 at 300-500 ms and 600-900 ms time intervals. The morphological and the semantic conditions showed lesser priming effects in BA21 (600-900 ms) and in BA22 (300- 500 ms), respectively. Moreover, the behavioral data showed significant priming for all three conditions. The overall results suggest that the consonantal root in EA is an independent lexical unit, a finding consistent with root-based models of Semitic morphology. Our results also showed that the subliminal speech priming technique is a promising way to explore unwritten dialects of Arabic.

Topic Area: LANGUAGE: Other

Code-switching in real time: ERP evidence from habitual bilingual code-switchers

Poster A47, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Eleonora Rossi[1,2], Megan Zirnstein[2], Gerrit Jan Kootstra[3]; [1]California State Polytechnic University, Pomona, [2]University of California, Riverside, [3]Windesheim University of Applied Sciences

Code-switching (i.e., the fluent and natural alternation between a bilingual's two languages during discourse) is ubiquitous in many bilingual communities. Despite its prevalence, very little is known about its neurophysiological signature. Recent ERP studies show that language switching might be costly, with code-switches eliciting ERP components that have been related to effortful processing and sentence reanalysis, such as the N400, and the P600 (e.g., [1];[2]). However, most studies have tested non-habitual code-switchers. Only recently, it has been proposed that habitual code-switchers might engage a wider control network to adapt to specific task demands, and linguistic regularities[3]. Recent fMRI data[4] have supported this hypothesis by showing that habitual code-switchers are differentially sensitive to regularities present in natural code-switching contexts. Here, we tested 19 Spanish-English habitual code-switchers using ERPs. Participants' EEG was recorded while they saw a picture, presented together with a label describing the object, composed of the determiner and the noun. Stimuli were either non-code-switches (English only and Spanish only), or code-switches (Spanish to English). Crucially, the code-switch condition included both switches that occur frequently in natural language environments (i.e., el dog), and code-switches that have lower frequency of occurrence in natural code-switching contexts (i.e., la dog), as measured by existing Spanish-English code-switching corpora. Overall, results show that the less frequent code-switches elicit a more positive early component (P150), and a later more negative one (N400), reflecting sensitivity to regularities present in natural code-switching contexts, and suggesting a finer-tuned system language switching than previously posited in the literature.

Topic Area: LANGUAGE: Other

Sequence processing and language lateralization

Poster A48, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Shuang Geng[1], Qi Su[1], Shuai Wang[1], Xing Tian[2,3], Qing Cai[1,3]; [1]School of Psychology and Cognitive Science, East China Normal University, [2]New York University Shanghai, [3]NYU-ECNU Institute of Brain and Cognitive Science at NYU Shanghai

Sequence processing plays an important and irreplaceable role in language perception and production. However its origin and mechanism are not yet clear. Here, we asked three questions: (1) Whether two hemispheres contribute to sequence processing distinctively, and how two kinds of sequencing (the planning of sequencing and the execution of sequencing) influence lateralization differently? (2) Whether motor-sensory processing is left dominant or bilateral in language and sequence

processing? 3) Whether sequence processing is specific to language processing? In this study, we investigated the neural mechanism of sequence processing of syllable, tone, and finger movement sequences using functional MRI. Our results showed that (1) the planning of sequencing in a syllable task is strongly left dominant in the inferior frontal gyrus and superior parietal area, whereas the execution of sequencing in this task is not significantly left lateralized; (2) the sensory-motor (or perception-production) interaction during syllable sequencing and tone sequencing are different: bilateral middle frontal gyrus is involved in syllable sequencing; whereas a set of frontal regions in the right hemisphere underlies sensory-motor processing during tone sequencing; (3) execution of sequencing are further examined in three tasks: middle frontal gyrus and tempo-parietal junction are activated in tone sequencing; inferior frontal cortex is involved in motor sequencing when using right hand; left frontal and parietal regions are involved in syllable sequencing, but only in the imagery condition. Our results suggest that processing dynamics, modality and content of tasks modulated the hemispherical lateralization during sequencing in speech and language.

Topic Area: LANGUAGE: Other

Neural decomposition of synergistic and redundant information in interaction between audiovisual speech rhythms and brain oscillations

Poster A49, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Hyojin Park[1], Robin A. A. Ince[1], Gregor Thut[1], Joachim Gross[1]; [1]Institute of Neuroscience and Psychology, University of Glasgow

In audiovisual speech processing, auditory and visual information interact and are integrated to lead to a unified percept of speech. Previously, we have shown that low-frequency brain oscillations separately track auditory and visual speech signals to facilitate speech comprehension. However, it is still unclear to what extent auditory and visual information is represented in brain areas, either individually or jointly. Here, we applied a recently developed tool from Information Theory to decompose multivariate mutual information between auditory, visual and brain signals. This method allows quantification of the unique information the brain signals carries of each modality (auditory, visual). Furthermore, we can now address the question if activity in a certain brain area carries a synergistic or redundant representation of both sensory signals. We used low-frequency theta phase of auditory and visual speech signals and brain signals at each voxel measured by MEG. In adverse audiovisual speech condition in which attention to visual speech is critical for speech comprehension, we found redundant information in auditory/temporal region including posterior superior temporal gyrus while synergistic information in left motor and inferior temporal cortex. Importantly, this predicts speech comprehension. By means of this novel information theoretic tools, we here show for the first time evidence for neural decomposition of information of entrained audiovisual speech rhythms interacting with brain oscillations for facilitating speech comprehension. Our finding demonstrates how the brain processes audiovisual inputs efficiently-taking advantage of common information as well as making greater information from multisensory inputs that enable remarkable ability in human communication.

Topic Area: LANGUAGE: Other

Evaluating the massed practice and behavioral relevance principles in neurocognitive language therapy

Poster A50, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Friedemann Pulvermuller[1,2], Benjamin Stahl[1,3], Felix Dreyer[1], Guglielmo Lucchese[1], Verena Buscher[1], Bettina Mohr[4]; [1]Brain Language Lab, Freie Universitat Berlin, [2]Berlin School of Mind and Brain, Humboldt Universitat zu Berlin, [3]Charite Universitatsmedizin, Campus Mitte, Berlin, [4]Charite Universitatsmediizin, Campus Benjamin Franklin, Berlin

A range of principles from the cognitive and neurosciences have been proposed as guidelines for neurorehabilitation. One most prominent principle is that of massed practice, implying that 'more helps more', and, crucially, that more condensed delivery of the same amount of therapy yields better results than more diluted regimes. A further principle states that therapeutic action is more efficient if it closely matches the needs of everyday life, so that, in the therapy of language and communication, language use in therapy should implement communicative social interaction. To asses these claims, we performed randomized controlled trials, RCTs, on groups of patients with chronic aphasia due to focal left-perisylvian lesions. One study compared the effect of moderately intensive language action therapy delivered for 2h/d with that of highly intensive therapy with 4h/d. No benefit of highly intensive over moderately intensive therapy could be documented, thus suggesting that, if a basic intensity threshold is reached, further intensity increases may be inefficient. In contrast, therapy efficacy increased with prolonged therapy delivery (6 vs 12 working days). A second RCT used the same therapy intensity and compared utterance centered language naming training with intensive language action therapy embedding utterances into communication contexts. The more behaviorally relevant setting yielded better therapy progress than the utterance-centered approach. In conclusion, our results argue in favor of moderately intensive neurocognitive therapy maintained across several weeks of practice and carried out with exercises that systematically implement social-interactive communication. (Funded by the German Research Foundation (DFG) and the Freie Universität Berlin.)

Topic Area: LANGUAGE: Other

Neuroanatomical Correlates of Visuoconstruction in the Primary Progressive Aphasias

Poster A51, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Christa Watson[1], Maria Luisa Mandelli[1], Katherine Possin[1], Maria Luisa Gorno-Tempini[1]; [1]University of California, San Francisco

The most difficult differential diagnosis among the primary progressive aphasias (PPA) is between the logopenic variant (lvPPA) and the nonfluent variant (nfvPPA) as both often present with non-fluent speech. However, the variants have distinct atrophy patterns: left inferior frontal atrophy in nfvPPA and left temporoparietal atrophy in lvPPA. Since temporoparietal atrophy is often associated with visuospatial difficulties, we hypothesized that visuospatial tasks might help to differentiate lvPPA from nfvPPA. We compared visuospatial functions in three PPA variants and a neurologically healthy control group using a composite of three well-known visuoconstruction tasks (Beery VMI, Benson Figure Copy, and WAIS-III Block Design). Standardized test scores were averaged to create a visuoconstruction composite, which was regressed with whole brain voxel-wise gray matter after adjusting for age, gender, education, Clinical Dementia Rating scores, and total gray matter volume (proxy for degree of atrophy). The lvPPA and nfvPPA groups performed similarly to one another and significantly worse than control and semantic variant groups on the visuoconstruction composite. There were four regions where the visuoconstruction composite correlated with gray matter volume: left 1) precentral gyrus, 2) postcentral/precuneus, and 3) supplementary motor cortex (SMA); and 4) right posterior superior temporal gyrus (STG). The composite correlated with all regions in the nfvPPA group, but in the lvPPA group correlations were only found with the left SMA and right STG. In conclusion, scores on commonly utilized visuoconstruction measures did not differentiate the lvPPA and nfvPPA variants, but the two variants demonstrated distinct brain-behavior relationships.

Topic Area: LANGUAGE: Other

Multimodal characterization of ventro-occipito-temporal reading regions

Poster A52, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Garikoitz Lerma-Usabiaga[1], Manuel Carreiras[1,2], Pedro M. Paz-Alonso[1]; [1]BCBL. Basque Center on Cognition, Brain and Language., [2]IKERBASQUE, Basque Foundation for Science, Bilbao, Spain.

The ventral occipito-temporal (vOT) association cortex significantly contributes to recognize different types of visual patterns. It is widely accepted that a subset of this circuitry, including the visual word form area (VWFA), becomes trained to perform the task of rapidly identifying word-forms. An important open question is the connectivity of the region to other language areas. While some authors report connections between the vOT and the posterior parietal cortex via the vertical occipital fasciculus, others highlight its more anterior connections through the arcuate fasciculus. Characterizing the vOT connectivity pattern can be critical to shed further light on the computational role of the VWFA. We present the results of a multimodal (functional, diffusion-weighted and quantitative) MRI study with a sample of 100 young adults aimed at investigating the functional and structural connectivity patterns of the vOT reading regions. To examine how functional contrasts selection influence the location of the VWFA, we used the most relevant contrasts reported in the literature. Furthermore, due to the large intraindividual variability present in previous studies, our analyses were performed at the individual-subject level, and half of the subjects were scanned twice to check for test-retest reliability. Our results revealed a functional gradient across different contrasts that goes along the anterior-posterior and medial-lateral axes in the vOT, and that might explain the differences in structural connectivity previously reported. We propose a new subdivision of the vOT reading regions, and a reproducible procedure of interest for researchers working in this area.

Topic Area: LANGUAGE: Other

Abnormal Speech Feedback Processing in Individuals with 16p11.2 Deletions

Poster A53, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Carly Demopoulos[1], Hardik Kothare[1], Danielle Mizuiri[1], Jennifer Henderson-Sabes[1], Brieana Fregeau[1], Jennifer Tiernagel[2], Elliott Sherr[1], John Houde[1], Srikantan Nagarajan[1]; [1]University of California-San Francisco, [2]Simons Foundation Autism Research Initiative

Given the highly prevalent speech production deficits in children with 16p11.2 deletions, we examined the role of auditory feedback in the control of speaking in order to identify discrete points of dysfunction in the speech production system. A better understanding of these processes could lead to insights into novel targets for intervention. Two tests of sensitivity to auditory feedback during speech were collected from twelve 16p11.2 deletion and six sibling control participants. The first, called a pitch perturbation test, examined how subjects quickly changed the pitch of their voice within a trial to correct for a brief perturbation of their auditory feedback, a response known as “pitch feedback compensation”. The second test, called a speech formant adaptation test, examined how, over many trials, subjects learned to adapt to sustained vowel identity changes in their auditory feedback during vowel production. Results indicated that 16p11.2 deletion carriers showed an exaggerated pitch compensation response to unpredictable mid-vocalization pitch perturbations compared to sibling controls, $t(7.45)=2.54$, $p=.037$). In contrast, they showed reduced adaptation to sustained vowel identity changes in auditory feedback, ($t(12)=3.04$, $p=.010$). This reduced speech adaptation in the context of the strong compensation response during the pitch perturbation task indicates that while deletion carriers were able to detect and correct perceived speech errors in real time, they were unable to change their speech model in anticipation of highly predictable alterations in auditory feedback. These results suggest an over-reliance on auditory feedback and impaired predictive forward models for speaking in 16p11.2 deletions.

Topic Area: LANGUAGE: Other

Electrophysiological Correlates of Crowding in the Perception of Letters and Symbols

Poster A54, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Kurt Winsler[1], Phillip Holcomb[1], Katherine Midgley[1], Jonathan Grainger[2]; [1]San Diego State University, [2]CNRS & Aix-Marseille University

Crowding refers to an increased difficulty in processing target stimuli in peripheral vision when accompanied by flanking stimuli. A number of studies have shown that letters are more resilient to this crowding effect than other stimuli like symbols. It has been hypothesized that exposure to horizontal letter strings during years of reading experience might underlie this specific immunity to interference. However, the precise neuro-cognitive mechanism involved is still unclear. The current study aimed to better understand crowding effects using event-related potentials (ERPs). Thirty-two channels of EEG were recorded from 24 monolingual English speakers while completing a 2AFC task with 324 trials which were either letters or symbols, presented 2 degrees to the left or right of a fixation point. Targets were isolated or flanked by two characters either horizontally or vertically. Results showed a left lateralized increase in P1 amplitude as a result of crowding (regardless of orientation) for letters, reflecting additional visual processing. Moreover, larger N1/N170s were observed for crowded letters and this effect was larger in left hemisphere sites for vertically crowded targets compared to horizontally crowded targets. This provides evidence that during early perceptual processing horizontally flanked letters are more efficiently processed than vertically flanked letters. This pattern of effects was not observed for symbols, further emphasizing the optimization of the visual system for dealing with letters, specifically along the horizontal meridian of the visual field.

Topic Area: LANGUAGE: Other

Variables distinguishing school age children with autism who are held back in school compared to children with autism who are not held back

Poster A55, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Talent V. Dang[1,2], Philip Lai[3]; [1]The Salk Institute for Biological Studies, [2]University of California, San Diego, [3]University of Wisconsin

In this study investigating school-age children school performance, participants included four individuals with Autism who were held back (HB) and four individuals with Autism who were not held back (NBH). All participants were matched on age and gender. Using multiple parent questionnaires, specific questions were selected to measure expressivity, production of complex syntax, and social behaviors. There was no difference in IQ, but a difference in complex syntax was found, as the HB group used complex sentences in 41% of their clauses while the NHB group was using 59%. Behavioral social measures showed the HB group expressed less positive facial expressions (M= 3.5) than the NHB group (M= 17.5) while a similar amount of negative facial expressions were observed in both groups (NHB M= 6.5, HB M=4.2). This result is in line with parents' responses regarding their children affective behavior such as laughing out loud. The HB group scored higher when comparing parental responses regarding the ability to soothe their child when upset implying more difficulty for the HB group than NHB group. The goal of this study is to determine what variables might explain why a select number of children with Autism are held back in school. Results showed the HB group have patterns of social and language deficits as they are less expressive socially and produce less complex language. These two variables can provide evidence of why children are struggling and can be an area of focus for clinicians working towards better academic success for children with Autism.

Topic Area: LANGUAGE: Other

Decoding Linguistic Structure Building in the Time-Frequency Domain

Poster A56, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Phillip M. Alday[1], Andrea E. Martin[2,3]; [1]University of South Australia, [2]Max Planck Institute for Psycholinguistics, [3]University of Edinburgh

Linking hypotheses between cortical oscillations and the hierarchical structure of speech and language posit a correspondence across multiple timescales and levels of representation: fine speech structure is represented in the gamma band, while the speech envelope, i.e. syllables and words, in the alpha and theta bands (Ding et al., 2016; Giraud & Poeppel, 2012; Peelle & Davis, 2012). Detection of these signals is difficult because frequency-based encoding of stimulus-related information is distributed in cortical time and space. Addressing this problem in the fMRI signal, Multivariate Pattern Analysis (MVPA) extracts a stimulus-related abstract neural code (Haxby et al. 2011, 2014). Applied to M/EEG, MVPA yields enriched temporal information via the generalization across time method (GAT), which extracts and compares spatial patterns across time points (King & Dehaene, 2014). We tested the correspondence hypothesis by applying GAT to scalp EEG data from spoken pentasyllabic German words with either correct or incorrect lexical stress from Knaus (2013). An L1-regularized logistic regression classifier was trained and tested across syllable positions (time) on power-spectral density to predict correct stress. As predicted by Giraud & Poeppel (2012), alpha and theta activity displayed the strongest coupling with correct stress, and therefore, with lexical access, while beta and higher displayed almost none. A similarly trained classifier on time-domain (ERP) data performed poorly, indicating that lexical access relies crucially on information carried in alpha/theta oscillations. Our results offer a first quantitative estimation of the relative weightings of frequency bands carrying information required for lexical access during spoken word recognition.

Topic Area: LANGUAGE: Other

Modeling the minds of co-listeners during language comprehension: an ERP study.

Poster A57, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Olessia Jouravlev[1], Dima Ayyash[1], Zach Mineroff[1], Evelina Fedorenko[1,2,3]; [1]Massachusetts Institute of Technology, [2]Harvard Medical School, [3]Massachusetts General Hospital

During language comprehension, we make use of knowledge about the speakers' mental states (Brennan et al., 2010). Do we also keep track of what other listeners do or do not understand? We asked participants to read semantically implausible sentences (His boat has new wheels now) preceded by a context that rendered them plausible (e.g., Mike turned his boat into a car), while their ERPs were recorded. Participants performed a plausibility judgment task, read sentences passively, or answered comprehension questions. The presence of another comprehender (a confederate) was manipulated. In the critical condition, the target sentences were implausible to a confederate, who did not receive the context. Without a confederate present, participants showed no evidence of difficulty in semantic processing (no N400 effect). However, when the confederate was present, they exhibited an N400 effect, suggesting that they adopted the perspective of the confederate, who was unable to make sense of the critical sentences. This "social N400" effect held when participants were explicitly instructed to think about the state of mind of the confederate (Exp.1; replicating Rueschemeyer et al., 2015), but also, importantly, when no such instructions were given (Exp.2), suggesting that language comprehenders automatically engage in modeling the mental states of co-listeners. These results strongly support the idea that we robustly and consistently engage our Theory of Mind abilities during language comprehension.

Topic Area: LANGUAGE: Other

Working Memory and Cognitive Control Modulate Effects of Speaker Reliability on Predictive Processing during Comprehension

Poster A58, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Shruti Dave[1], Trevor Brothers[1], Matthew Traxler[1], Tamara Swaab[1]; [1]University of California, Davis

Previous work has shown that lexical prediction can be strategically modulated by task demands (Brothers et al, in press) and by the current comprehension environment (Brothers, Dave, Hoversten, Swaab, & Traxler, 2016). In the present study,we manipulated speaker reliability to explore if responsivity to predictive environment is modulated by individual differences in working memory (WM) and cognitive control (CC). Undergraduates listened to sentences spoken by two speakers – a "reliable" speaker who primarily produced sentences with predictable (High Cloze) continuations and an "unreliable" speaker who typically produced sentences with plausible but unexpected (Low Cloze) continuations. N400 effects of cloze probability were significantly larger for the reliable than for the unreliable speaker. Previous studies have shown that performance on WM and CC tasks can reliably predict the size of ERP effects during spoken language comprehension (e.g., Dave, Brothers, Traxler, & Swaab, 2015; Boudewyn et al., 2015; Nakano et al. 2010). We hypothesized that the scores on such tasks would predict the effects of speaker reliability on the size of the N400 cloze effects. Individual differences were measured with Flanker (CC) and listening span (WM) tasks. The results showed that the effects of speaker reliability on predictability were driven by listeners with higher scores on the WM and CC tasks. Moreover, good performance on the CC task enhanced the N400 effect of speaker reliability, but only for individuals with low WM scores. This suggests that dynamic modulation of predictive language comprehension strategies is driven by interactions across subcomponents of executive function.

Topic Area: LANGUAGE: Semantic

First Language Proficiency Modulates Individual Differences in Semantic Processing: An MEG Study.

Poster A59, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Morgan B. Johnson[1], Lisa J. Beck[1], Lyam Bailey[1], Tim Bardouille[1,2], Aaron J. Newman[1]; [1]Dalhousie University, [2]BIOTIC, IWK Health Centre and Capital District Health Authority

Recent research has demonstrated that native language (L1) processing – in terms of proficiency and the brain networks involved – may vary between individuals. This has been shown with processing word meanings (lexical semantics) in sentence context, with standardized measures of language proficiency modulating the N400 EEG effect. The present study extended these findings by using magnetoencephalography (MEG) and investigating processing lexical semantics at the individual word, rather than sentence, level. Language proficiency was assessed using several subtests of the Test of Adult and Adolescent Language 3 (TOAL-3) and the Test of Word Reading Efficiency 2 (TOWRE-2). Results showed that incongruent trials, where audio-visual stimuli were mismatched (e.g., a picture of an apple followed by the word "chair"), elicited an enhanced N400m (the MEG equivalent of the N400) relative to congruent trials. At the group level, generalized additive mixed-effects modeling (GAMM) confirmed the maximal N400m effect at left anterior sensor sites between 350-500 ms post-stimulus. However, at the individual level, scalp distribution of the N400m varied between subjects in this time window. Furthermore, GAMM revealed that scores on both the Listening Vocabulary subtest of the TOAL-3 and the Phonemic Decoding subtest of the TOWRE-2 correlated with N400m amplitude and laterality. Specifically, higher scores on both tests diminish the N400m effect in the right hemisphere. Thus people who have higher vocabularies and are more fluent readers process semantic incongruity more efficiently, and this is associated with increased left-lateralization of neural activity.

Topic Area: LANGUAGE: Semantic

Time-course of motor involvement in literal and metaphoric action sentence processing: A TMS study

Poster A60, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Megan Reilly[1], Olivia Howerton[1], Rutvik Desai[1]; [1]University of South Carolina

There is ample evidence that the motor cortex is involved in reading sentences that contain an action verb ("The lengthy spike was hammered into the ground"). This also holds for metaphoric sentences ("The weak army was hammered again in battle"). One view suggests that verbs such as 'hammered' are homonyms, with one meaning related to the literal action (physical hammering) and one to the abstract meaning (defeat badly). Another view holds that such verbs are polysemous, and the two senses are related and not independent. The metaphoric or abstract sense is grounded in the literal sense. Using single-pulse transcranial magnetic stimulation (TMS), we investigated whether disruption to motor areas affects literal and metaphoric sentence comprehension. In the primary motor cortex, stimulation 300 ms post-verb presentation impaired comprehension of both literal and metaphor sentences relative to control sentences. This supports grounded semantic views, where sensory-motor areas play a causal role in comprehension. These results also suggest that the literal meaning of an action verb remains activated during metaphor comprehension, even after the temporal window during which homophones are disambiguated (around 200 ms). This suggests that such verbs are polysemous rather than homonymous, and both senses are related and grounded in motor cortex. A second experiment using stimulation to the left anterior inferior parietal lobe suggests that TMS to a higher-order motor region selectively inhibits metaphor processing.

Topic Area: LANGUAGE: Semantic

Smaller N400 Amplitudes are Reflected in Creative Individuals

Poster A61, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Kristina Pfeifer[1], Gavin Dowd[2], Reza Ghafur[2], Alejandro Heredia[2], Mark W. Geisler[2]; [1]San Francisco State University

Recalling uncommon information is thought to be a unique characteristic within creative individuals (Mednick, 1962). To test this theory we examined the amplitude of the N400, which becomes larger in negativity when processing unrelated semantic information (Bentin et al., 1985). Due to the ease in which creative individuals produce meaning from unrelated associates (Benedek et al., 2012), smaller N400 amplitudes were predicted in response to remote word pairs. Participants (N = 45) were asked to try and form an association while viewing related, indirect and unrelated word pairs while electroencephalography was recorded form 9 electrode sites. Three measures of creativity were examined separately: divergent thinking, creative personally, and scientific creative achievement. N400 amplitude was largest for unrelated word pairs, intermediate for indirect word pairs, and smallest for related word pairs, with the difference between conditions greatest at electrode site P4. Based on this finding, which is consistent with previous N400 studies on word reading (Federmeir & Kutas, 1999), electrode site P4 was used for analysis. Subtraction waveforms yielded two conditions of interest: the unrelated effect (unrelated minus related) and the indirect effect (indirect minus related). A significant positive correlation was found for the indirect effect indicating that those high in scientific creative achievement, divergent thinking and creative personality had smaller N400 amplitudes (all rs ≥ .307). For the unrelated effect, the same positive correlation was found for scientific creative achievement and creative personality (all rs ≥ .355).

Topic Area: LANGUAGE: Semantic

A neurobiologically inspired computational model of sensorimotor grounding of abstract semantics

Poster A62, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Malte R Schomers[1,2], Friedemann Pulvermüller[1,2]; [1]Brain Language Laboratory, Freie Universität Berlin, Germany, [2]Berlin School of Mind and Brain, Humboldt-Universität zu Berlin, Germany

Explaining abstract semantics in terms of grounding in sensorimotor systems poses a particular challenge (Dove 2016, Psych.Bull.Rev). Concrete concepts can be grounded through high overlap of perceptuo-motor semantic features (e.g., the visual features of 'eye' or the motor features of 'to grasp' are highly similar across instances). But how can grounding occur for abstract concepts that have highly variable features across all instances in which the concept is used, exhibiting a family-resemblance relationship? We investigate this question using a neurobiologically well-informed computational model of the human brain areas involved in phonological and semantic word representations. We extended an existing model that demonstrated grounding of concrete action vs. object concepts (Garagnani & Pulvermüller 2016 Eur.J.Neurosci.; Tomasello et al., 2016, Neuropsychologia) to abstract semantics: The model was trained to associate phonological word form representations (neuronal patterns in acoustic-articulatory language cortex) with highly variable sets of sensorimotor semantic features (patterns in visual and motor cortices) exhibiting a family-resemblance relationship. Compared to implementations of 'concrete' semantics relying on conceptual-semantic feature overlap, the neuronal representations of 'abstract' words (1) shifted more strongly towards the perisylvian brain areas, (2) were less 'cohesive' (less likely to be active together), and (3) exhibited lower average firing rates during 'concept retrieval'. Crucially, these results show that abstract meaning can be grounded in action and perception, while indicating a relatively greater reliance of abstract semantics on perisylvian cortical areas as well as processing advantages of concrete over abstract words. The results are discussed in light of the current embodied-cognition debate.

Topic Area: LANGUAGE: Semantic

Verbal labelling of tactile percepts increases connectivity between somatosensory and auditory cortices

Poster A63, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Tally McCormick Miller[1,3], Timo Torsten Schmidt[2,4], Felix Blankenburg[2,3], Friedemann Pulvermüller[1,3]; [1]Brain Language Laboratory, Freie Universität Berlin, [2]Neurocomputation and Neuroimaging Unit, Freie Universität Berlin, [3]Berlin School of Mind and Brain, Humboldt Universität Berlin, [4]Institute of Cognitive Science, Universität Osnabrück, Germany

In its strong form, the linguistic relativity ('Whorfian') hypothesis claims that language structure has a causal effect on perception. To date, the majority of research relies heavily on natural languages and between-group comparisons to determine whether differences in vocabulary may lead to differences in perception. To determine whether labels could facilitate tactile perception, we used complex vibroractile patterned stimuli. To avoid natural language confounds while studying within-subject manipulation, these patterns were simultaneously presented with pseudowords during a week-long intense association phase. To test whether consistently pairing a percept (vibrotactile pattern) and a pseudoword could influence perceptual abilities, one set of pseudowords was assigned to one set of vibrotactile patterns and these were consistently paired during association. A second set was randomly paired as a control condition. After one week of associative training, subjects demonstrated discrimination improvement only for concordantly labeled vibrotactile stimuli. fMRI data were collected after this association phase. To assess corresponding changes in the interaction of auditory and somatosensory cortical networks, we used psychophysiological interaction analyses (PPI). We tested for differences in functional connectivity between auditory and primary/secondary somatosensory cortex when pseudowords from the concordant condition were presented, in comparison to pseudowords from the control condition. This analysis revealed increased bilateral coupling between primary auditory and secondary somatosensory cortex for concordantly labelled stimuli. This suggests a rapid formation of an integrated network via Hebbian associative learning, and that consistently pairing a verbal label with a percept may potentially enable one to better distinguish this percept amongst similar percepts.

Topic Area: LANGUAGE: Semantic

Processing of up/down words recruits cortical oculomotor areas

Poster A64, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Markus Ostarek[1,2], Jeroen van Paridon[1,2], Samuel Evans[3], Falk Huettig[1,4]; [1]Max Planck Institute for Psycholinguistics, Nijmegen, [2]International Max Planck Research School for Language Sciences, [3]Institute of Cognitive Neuroscience, University College London, [4]Donders Institute for Brain, Cognition, and Behavior, Radboud University, Nijmegen

Behavioural evidence suggests that processing words with spatial up/down associations (e.g., cloud vs. grass) influences performance at detecting/discriminating visual targets appearing in compatible vs. incompatible location (Gozli et al., 2013). Recent eye-tracking studies (Dudschig et al., 2013; Dunn, 2016) indicate that such implicit up/down words modulate vertical saccade latencies. Based on these findings, we tested the hypothesis that conceptual processing of up/down words recruits the cortical saccade network. We collected functional magnetic resonance imaging data from 18 participants who first performed a semantic judgement task on 12 up words, 12 down words, and 24 abstract control words, and then performed a separate run involving upward and downward saccadic eye movements. Searchlight-based multivariate pattern analysis was used to 1) identify brain areas from which the words' spatial associations could be decoded and 2) identify brain areas from which the direction of eye movements could be decoded. Our main result was that activity patterns in Brodmann areas 6 and 8 (including the frontal and supplementary eye fields) yielded above-chance classification in both domains. This suggests that conceptual processing of up/down words at least partly involves cortical oculomotor areas that are central for the planning and execution of vertical saccadic eye movements.

Topic Area: LANGUAGE: Semantic

Visual gender cue effects on incremental language comprehension

Poster A65, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Alba Rodriguez[1,3], Yoana Vergilova[2], Matthew W Crocker[2], Pia Knoeferle[1]; [1]Humboldt University Berlin, [2]Saarland University, Germany, [3]Bielefeld University, Germany

Psycholinguistic studies of gender knowledge effects have often manipulated the match between a linguistic context and words in a subsequent sentence (e.g. finding the pronoun "her" after a sentence talking about a "minister"; see Hammer et al., 2008; Kreiner et al., 2009; Xu, et al., 2013). Gender cues have also been conveyed through pictorial contexts. For instance, event-related brain potential (ERP) studies have shown that mismatches between a picture and the ensuing sentence affect sentence processing in real time (Vissers et al., 2008; Willems et al., 2008; Knoeferle et al., 2011). We examined the effects of prior visual gender cues in videos of male vs. female hands performing an action on participants' ERPs as they listened to sentences containing a masculine or feminine actor name (translation of German object-verb-subject example sentence: 'The cake (obj) bakes soon Susanna/Tobias (subj)'). The gender of the hands either matched or mismatched the gender of the actor's name. At 'Susanna/Tobias', mean amplitude N400s were more negative (250-400 ms) for gender mismatches than matches. Additionally, gender mismatches (vs. matches) elicited more positive mean amplitude (500-700 ms). As observed for linguistic contexts, amplitude differences were more pronounced at posterior than anterior sites. The findings suggest that even subtle gender cues – an actor's hand – elicited semantic expectations for a (gender-matching) actor (name). Failure to confirm these expectations seemed to affect both lexical semantic and integration processes.

Topic Area: LANGUAGE: Semantic

Influence of Speakers' Gaze on Listeners' Comprehension: Evidence from Event Related Potentials (ERP)

Poster A66, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Torsten Kai Jachmann[1], Heiner Drenhaus[1], Maria Staudte[1], Matthew W. Crocker[1]; [1]Saarland University, Germany

Eye-tracking studies have shown that language external cues such as gaze influence listeners' visual attention and affect sentence comprehension (Staudte, 2011). However, little is known about the underlying nature of processing difficulties of contradictory visual and auditory information. We present findings from an ERP study (30 German right-handed participants (18–32)) that utilized a stylized face performing gaze cues time-aligned to an auditory sentence. The sentence described a size or brightness comparison between two out of three objects present in a visual scene (fully counter-balanced). Gaze cues preceded the naming of the object by 800ms in order to obtain a natural gaze behavior (Kreysa, 2009). The gaze cue toward the second named object was manipulated such that it was either congruent (toward the object), incongruent (toward the unnamed object), or neutral (toward the bottom of the screen). ERPs time-locked to the onset of the noun following the manipulated gaze cue revealed that, compared to the congruent condition, incongruent and neutral gaze cues evoked an early-starting posterior negativity (150ms – 450ms). The incongruent gaze cue additionally induced a late sustained posterior positivity starting around 500ms after noun onset (500ms – 1000ms). The results suggest that congruent gaze facilitates comprehension, as manifest by a reduced negativity (N400), whereas incongruent gaze not only interferes with lexical retrieval of the noun, as revealed by modulation of the N400 (e.g.; Kutas, 2011), but further entails an update of the situation build on the preceding visual information, as indexed by the late positivity (e.g.; Polich, 2009).

Topic Area: LANGUAGE: Semantic

Evidence for Right Hemisphere Role in Semantic Exemplar Generation

Poster A67, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Alessandra Macbeth[1], Adam Felton[1], Christine Chiarello[1]; [1]University of California, Riverside

Prior research has indicated a right hemisphere (RH) role in the activation of distant semantic meanings during language comprehension. Here we examined whether similar asymmetries also exist during semantic production. Two hundred subjects completed an exemplar generation task, where category words (e.g., animal) were presented to left or right visual fields (LVF, RVF), and participants verbally generated one exemplar for each word. We measured uniqueness and latent semantic analysis (LSA; computes semantic distance) scores for each responses given. Uniqueness scores were computed by summing the number of individuals who gave each exemplar response, and then assigning that value to each item. Lower scores indicate more unique responses (e.g., for "citrus", "grapefruit" (uniqueness=5) was a more unique response than "orange" (uniqueness=148). For uniqueness, a mixed ANOVA revealed main effects of VF, $F(1,198)=169.0$, $p<.001$ (mean LVF=41.18, RVF=48.37), and sex, $F(1,198)=6.65$, $p=.01$ (mean Males=43.86, Females=45.85), but no interaction. A similar analysis for LSA uncovered a main effect of VF, $F(1,198)=35.62$, $p< .001$ (mean LVF=.38, RVF=.41), but no main effect of sex or interaction. Our results indicate that participants produced more unique and semantically distant exemplar responses to LVF/RH category words, and males produced more unique responses overall. We conclude that when processing is initiated by the right hemisphere, more semantically distant and unique exemplars are generated than for left hemisphere initiated processing, complementing findings from comprehension tasks. Therefore, a RH role in the accessibility of distant semantic meanings may influence word choice in some production tasks.

Topic Area: LANGUAGE: Semantic

Effects of Text Difficulty during Natural Reading: A co-registered eye tracking and fMRI study

Poster A68, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Wonil Choi[1], Matthew Lowder[2], John Henderson[2]; [1]GIST College, [2]Center for Mind and Brain, University of California, Davis

We conducted a co-registered eye-tracking and fMRI experiment to examine how global text difficulty influences eye movements and neural activation during natural reading. Forty participants read forty paragraphs representing a wide range of difficulty levels (assessed using Flesch-Reading-Ease scores) in the scanner while their eye movements were recorded. Each paragraph was presented for twelve seconds. Eye tracking results showed robust relationships between text difficulty and online reading measures: As texts became more difficult, readers had longer fixation durations, shorter saccadic amplitudes, and slower reading rates (measured in words per minute). These results suggest that eye movement behaviors are sensitive to objective measures of global text difficulty. fMRI results demonstrated that there were strong negative correlations between text difficulty and activation in language-related areas such as bilateral superior temporal gyrus/sulcus, bilateral angular gyrus, right middle temporal gyrus, and right inferior frontal gyrus (pars triangularis), suggesting that deeper semantic networks are involved when readers process easy texts compared to difficult texts. In addition, activations in right superior frontal gyrus, right calcarine sulcus, left middle occipital gyrus, left lingual gyrus, and left amygdala were also negatively correlated with global text difficulty. However, global text difficulty was positively correlated with brain areas such as bilateral posterior cingulate gyrus, bilateral precuneus, and left dorsal angular gyrus, demonstrating that these regions were more active when the text was more difficult to understand. Overall, the results suggest that patterns of eye movements as well as brain activation are sensitive to changes in the global difficulty of texts.

Topic Area: LANGUAGE: Semantic

Speaker-specific predictions about category membership during language comprehension

Poster A69, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Rachel Ryskin[1,2], Shukhan Ng[3], Katie Mimnaugh[3], Sarah Brown-Schmidt[4], Kara D. Federmeier[3,5]; [1]Massachusetts Institute of Technology, [2]Boston University, [3]University of Illinois at Urbana-Champaign, [4]Vanderbilt University, [5]Beckman Institute for Advanced Science and Technology

During language comprehension, listeners predict features of upcoming words. Previous work (Federmeier et al., 2010) examined predictive processes when readers judge the fit of a word with a category ("A kind of tree"). Atypical exemplars (ash) elicit a larger frontal positivity compared to typical exemplars (oak) and anomalous words (tin). This frontal positivity may index processes associated with a prediction being disconfirmed (Federmeier et al., 2007). An open question is whether such predictions are context-dependent. Here, we first successfully replicated Federmeier et al. (2010) in the auditory modality. In a second experiment, we extended the design to test the context-specificity of predictions using two-speaker contexts (Bob and Susan). Speakers alternated providing category cues (e.g., Susan: "Bob, name a kind of tree.") and answering (e.g., Bob: "oak"). Critically, participants were provided with advance information about one of the speakers (e.g., Bob; counterbalanced across subjects) through short interviews that revealed that Bob had a strong preference for, e.g., ash trees. We hypothesized participants might make speaker-specific predictions, expecting "oak" if Susan was being asked about trees but "ash" if the person being asked was Bob. Indeed, we observed a significantly increased frontal positivity in response to a typical word when it was said by Bob compared to Susan. Interestingly, no speaker-differences were observed in the N400 window. These results suggest that participants made speaker-specific predictions about upcoming words and that these predictions had consequences for the integration of new information into the existing representation, but not for the initial semantic processing.

Topic Area: LANGUAGE: Semantic

Examination of the relationship between resting state neural oscillations and lexical semantic retrieval in mild traumatic brain injury

Poster A70, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Marissa DeCaro[1], Amy Ramage[1], Stephanie Barlow[1], Daniel Seichepine[2], Robert Ross[1]; [1]University of New Hampshire, [2]University of New Hampshire-Manchester

Mild traumatic brain injury (mTBI) is an impact to the head that causes neurological symptoms for any period of time. Language deficits observed following concussion appear to be due to disruptions in white matter integrity that changing neural communication. This study assessed oscillatory power, an index of neural communication recorded with EEG, to identify how resting-state network activity relates to lexical-semantic retrieval in young adults reporting between 2-5 concussion events who were at least 4 weeks post-concussion. Performance on the Boston Naming Test (BNT) was correlated with resting oscillatory power in the theta (4-8 Hz) and two gamma frequency bands, 30-50 (low gamma) and 70-90 Hz (high gamma). EEG data was recorded with a 64-channel ActiChamp system as participants sat in quiet wakefulness for four minutes with their eyes open. Four ROIs over posterior regions of the brain were defined. Multivariate regression was used to determine whether theta, low, or high gamma Hz bands recorded in our ROIs is predictive of performance on the BNT. Our preliminary results show that our model has an R2 = .743, suggesting performance on the BNT is predicted by theta and gamma oscillatory power over posterior brain regions during rest. These results may help to identify which oscillatory bands correlate with difficulty of word retrieval in mTBI.

Topic Area: LANGUAGE: Semantic

Accessing Script Knowledge: The Case Of Emotion

Poster A71, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Katharina Menn[1], Dorothee J. Chwilla[1]; [1]Donders Institute for Brain, Cognition, and Behaviour, Radboud University

In the emotion literature it is generally agreed upon that there exist mood-dependent processing styles (e.g., Isen, 2001; Gasper & Clore, 2002). Positive mood is associated with a more global, category level of information processing, that is, relating information to what is known based on world knowledge. In contrast, negative mood invalidates accessible cognitions and is characterized by local, item specific processing with close attention to details. In the present study we tested this view by investigating the effect of mood on the processing of world knowledge. To this aim we presented word triplets that formed a conceptual script but were not associatively and/or semantically related (e.g., DIRECTOR - BRIBE – DISMISSAL) or were unrelated. Mood (happy vs. sad) was induced by presenting film clips. Reaction time (RT) and ERPs were recorded. Participants were asked to indicate whether the triplets formed a plausible scenario. The main findings were as follows: The mood induction was successful. Consistent with previous work a reduction in RT and N400 amplitude was found for script-related compared to unrelated triplets (Chwilla & Kolk, 2005). Importantly, for N400, a mood by plausibility interaction was present. The interaction reflected the presence of a broadly distributed N400 script priming effect for positive mood ($p < .001$) but absence of an N400 script priming effect for negative mood ($F < 1$). The present N400 results provide further support for

mood-dependent processing styles. Happy mood validates accessible cognitions and exploiting world knowledge whereas sad mood discourages the use of world knowledge.

Topic Area: LANGUAGE: Semantic

N400 Effects on Conceptual Expansion

Poster A72, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Alejandro Heredia Cedillo[1], Kristina Pfeifer[1], Gavin Dowd[1], Reza Ghafur[1], Mark W. Geisler[1]; [1]San Francisco State University

Conceptual expansion is defined as broadening our existing knowledge structures about the world by integrating novel information (Ward, 1994). The amplitude of the N400 Event-Related Potential becomes larger when semantic meaning is violated in a contextual setting (Kutus & Federmeier, 2000). However little research has been done on N400 amplitude and its sensitivity to conceptual expansion. If N400 amplitude is not solely sensitive to violations in semantic expectancies then smaller N400 amplitudes should occur when conceptual expansion is successfully employed. Participants (N = 45) were asked to try and form an association when viewing related, indirect, and unrelated word pairs while electroencephalography was recorded from 9 electrode sites: Fz, Cz, Pz, F3, F4, C3, C4, P3 and P4. Conceptual expansion was defined as making an association between indirect or unrelated word pairs via verbal response. Subtraction waveforms were used for analysis, which left two conditions of interest: the unrelated effect (unrelated minus related) and the indirect effect (indirect minus related). A tertiary split determined high and low response groups for the indirect (high = 24, low = 6) and unrelated (high = 18, low = 15) conditions. Smaller N400 amplitude was found for high verses low groups, with trending effects in the indirect condition ($p = .067$) and significant effects in unrelated condition ($p = .016$). For the indirect condition, this effect was significant over the parietal lobe, while in the unrelated condition trending effects were broadly distributed over the scalp.

Topic Area: LANGUAGE: Semantic

Prototype representations in ventromedial prefrontal cortex and hippocampus during concept generalization

Poster A73, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Caitlin Bowman[1], Dagmar Zeithamova[1]; [1]University of Oregon

Healthy memory function involves both the ability to remember specific details of prior events and the ability to integrate common event features to form abstract concepts that guide behavior in new situations. The nature of the memory representations supporting these two functions has been of considerable debate. Prototype models posit that abstract representations of central tendency are formed to guide generalization. Exemplar models posit that abstract information can be extracted on demand from individual instances and does not need to be maintained as a distinct representation. The present study used a category-learning task to simultaneously measure event-specific and abstract representations. Participants were trained to sort exemplars into two categories, then underwent functional MRI 1) while passively viewing training items and new exemplars and 2) during a generalization test that probed for category knowledge applied to novel exemplars. Exemplar and prototype models were fit to behavioral data in individual subjects and then used as regressors in neuroimaging data to identify the neural correlates of each. Behavior was better fit by the prototype than the exemplar model, associated with robust prototype correlates in the ventromedial prefrontal cortex and anterior hippocampus during the generalization test. In contrast, during passive viewing of old and new exemplars, neural pattern similarity analyses revealed that posterior hippocampus and portions of parietal cortex were sensitive to event-specific information. Together, results show that event-specific and abstract representations co-exist within the hippocampus and that medial prefrontal and parietal regions differentially support these representations to serve multiple memory functions.

Topic Area: LONG-TERM MEMORY: Episodic

Patterns of Alpha-band Oscillations Track Spatial Long Term Memory Performance

Poster A74, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

David Sutterer[1], Joshua Foster[1], John Serences[2], Edward Vogel[1], Edward Awh[1]; [1]University of Chicago, [2]University of California - San Diego

Recent work has demonstrated that it is possible to reconstruct spatially-specific channel tuning functions (CTFs) during the encoding and delay period of a working memory (WM) task, and during the retrieval period of a long term memory (LTM) task, using an inverted encoding model (IEM) and electroencephalography (EEG). Specifically, these CTFs can be derived from the distribution of alpha-band (8-12hz) activity across the scalp, providing a temporally resolved measure of both the location stored in WM as well as the locations retrieved from LTM. Here we show that the pattern of alpha-band activity across the scalp tracked participants' memory performance as they learned object-position associations over the course of the experiment. Participants learned randomly assigned positions for a collection of 80 unique shapes, with the position selected from a continuous 360 degree space around a circle. Immediately following encoding, participants were presented with shape cues and asked to retrieve the associated position. Participants repeated the encoding and retrieval process for the to-be-remembered object position pairings 9 times over the course of the session. We found that the spatial selectivity of alpha-band activity tracked subjects' memory performance as learning progressed and when trials were sorted based on the degree of response error. Thus, the topography of alpha band power may serve as a useful assay of spatial memory retrieval that can be acquired without an overt behavioral response.

Topic Area: LONG-TERM MEMORY: Episodic

Detecting neural correlates of autobiographical memory for recent and remote memories through high-resolution fMRI

Poster A75, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Farah Naaz[1], Lindsay K. Knight[1], Brooke N. Siers[1], Brendan E. Depue[1]; [1]University of Louisville

There is ongoing debate on the degree of involvement of the hippocampus in recollection of memories. Research suggests increasingly diffuse activation of representations leading to independence from hippocampal processes as memories age; while other researchers theorize that recollection never becomes independent of the hippocampus, but instead may show migration corresponding to the long axis (anterior-posterior). Different theories also suggest that the degree and spatial extent of hippocampal activation is dependent on spatial information. Therefore, it is critical to explore differences in hippocampal activation manipulating both age and spatial content of memory. The current study explores this issue by using autobiographical memories for objects and locations from three time periods: early, teen years, and recent. Twenty participants were scanned using high-resolution functional scans (1.5x1.5x1.5mm). Participants generated 30 unique cues and various ratings for these memories one day before the scan. Results indicate a common trend across types of memories and time periods. Objects and locations activated similar regions of the hippocampus and parahippocampal gyrus, however, the degree of activation was significantly greater for location memories. Similarly, increasing age led to decreased activation in the hippocampus and parahippocampal gyrus in a linear manner. The degree of activation corresponding to manipulations of age can be allocated to self-reported aspects of these memories: recent memories are less difficult to retrieve, were reported to be more vivid, important, and frequently recalled. The current study suggests that the hippocampus appears to always be recruited in recollection, however the level activation varies as a function of age.

Topic Area: LONG-TERM MEMORY: Episodic

The Role of the Posterior Parietal Cortex in Episodic Retrieval

Poster A76, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Marty Fiati[1], Peter Bright[1]; [1]Anglia Ruskin University

Increasingly findings from the memory literature have implicated the posterior parietal cortex (PPC) in the memory operations which occur at the time of episodic retrieval. Involvement of the PPC has been found to support binding of the fine multisensory features in an episode. In the current study, participants performed a multisensory episodic retrieval task in which they first identified previously studied faces, and subsequently made based source judgements denoting the spatial location (left/right), voice (male/female), and study task (pleasantness rating/celebrity judgement) that they had associated with each face at study. Recorded ERPs associated accuracy of source recollection with a late positivity over the PPC. In order to evaluate the causal role of this activity with retrieval, transcranial direct current stimulation (tDCS) was employed at the site of maximal activity in the left PPC (P3) before performing the task. The performance of 30 participants following excitatory anodal tDCS, or inhibitory cathodal tDCS, was compared to sham tDCS. Excitatory stimulation was not found to lead to greater retrieval of multimodal contexts than sham stimulation overall. Inhibitory stimulation however was found to decrease retrieval of multimodal episodic contexts compared to sham stimulation. The specificity of these changes to PPC stimulation was further verified in a sample of participants who underwent the same tDCS protocol to the left motor area (M1), but did not exhibit this change in task performance. The findings indicate that the binding of different sensory features of an episode at retrieval is decreased by reductions in activation of the PPC.

Topic Area: LONG-TERM MEMORY: Episodic

Neural correlates of preparation during context memory encoding in young and older adults

Poster A77, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Jonathan Strunk[1], Audrey Duarte[1]; [1]Georgia Institute of Technology

Previous research suggests that older adults have deficits in the utilization of goal relevant information and are less likely to use preparatory strategies, compared to the young. In younger adults, preparatory processes during encoding have been found to reflect subsequent memory performance. Previous studies investigating preparatory activity in memory have not assessed the impact of the informative value of the cue. The current fMRI study investigates the effects of aging on informative vs neutral cuing during context memory encoding and related neural activity. During encoding, participants assessed the likelihood of objects paired with one of two context images (face or scene). Preceding each stimulus was an informative cue (indicating the to-be-presented context), or a neutral cue (no context information). Item and context memory performance did not differ between informative and neutral trials for either young or older adults and memory performance was matched across age groups. Informative cues elicited greater activity than neutral cues in temporal and frontal regions for the young adults only, and in occipital regions sensitive to face and scene categories for both age groups. In both young and older adults, activity within the occipital regions overlapped with subsequent context memory accuracy. Although cue type did not modulate performance, these results suggest that both young and older adults utilized the informative cues differently than the neutral cues, and engaged cue-related regions in support of context memory performance.

Topic Area: LONG-TERM MEMORY: Episodic

EEG oscillations and value-based recognition memory

Poster A78, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Blake Elliott[1], Chris Blais[1], Gene Brewer[1]; [1]Arizona State University

The ability to selectively encode important or valuable information is an essential aspect of human memory. However, the temporal processes underlying how value can affect memory is not yet well understood. In the present research we examined behavioral and neurophysiological correlates of value-based memory encoding. Participants were asked to encode words in multiple study phases that were randomly paired with high or low point values. They were instructed to maximize their score on a subsequent word recognition test by successfully remembering as many words as possible. Subjective states of recollection (i.e., "Remember") and familiarity (i.e., "Know") were assessed at retrieval. High value words were discriminated more effectively than low value words and this difference was primarily driven by increases in Remember responses with no difference in Know responses ($p < .001$). We then examined EEG oscillatory signals from the encoding period as a function of whether subjects subsequently recognized the item. We found decreased theta power during the first 0-1000 ms post-stimulus followed by increased high-frequency gamma power from 1000-2000 ms for subsequently recollected high value words compared to low value words. Overall, the behavioral and neurophysiological data suggests that value directed encoding results in a greater effect on subjective states of recollection, and that higher valued recollected responses can be dissociated from lower valued responses at encoding using time-frequency analysis.

Topic Area: LONG-TERM MEMORY: Episodic

Altered hippocampal-prefrontal oscillatory dynamics coordinating memory binding in two cases of developmental amnesia

Poster A79, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Nicholas B. Diamond[1,2], Rosanna K. Olsen[2], Jennifer D. Ryan[1,2]; [1]University of Toronto, [2]Rotman Research Institute, Baycrest Health Sciences

The hippocampus and medial prefrontal cortex (mPFC) are critical for binding information across space and time into memory representations. However, it is unclear how hippocampal and mPFC activity is coordinated during binding. A recent model suggests that theta and beta oscillations are the resonant frequencies along two distinct thalamic pathways – including the anterior and mediodorsal thalamic nuclei, respectively – that connect the hippocampus and surrounding medial temporal lobes with the mPFC (Ketz, Jensen, & O'Reilly, 2014). Yet little is known about how human brain lesions affect local and distributed oscillations in memory. We used magnetoencephalography to investigate how damage along hippocampal-prefrontal pathways perturbs the oscillatory dynamics that organize memory formation. Two developmental amnesic cases (H.C., N.C.) with distinct thalamic lesions and matched control participants performed a task requiring the formation and temporary maintenance of spatiotemporal relations among successively presented objects. Control participants exhibited increasing theta power and decreasing beta power in the hippocampus and mPFC with increasing binding demands, and mPFC power changes predicted subsequent memory. Case H.C. exhibited impaired binding performance and aberrant hippocampal theta and beta dynamics relative to controls, with over-recruitment in medial frontopolar cortex. Case N.C. performed normally despite marked reductions in theta power encompassing the hippocampus and mPFC, exhibiting stronger hippocampal beta desynchronization and recruitment of lateral prefrontal and temporal regions, which may reflect compensatory processes. These findings demonstrate that lesion-induced alterations to oscillatory dynamics are complex and not band-limited and, more broadly, that memory binding depends on distributed frontotemporal interactions across multiple timescales.

Topic Area: LONG-TERM MEMORY: Episodic

Neural similarity patterns across repeated memory encoding are further influenced by the modality in which stimuli are presented

Poster A80, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Carolin Sievers[1], Fraser W. Smith[1], Louis Renoult[1]; [1]University of East Anglia, UK

The present experiment used functional magnetic resonance imaging to investigate representational similarity patterns across repeated stimulus encoding with stimuli being presented in different modalities. Twenty adult participants performed a categorization task during the encoding phase, followed by an unexpected recognition-source memory task. During encoding, each stimulus was presented four times in one of three modalities: 1) repeatedly as a picture, 2) repeatedly as a word, 3) alternately as a picture or a word. We hypothesized subsequent correct source memory judgements to be associated with higher neural pattern similarity at encoding compared to incorrect source memory judgements. Furthermore, we predicted that pattern similarity would be influenced by the modality the stimulus was presented in. In line with these hypotheses, cortical neural similarity was generally found to be higher for correct compared to incorrect source memory judgements. Moreover, effects of modality on similarity patterns differed across regions of interest. Visuo-perceptual regions, such as superior occipital and fusiform gyri, were associated with higher similarity for the picture (1) than word (2) modality. Regions previously linked to multi-modal feature integration, e.g., angular gyrus, tended to show higher similarity for the alternating picture and word (3) modality. These results suggest subsequent source memory effects on cortical similarity patterns to be relatively global,

while differences in similarity patterns relating to modality are more region-specific. Moreover, regions such as the angular gyrus appear to rely on greater pattern similarity in a cross-modal compared to a unimodal condition despite perceptual dissimilarities of stimuli across multiple encoding.

Topic Area: LONG-TERM MEMORY: Episodic

Hippocampal forgetting signals: the case of prior knowledge consistency

Poster A81, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Niv Reggev[1], Talya Sadeh[2], Oded Bein[3], Anat Maril[4]; [1]Harvard University, [2]Ben Gurion University of the Negev, [3]New York University, [4]Hebrew University of Jerusalem

Prior knowledge (PK) plays a pivotal role in memory by serving as a scaffold upon which new events can be rapidly assimilated. Whereas previous studies focused on the encoding of PK -consistent and –inconsistent events, here we probe the vastly understudied processes underlying the initial stages of forgetting of these events. Based on a recent framework portraying memory decay as hippocampus-centered and on findings stressing the importance of hippocampal processes in assessing previous knowledge, we hypothesized that consistency will facilitate slower hippocampal decay-related patterns compared to PK-inconsistency. Participants were presented with PK-consistent (e.g., “yellow lemon”) or inconsistent (“purple banana”) target pairs, with each pair presented twice (between-repetition lag: 2 to 36.5 s; mean: 17.65 s). Using Representational Similarity Analysis (RSA), we correlated hippocampus-derived multivariate patterns of the first and second presentation of the same pair. Overall, the correlation was higher for short compared to long delay uniquely for repeated pairs, providing the first evidence, to our knowledge, of fMRI-measured neuronal decay in the human hippocampus. This pattern was qualified by an interaction with PK status, such that PK-consistent events demonstrated higher similarity (reduced forgetting) compared to PK-inconsistent events. Our results demonstrate that hippocampus-induced forgetting signals can be readily measured over short intervals. Moreover, they suggest that decay of hippocampal-representations can be accelerated when no prior information exists, stressing that prior knowledge should be taken into account in the consideration of hippocampal function and architecture.

Topic Area: LONG-TERM MEMORY: Episodic

The effect of shared distinctiveness on source memory and illusory correlations: An event-related potential study

Poster A82, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Michael Weigl[1], Hong Hanh Pham[1], Axel Mecklinger[1], Timm Rosburg[1,2]; [1]Saarland University, [2]University Psychiatric Clinics Basel

An illusory correlation (IC) is the erroneous perception that two uncorrelated categories are correlated. The Shared Distinctiveness Approach (SDA) explains ICs with heightened accessibility of distinctive category combinations in episodic memory. However, empirical evidence for this approach is heterogeneous. In the present event-related potential (ERP) study, we exploited the fact that distinctive items elicit a P300 at encoding, which potentially predicts subsequent memory performance, and investigated the behavioral effect of shared distinctiveness on source memory and ICs. Distinctiveness at encoding was created by infrequently presenting words that differed either in color or valence from frequently presented, positive words. Shared distinctive items deviated in both color and valence. We hypothesized that shared distinctiveness would lead to an enhanced P300 subsequent memory effect (SME), better source memory performance, and an overestimation of the frequency of shared distinctive items. Behavioral results indicate the presence of a shared distinctiveness effect in source memory and an overestimation of the frequency of shared distinctive items. Moreover, the P300 was larger for the distinctive color than for the frequent color and predicted subsequent source memory performance. However, the P300 was unexpectedly larger for positive than for negative stimuli, and shared distinctiveness did not further boost the SME. These results indicate that shared distinctiveness indeed leads to better source memory and ICs, supporting the SDA. The behavioral effects, however, were not associated with the expected SMEs, possibly due to the exclusion of high performing participants from the ERP analyses who had too few trials of later forgotten items.

Topic Area: LONG-TERM MEMORY: Episodic

Self-referential memory and rest activity within the posteromedial cortex originate from different neuronal populations

Poster A83, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Amy Daitch[1], Josef Parvizi[1]; [1]Stanford University

Brain regions within the default mode network (DMN) are engaged during periods of rest, as well as during goal-directed self-referential processes such as remembering a past event. Given the spatial smoothing inherent to neuroimaging methods, and their limited temporal resolution, it has been difficult to discern if the self-referential memory and resting activity in the DMN originate from the same neuronal populations. We recorded intracranial signals from the posteromedial cortex (PMC), a hub of the DMN, in 14 human subjects, and measured activity from discrete neuronal populations during experimental memory and rest conditions. We replicated our previous findings that PMC sites activated during autobiographical memory retrieval were almost always distinct from those activated during cued rest (Dastjerdi 2011 PNAS; Foster 2012 PNAS; Foster 2015 Neuron), though these two types of neuronal populations were anatomically close (less than 1 cm apart). More importantly, we

discovered two distinct patterns of activity during cured rest: Some PMC neuronal populations exhibited fast and transient responses that were time-locked to the rest cue (possibly signaling a switch from non-rest to rest) while others showed delayed and sustained responses during rest condition (possibly reflecting the maintenance of resting state with spontaneous thought). Our findings shed new light on the functional heterogeneity within the PMC at the level of neuronal populations and offer new information about resting activity within the DMN.

Topic Area: LONG-TERM MEMORY: Episodic

Hippocampus is necessarily involved in recollection memory precision

Poster A84, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Aneesha S Nilakantan[1], Donna J Bridge[1], John A Walker[1], Stephen A VanHaerents[1], Joel L Voss[1]; [1]Northwestern University Feinberg School of Medicine

Episodic recollection depends critically on the hippocampus. Recollection is often measured with source memory tests in which participants are asked to recall the context in which an object was studied. However, even when recollection is successful (e.g., "I parked my car at the museum"), the quality of information and details recollected vary (e.g., "I parked my car at the museum on the left on the fourth floor"). Most studies explore memory success but do not consider the varying amounts of detail (memory precision) recalled. The neural processes and the role of the hippocampus in recollection precision relative to success are unclear. Because diminished hippocampal integrity has been associated with recollection impairments, we assessed precision in healthy aging and following unilateral mesial temporal lobe (including hippocampus) resection. 18 young adults (18-35 years-old), 18 older adults (65-80 years-old) and 9 resection patients (31-51 years-old) participated in an associative object-location memory study, designed to segregate memory success from memory precision. Distance error was modeled for each group, resulting in a group-specific recollection threshold. Success was defined as trials with error below this threshold. Within successfully recollected trials, precision was defined as the mean distance error. Recollection success was relatively well matched among groups (with a difference for resection patients versus young adults at $p=0.045$). However, relative to young adults recollection precision was significantly impaired for older adults ($p<0.001$) and resection patients ($p=0.002$). Reductions in recollection precision for older adults and hippocampal resection patients provide evidence that the hippocampus necessarily contributes to memory precision.

Topic Area: LONG-TERM MEMORY: Episodic

Sensory stimulation during sleep to selectively strengthen memories: Sounds can be arbitrarily associated with visuo-spatial learning

Poster A85, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Larry Cheng[1], James Antony[2], Paula Pacheco[2], Ken Norman[2], Ken Paller[1]; [1]Northwestern University, [2]Princeton University

A powerful way to study the memory functions of sleep, Targeted Memory Reactivation (TMR), requires stimuli that act as reminders of previous learning. In TMR studies of learning object-location associations, for example, each object was accompanied by its characteristic sound (e.g., door-creak, dog-bark) during spatial learning episodes. The same sounds were then presented softly during slow-wave sleep. Although selective memory benefits have been repeatedly demonstrated with these procedures, not all objects have characteristic sounds. It is thus important to determine whether spatial learning can also be improved during sleep when TMR is applied using arbitrary sounds. Here we report findings showing that memory for object-location associations can be improved by reactivation during sleep even when sounds are not semantically related to the objects. Participants first memorized associations between environmental sounds and random objects (famous faces, famous landmarks, and common visual objects). Next, they learned a random screen location for each object. During a subsequent afternoon nap session, memories were cued using TMR with half of the sounds. When spatial recall was tested later, memories were significantly more accurate for cued objects than for uncued objects. These findings broaden the generalizability of auditory TMR for spatial learning to circumstances when idiosyncratic sounds are not available. Characteristic sounds are unnecessary if associations with novel sounds can be acquired. The TMR methodology can thus be used with a wide variety of learning tasks, both to study mechanisms of memory consolidation and in applications when improved learning could be beneficial.

Topic Area: LONG-TERM MEMORY: Episodic

Rhythmic enhancement of visual long-term memory

Poster A86, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Hunter A. Johndro[1], Lauren Jacobs[1], Aniruddh D. Patel[1], Elizabeth Race[1]; [1]Tufts University

Previous research has demonstrated that background auditory information can enhance perceptual discrimination, particularly discrimination of stimuli presented in alignment with a predictable auditory rhythm (Escoffier, 2010). It has been argued that this rhythmic enhancement of perception reflects the temporal entrainment of attention, with peaks of attention at the times of musical beats. Indeed, is known that internal neural oscillations synchronize to the beat of external auditory rhythms (rhythmic entrainment). The present study investigated whether rhythmic auditory information can similarly enhance long term memory (LTM). Participants viewed a series of male and female faces in the context of (a) rhythmic, naturalistic music or (b) silence, and made gender discrimination decisions for each face. Critically, in the music condition, faces were either presented on or off of the musical beat. In a subsequent recognition memory test, participants viewed old and new faces, and made confidence decisions about their memory for each face. Memory enhancement was observed for faces presented on the beat at encoding compared to faces

presented off the beat or in silence. This rhythmic enhancement of LTM was most pronounced for individuals with low baseline levels of LTM performance as well as individuals with enhanced capacity to discriminate musical beats (as measured by the Beat Alignment Test; Iversen & Patel, 2008). These results indicate that rhythmic, auditory background information can enhance encoding and subsequent long-term memory, and suggest potential therapeutic applications for enhancing LTM in populations with compromised memory function.

Topic Area: LONG-TERM MEMORY: Episodic

Frequency dependence of noninvasive brain stimulation effects on hippocampal-cortical networks

Poster A87, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Molly S. Hermiller[1], Zainab Fatima[1], Jonathan O'Neil[1], Robert Palumbo[1], Stephen VanHaerents[1], Tommi Raij[1,2], Donna Bridge[1], Joel L. Voss[1]; [1]Northwestern University Feinberg School of Medicine, [2]Rehabilitation Institute of Chicago

The hippocampus serves as a hub within hippocampal-cortical networks that are thought to contribute to distinct memory processes, such as item versus source memory. Transcranial magnetic stimulation (TMS) can be used to manipulate brain networks and test their causal roles in various memory expressions. We previously showed that multi-day 20-Hz repetitive TMS (rTMS) of lateral parietal areas can increase fMRI connectivity among distributed hippocampal-cortical network regions and enhance associative memory. rTMS using patterns such as theta-burst stimulation (TBS) could improve targeting of the hippocampal-cortical network. Here, we compared within-subject effects of single-session intermittent TBS, continuous TBS, and 20-Hz rTMS relative to sham (counterbalanced across four days) on memory performance and fMRI connectivity. On each experimental day, subjects (N=12) studied 96 unique words presented in one of eight colors. Words were later tested in an old/new recognition test followed by forced-choice associative color recognition. During the retention interval, rTMS was delivered, followed immediately by a resting-state fMRI and then memory testing. Whereas one session of 20-Hz rTMS had no robust effects on hippocampal connectivity, intermittent and continuous TBS both significantly modulated hippocampal-cortical fMRI connectivity. Changes were more constrained to the posterior/medial hippocampal cortical network following intermittent TBS, whereas changes were more cortically distributed following continuous TBS. Recollection-related performance measured in the memory test increased significantly only after intermittent TBS. These findings suggest that stimulation effects vary for different stimulation frequencies and patterns. This research has implications for distinguishing hippocampal-cortical network contributions to item versus source memory.

Topic Area: LONG-TERM MEMORY: Episodic

Predicting Individual Differences in Learning and Memory By Measuring Limbic White Matter

Poster A88, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Athanasia Metoki[1], Kylie H. Alm[1], Yin Wang[1], Ingrid R. Olson[1]; [1]Temple University, Department of Psychology

Some people can easily remember details of their high school graduation, while other people have only vague impressions of this milestone event. Individual differences in memory contribute to disparities in social expertise and academic performance. Here, we asked whether variation in a limbic white matter tract, the uncinate fasciculus (UF), accounts for variation in learning and memory. We tested two hypotheses: (1) That the UF is involved in associative but not non-associative memory; and (2) that a subregion of the UF, the “face-specific UF”, defined by its connectivity between face patches in the anterior temporal lobe and orbitofrontal cortex, specifically contributes to associative memory for faces. Healthy young adults performed three tasks: in Exp. 1, they learned to associate common names with highly similar faces; in Exp. 2, they learned to associate uncommon names with highly dissimilar faces; and in Exp. 3, item and associative memory for word lists were tested. Diffusion tensor imaging and deterministic tractography were performed. Results revealed that microstructure of the whole UF predicted individual differences in performance on both face-name tasks (25% and 38% of the variance, respectively), directly replicating prior results. Whole UF microstructure also predicted variability on the word association task (20% of the variance). In contrast, connectivity in the face-specific UF selectively predicted face-name learning (40% of the variance). These findings suggest that the UF may be essential for associative memory, while a face-selective subregion of the UF is involved more specifically in memory for social stimuli.

Topic Area: LONG-TERM MEMORY: Episodic

A Sad Mood Prior to Sleep is Sufficient to Enhance Sleep-Dependent Consolidation of Sad Memories

Poster A89, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Mckensey Johnson[1], Holly Bowman[1], Gretta Johnson[1], Israh U. Imam[1], Anjelica E. Langdon[1], Carmen E. Westerberg[1]; [1]Texas State University

Sleep-dependent memory consolidation is discriminatory, in that only a subset of recent memories are selected for long-term perseverance, through the reactivation of these memories during sleep. Reactivation may occur spontaneously, or through targeted reactivation, whereby cues associated with a memory are re-presented

during sleep. We previously demonstrated that when sounds associated with a sad mood were re-presented during sleep, the consolidation of sad memories was enhanced. Here, we tested whether a sad mood prior to sleep is sufficient to enhance sad memory consolidation through spontaneous reactivation, without concomitant targeted reactivation during sleep. After listening to a story containing both sad and happy events, a sad mood was induced in 18 participants through music accompanied by a guided imagery task, wherein participants imagined themselves in a series of sad scenarios. Next, participants took a 90-min nap monitored with electroencephalography (EEG). Upon waking, they were asked to recall the story. Mood was assessed just prior to story encoding, sleep, and story recall. Participants recalled significantly more sad than happy story details, and EEG data provide clues regarding aspects of sleep physiology relevant to this enhancement. Furthermore, mood assessments revealed that participants were significantly sadder just prior to sleep compared with at encoding and at recall, indicating that a sad mood prior to sleep is sufficient to enhance the consolidation of sad relative to happy memories. This study demonstrates a novel method for influencing the selectivity of memory consolidation, and the results may have implications for treating mood disorders such as depression.

Topic Area: LONG-TERM MEMORY: Episodic

Structure-Function Correlates of Successful Associative Encoding – A Multimodal Imaging Approach.

Poster A90, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Nina Becker[1,2], Grégoria Kalpouzos[2], Alireza Salami[2], Erika J. Laukka[2], Yvonne Brehmer[1,2]; [1]Otto Hahn Group on Associative Memory, Max Planck Institute for Human Development, Berlin, Germany, [2]Aging Research Center, Karolinska Institutet and Stockholm University, Stockholm, Sweden

Functional magnetic resonance imaging (MRI) studies have demonstrated a critical role of hippocampus and inferior frontal gyrus (IFG) in successful associative encoding. Similarly, structural MRI studies have reported a positive relationship between associative memory and gray-matter (GM) volume of hippocampus and prefrontal cortex. Here, we sought to identify covariance patterns of GM volume and brain activity related to successful associative encoding by fusing structural and functional MRI data. T1-weighted images (3T GE) were collected from 24 young adults (M = 24.9 years), and functional MRI was employed during encoding of object pairs. A subsequent recognition task tested participants' memory performance. Unimodal analyses using voxel-based morphometry revealed that participants with better associative memory showed larger GM volume in left anterior hippocampus. Similarly, subsequent memory analysis revealed activity in left anterior hippocampus and IFG related to successful associative encoding. Using joint independent component (IC) analysis, we investigated whether functional activation patterns within the associative encoding circuit could be locally or distally accounted for by GM volume. Results revealed one IC that comprised a covariance pattern between GM volume in anterior hippocampus and encoding-related activity in IFG. These regions were largely overlapping with those identified in the unimodal analyses. Importantly, individual IC loadings were positively correlated with associative memory indicating that individuals with stronger structure-function association performed episodic encoding more efficiently. Our findings suggest that GM within the medial temporal lobe modulates distally distinct parts of the associative encoding circuit, and extend previous studies that demonstrated hippocampal-IFG functional connectivity during associative memory tasks.

Topic Area: LONG-TERM MEMORY: Episodic

Changes in Item Representations Following Category Learning

Poster A91, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Stefania Ashby[1], Caitlin Bowman[1], Dagmar Zeithamova[1]; [1]University of Oregon

Learning about category membership can alter representations of individual items resulting in increased perceived similarity of items within a category and decreased perceived similarity of items from different categories. The current study aimed to investigate changes in subjective similarity ratings and neural pattern representations before and after category learning. Stimuli were faces constructed as 50/50 blends of never-seen "parent" faces. Two parent faces determined category membership and were each blended with three other parent faces for a total of six unique face stimuli. Thus, pairs of faces could share a parent face relevant for categorization, a parent face irrelevant for categorization, or not share a parent face. Participants first rated the similarity of pairs of faces and then passively viewed the stimuli during functional MRI prior to category learning. The same passive viewing and subjective similarity ratings were repeated after participants were trained to sort the six face blends into two categories. Prior to category learning, subjective similarity ratings were the same for pairs of faces from the same category as for pairs of faces from different categories that had a parent in common. After category learning, similarity ratings for items within a category increased, while rated similarity of faces that shared a parent but belonged to different categories decreased. Tracking the behavioral data, neural patterns in the ventromedial prefrontal cortex differentiated category membership of faces after learning but not before. These findings elucidate the neural mechanisms underlying the changes in item representations resulting from category learning.

Topic Area: LONG-TERM MEMORY: Episodic

Schema-related predictions and their violations in episodic memory

Poster A92, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Darya Frank[1], Daniela Montaldi[1], Bianca Wittmann[2], Deborah Talmi[1]; [1]University of Manchester, [2]University of Giessen

The ability to predict future events from previous experience is an important advantage from an evolutionary viewpoint and stands at the basis of some theoretical accounts of the human brain (Friston, 2005; Bar, 2007). Given the importance of such predictions, of special interest is the fate of information that violates them. Such information stands out and attracts more attention, which encourages more elaborative encoding. However, it could also be unreliable in light of many previous experiences and thus discarded. Here we examine the fate of schema-congruent and incongruent information by using multi-element events with strong contextual settings to elicit predictions. Participants encoded pairwise associates in an interleaved manner across four blocks. Between blocks, these associates created events, comprising four elements out of which one was either congruent or incongruent with the context. We then employed an item-recognition test for each element followed by a cued-recall test for its pairwise associate. We found that incongruent elements were less remembered than congruent ones and served as worse cues than their congruent counterparts. Interestingly, the post-violation incongruent pair was better recalled than the congruent one, even though their semantic features were identical. Our results suggest items associated with a prediction error are not necessarily more accessible in episodic memory (Van Kesteren et al., 2012). The post-violation finding could be related to reduced interference from previous list items. To further elucidate these results, future work will explore different levels of predictions and the timescale of these effects.

Topic Area: LONG-TERM MEMORY: Episodic

Galectin-3 is a novel negative regulator of memory formation

Poster A93, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Hsiao-Yuan Lee[1,2], Yan-Chu Chen[2], Yun-Li Ma[1], Cheng-Hsiung Lin[1], Wei-Lun Hsu[1]; [1]Institute of Biomedical Sciences, Academia Sinica, Taipei, Taiwan 115, [2]Graduate Institute of Life Sciences, National Defense Medical Center, Taipei, Taiwan 114

Galectin-3 is a member of the galectin protein family and it is known to interact with other proteins through recognition of beta-galactoside conjugate on these proteins by its carbohydrate recognition domain. Galectin-3 was found to regulate cell proliferation and inhibit apoptosis. It also plays a pro-inflammatory role and promotes inflammatory responses. But its role in the brain was less studied. Our result showed that galectin-3 expression level is much higher in the hippocampus than in several other brain areas examined in rat. Thus, we studied the role of galectin-3 possibly involved in learning and memory function. Our results revealed that both contextual fear conditioning training and N-methyl-D-aspartate (NMDA) injection to CA1 area dramatically decreased galectin-3 expression in rat hippocampus. Overexpression of galectin-3 impaired fear memory, whereas fear retention and hippocampal long-term potentiation were enhanced in galectin-3 knockout mice. Further, we found that galectin-3 is associated with integrin-alpha3 in rat hippocampus and this association was reduced after fear conditioning training. Moreover, transfection of galectin-3 siRNA to rat CA1 area facilitated fear memory and increased the phosphorylation level of focal adhesion kinase (FAK), but these effects were blocked by co-transfection of the FAK phosphorylation mutant plasmid Flag-FAKY397F. These results together suggest that extracellular galectin-3 impairs fear memory formation through inhibition of integrin-mediated signaling.

Topic Area: LONG-TERM MEMORY: Other

Age Related Changes in Neural Noise in the Default Mode Network

Poster A94, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Nicole Dosamantes[1], Jorge Yanar[1], Lorri Kais[1], Hannah Walker[1], Mark Albert[1], Robert G Morrison[1]; [1]Loyola University Chicago

The Default Mode Network (DMN) describes a network of highly connected brain regions that are more active in the absence of task engagement. These regions, including medial prefrontal cortex, posterior cingulate, and areas in lateral parietal and temporal cortices show a high degree of functional connectivity when active. Activation and connectivity in these regions show declines with aging, particularly when neurodegeneration is present. Recently, Voytek et al. (2015) argued that increases in neural noise may be an important mechanism responsible for cognitive aging. They estimate neural noise by calculating the slope of the power spectral density (PSD) in semi-log space using a general linear model with a robust regression method, and find that the slope of the PSD gradually flattens with age in electrophysiological recordings made during the performance of a visual working memory task. In this study we aimed to investigate whether neural noise as measured through these techniques also underwent age-related increases during rest in the DMN. Specifically, we recorded resting-state scalp electroencephalography (rsEEG) from 36 young adults (24 to 52 YO, M=31) and 49 older adults (65 to 92 YO, M=80) and utilized source modeling as implemented in BESA to estimate EEG from these six regions of the DMN. We then calculated the PSD from artifact-free rsEEG segments and calculated the slope using RANSAC regression. Younger adults showed more negative PSD slopes throughout the 6 DMN regions, suggesting that older adults show evidence of more neural noise in areas associated with DMN during rest.

Topic Area: METHODS: Electrophysiology

Alpha-frequency transcranial alternating current stimulation (tACS) induces plastic increases in posterior-frontal network connectivity

Poster A95, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Kevin Clancy[1], Sarah Baisley[1], Nika Kartvelishvili[1], Mingzhou Ding[2], Wen Li[1]; [1]Florida State University, [2]University of Florida - Gainesville

Alpha oscillations (8-12 Hz) play a significant role in a variety of cognitive and sensory processes by mediating long-range network communications. Recent work attempts to modulate alpha oscillations using transcranial alternating current stimulation (tACS) at the alpha frequency. The long-term effects of alpha modulation, however, have not been established. We addressed this issue by administering high-density (HD) tACS (30 minutes at 1-2 mV; individual peak alpha frequency/PAF; midline parieto-occipital POz site) in healthy subjects (n= 13; with a sham-control group) over four consecutive days. We found that (1) alpha stimulation increased posterior alpha power immediately and 30 minutes post-stimulation on both Day 1 and Day 4, which was paralleled by the same pattern of increase in ipsilateral bottom-up causal connectivity (indexed by Granger Causality; GC; p's < .05), and (2) the magnitude of power change and the magnitude of GC change were significantly correlated (r =.60, p < .05). Furthermore, bottom-up GC showed a sustained augmentation from Day 1 to Day 4. No such effects were observed in the sham control group (p's > .16). These results suggest that alpha tACS can be used to affect long-term plastic changes in alpha power and alpha network communication. That local posterior modulation of alpha oscillations can alter posterior-frontal causal connectivity implicates a role of sensory processing and sensory input in influencing higher-order cognitive processes. The long-term plastic effects also provide support for alpha tACS as a viable treatment for psychiatric and neurological disorders that are characterized by impaired oscillatory activities.

Topic Area: METHODS: Electrophysiology

Novel characterization of an architecturally distinct sleep stage and its implications for recovery from the minimally conscious state

Poster A96, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Jackie L. Gottshall[1,2], Zoe M. Adams[1], Peter B. Forgacs[1,3,5], Tanya J. Nauvel[1,4], Nicholas D. Schiff[1,3,5]; [1]Feil Family Brain and Mind Research Institute, Weill Cornell Medicine, NY, [2]Neuroscience Program, Weill Cornell Graduate School of Medical Sciences, NY, [3]Department of Neurology, Weill Cornell Medicine, NY, [4]Computational Biology and Medicine Program, Weill Cornell Graduate School of Medical Sciences, NY, [5]The Rockefeller University, NY

Survival rates from severe brain injuries have increased in recent decades, producing a growing population of patients who avoid fatality yet remain in a chronic condition of ambiguous awareness, termed the minimally conscious state (MCS). Recently, presence of sleep architecture has been correlated with favorable prognosis in MCS, warranting further study of dynamic sleep processes as potential indicators of cognitive recovery. Here we define criteria for a novel sleep stage present in some MCS patients: >70% of the epoch consists of high voltage, low frequency activity (<2Hz) of which ≥50% displays an overriding mid-frequency (8-14Hz) component. Overnight video-EEG of four patients were scored using these criteria and analyzed for spectral content. In all patients, this novel stage occurred predominantly at the juxtaposition of stage 2 and slow wave sleep (SWS) and displayed a unique spectral profile. We posit that unstable transitioning from thalamus-driven stage 2 into deeper, cortically-driven sleep rhythms underlies this novel stage. Notably, in one patient this stage disappeared with concurrent improvements in subjective alertness following initiation of central thalamic deep brain stimulation (Adams et al., 2016). Based on our findings, we propose the presence of a distinct sleep stage during the MCS recovery process indicative of incomplete daytime activation and engagement of neocortical structures that then fail to drive the switch into cortically-driven SWS. This model predicts that: 1) if present, this stage is indicative of preliminary recovery of cortical activation linked to increased daytime arousal and behavioral engagement, and 2) should consistently yield to normal SWS.

Topic Area: METHODS: Electrophysiology

Age Related Changes in Neural Noise During Cognitive Control

Poster A97, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Jorge Yanar[1], Nicole Dosamantes[1], Lorri Kais[1], Hannah Walker[1], Mark Albert[1], Robert G Morrison[1]; [1]Loyola University Chicago

Executive functions include a cluster of abilities important for cognitive control. While they commonly decline with age, their preservation is believed to provide cognitive resilience in the face of neurodegenerative disease. The neurocognitive mechanism responsible for decline in cognitive control has not been conclusively identified. Recently, Voytek et al. (2015) argued that increases in neural noise may be an important mechanism responsible for cognitive aging. They estimate neural noise by calculating the slope of the power spectral density (PSD) in semi-log space using a general linear model with a robust regression method, and find that the slope of the PSD gradually flattens with age in electrophysiological recordings made during the performance of a visual working memory task. In this study, we aimed to investigate whether neural noise as measured through these techniques also underwent age-related increases during the performance of a Go-No Go task, a common measure of response inhibition. Specifically, we recorded scalp electroencephalography (EEG) from 35 young adults (24 to 44 YO, M=30, SD=5) and 30 older adults (66 to 99 YO, M=81, SD=6) while they performed a visual Go-No Go task. We then calculated each participant's PSD and estimated slope using RANSAC regression. Younger adults showed more negative PSD slopes in occipital, parietal, temporal, and central electrodes, with the highest correlations between slope and age being located in the occipital-parietal regions. Our results support the neural noise hypothesis and extend its findings to response inhibition on a larger sample of individuals with a broader age range.

Topic Area: METHODS: Electrophysiology

Cross-Frequency Coupling as a Biomarker of Human Cognitive Functions

Poster A98, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Maria Mikail[1], Reza Zomorrodi[2,3], Zafiris J. Daskalakis[2,3,4], Tarek K. Rajji[2,3,4]; [1]Royal College of Surgeons, Dublin, Ireland, [2]Temerty Centre for Therapeutic Brain Intervention, Centre for Addiction and Mental Health, Toronto, Canada, [3]Schizophrenia Division, Centre for Addiction and Mental Health, Toronto, Canada, [4]Department of Psychiatry, University of Toronto, Toronto, Canada

Cognitive process and memory function require transient and distributed interaction of neural networks. The most plausible proposed mechanism is cross-frequency coupling between neural oscillations. In this study, we systematically reviewed the current finding in cognitive function in PubMed database (2000-September 2016) for human species, and explored CFC strength from distribution of gamma- amplitude over theta-phase bins using Kullback-Leibler function. Healthy human brain in the resting state shows a significant coupling in the alpha-gamma range in dorsolateral prefrontal, anterior cingulate and parietal and occipital lobe. The strength of this coupling was increased in patients with epilepsy and autism spectrum disorder and significantly decreased in beta-gamma range in Parkinson's diseases. However, during cognitive process CFC mostly shifts to the lower frequency. In the memory process, delta/theta-gamma coupling was shown in fronto-parietal or parietal-occipital networks and impairments were reported in patients with schizophrenia and epilepsy. In visual and auditory perception tasks, delta-theta in visual cortex and theta-gamma coupling in medial frontal cortex were demonstrated, respectively. In the attention control process, theta-gamma coupling significantly increased in the frontal-posterior region, while an abnormal low strength in ADHD and high in epileptic patients has been reported. In our computational model, we illustrated the same coupling strength or abnormality might occur in different conditions, which might have diverse neurophysiological interpretation. Although method of calculation and interpretation of results still is a challenge, recent evidence indicates the importance of CFC mechanism during cognitive function, which might be considered as a marker to assess neurological and psychiatric diseases.

Topic Area: METHODS: Electrophysiology

A statistical method for analyzing and comparing spatiotemporal cortical activation patterns

Poster A99, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Patrick Krauss[1], Achim Schilling[1], Claus Metzner[1], Konstantin Tziridis[1], Holger Schulze[1]; [1]University of Erlangen

We present a new statistical method to analyze multichannel steady-state local field potentials (LFP) recorded within different sensory cortices of different rodent species. Our spatiotemporal cluster analysis (SCA) method enables statistical analyzing and comparing clusters of data points in n-dimensional space. To evaluate the analytical power of our SCA approach, we first tested the method using artificially generated data sets. Subsequently, we demonstrate that using this approach stimulus-specific spatiotemporal activity patterns can be detected and be significantly distinguished from each other during stimulation with long-lasting stimuli. In addition we extend the method to human electroencephalogram (EEG) data and exemplarily show that therewith different REM and non-REM sleep stages may be differentiated, demonstrating the universal applicability of our approach. Our method thereby may be used for the development of new read-out algorithms of brain activity and by that opens new perspectives for the development of brain-computer interfaces (BCI).

Topic Area: METHODS: Electrophysiology

A novel paradigm for rapid and simultaneous evaluation of auditory and visual pathways

Poster A100, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Andrew S. Kessler[1], Kristina C. Backer[1], Laurel A. Lawyer[1], Sharon Coffey-Corina[1], David P. Corina[1], Lee M. Miller[1]; [1]University of California, Davis

Electroencephalography (EEG) can provide objective assessments of auditory and visual sensory capabilities in children at risk for language and cognitive impairments. Existing EEG paradigms are often limited to measuring activity from one sensory domain at a time, may be time consuming, and may target only a subset of responses from that particular sensory domain (e.g., only auditory brainstem responses (ABR) or P1-N1 cortical auditory evoked potentials (CAEPs)). We have devised a passive EEG paradigm that provides a rapid and simultaneous assessment of early auditory and visual capabilities suitable for infants and children. Method. Subjects watch a centrally-presented silent cartoon flanked by a visual display of flickering rings at two eccentricities while an engineered auditory speech stimulus is presented (12 minutes). Visual stimuli are designed to elicit transient and steady-state visual evoked potentials. The use of high-contrast (black/ white) and isoluminant (red/green) visual displays differentially weight contributions of magnocellular and parvocellular visual pathways, while the multiplexed acoustic speech simultaneously assesses the ascending speech processing hierarchy. Results. We report EEG data from 25 healthy young adults, which validate the paradigm's ability to reliably elicit ABR, middle latency, late latency (P1-N1), and steady state auditory responses. We find significant differences in the spectral pattern of the visual steady state responses when comparing high-contrast and isoluminant visual conditions. The unique topographies of auditory and visual responses are highlighted. Conclusion. These data demonstrate a child-friendly EEG paradigm that assesses the integrity of early auditory and visual sensory systems and is sensitive to cross-modal interactions.

Topic Area: METHODS: Electrophysiology

Emerging EEG/ERP Methods: New Potential for Tobacco Science

Poster A101, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Mauricio Rangel-Gomez[1], Raul Cruz-Cano[1], Pamela Clark[1], Edward Bernat[2]; [1]School of Public Health, University of Maryland, College Park, [2]Department of Psychology, University of Maryland, College Park

EEG/ERP measures have proven useful for indexing differential effects of tobacco product characteristics, and emerging time-frequency (TF) signal processing approaches offer a number of advantages with the potential to further advance work in this area. TF approaches were applied to index changes in brain processing (N=31) during a common oddball task, before and after consuming smokeless products to satiation. Products were manipulated in a 2 (nicotine, no-nicotine) x 2 (flavor, unflavored) within-subjects design. TF decomposition allowed to determine activity in: delta (0-3 Hz), theta (4-7 Hz), alpha (8-12 Hz), and gamma (30-50 Hz). Delta activity, evidenced significant differences in visual processing areas for both flavor and nicotine, suggesting changes in visual attention and engagement in the task. Theta activity was significantly related to both flavor and nicotine. Theta activity was consistent with the N2 component, N2 is widely understood to index orienting and novelty processing with sources in the anterior cingulate cortex (ACC). Alpha activity was related to nicotine and not flavor, with decreases observed for nicotine relative to no-nicotine. Alpha has been shown to index inhibitory activity, such that when engagement in the increases, alpha decreases. Gamma activity was associated with flavor and not nicotine, although the pattern was more complex. Here early gamma activity (0-250 ms) evidenced an increase in amplitude, and late (500-1000 ms) decreases in amplitude, for flavor relative to unflavored.

Topic Area: METHODS: Electrophysiology

Distinct Neural Mechanisms for Correcting Increases and Decreases in Asynchrony During Sensorimotor Synchronization

Poster A102, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Kelly Jantzen[1], Rachel Walls[1], McKaila Leytze[1], Elisabeth Amir-Brownstein[1], Andrew Jaye[1], Kathleen Lucier[1], Sarah Martinez[1], McNeel Jantzen[1]; [1]Western Washington University

Sensorimotor coordination is mediated by distributed cortical systems for maintaining a tight coupling between action and the environment in the presence of internally and externally generated errors. Recent work provides clues that different cortical mechanisms may be employed when correcting for errors that increase tap-tone asynchrony compared to those that decrease it, that is for shortening and lengthening tap intervals. We tested this hypothesis directly using EEG and TMS in three separate experiments. In each experiment we evaluated error detection and correction by systematically introduced positive and negative phase shift perturbations that were either liminal (10%) or subliminal (3%, EEG experiment only). Three main EEG findings support our hypothesis. First, a theta band response indicative of error detection and top down control was observed in frontal-medial pre-SMA and anterior cingulate only for liminal positive perturbations. Second, we observed an increase in theta band coupling between SMA and contralateral motor cortex exclusively for positive perturbations suggesting a top down modulation of motor parameters required to lengthening tap intervals. Third, when compared to other conditions, liminal positive perturbations result in an increase in post movement beta rebound – a signature of inactivity – within contralateral primary motor cortex. This latter finding was supported by follow up TMS studies showing reduced excitability and increased short intracortical inhibition of motor cortex for positive perturbations. We propose that fronto-medial motor areas exert a top down inhibitory influence over primary motor cortex to effectively lengthen tap intervals in response to lengthening tap-tone asynchronies.

Topic Area: PERCEPTION & ACTION: Motor control

Motor evoked potentials reflect changes in rapid inhibitory control during serial ordering

Poster A103, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Lawrence P Behmer Jr.[1], Matthew J C Crump[1], K J Jantzen[2], Sarah Martinez[2], Rachel Walls[2], Elisabeth Amir-Brownstein[2], Andrew Jaye[2], Mckaila Leytze[2], Kathleen Lucier[2]; [1]Brooklyn College of CUNY, [2]Western Washington University

Theories of serial ordering assume all responses in a sequence are activated in parallel and held in a buffer for execution. An inhibition or timing process impedes responses in a graded fashion with earlier more active responses executed before more inhibited later responses. There is no direct evidence in humans that planned responses are inhibited as a function of serial order. The necessary evidence could be provided by a response activation “thermometer” measuring whether the current “temperature” or activation level is graded by position across all responses in the buffer. We used transcranial magnetic stimulation to probe the level of excitation for flexion of the right index finger (first dorsal interosius muscle mucle) during typing. Motor evoked potentials (MEPs) were recorded at the onset of typing 5-letter words and nonwords. A single letter typed by the right index finger varied across letter positions one to five. The amplitude of the MEP when the right index finger was used in letter positions one and two reflected the relatively active state of the FDI. MEP amplitude decreased monotonically with further increases in position. Interestingly we also found smaller MEPs when the right index finger was the first rather than second response, indicative of a rapid deactivation at the completion of a key press. This is the most direct human evidence to date corroborating inhibition/timing theories, showing that completed responses are rapidly deactivated and future responses are activated in a graded fashion as a function of serial position.

Topic Area: PERCEPTION & ACTION: Motor control

Cognitive interference modulates speech acoustics in a vowel-modified Stroop task

Poster A104, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Caroline Niziolek[1], Ian Quillen[1], Kimberly Lin[1], Sara Beach[2], Swathi Kiran[1]; [1]Boston University, [2]Harvard Medical School

How do cognitive processes influence speaking? The Stroop effect is a classic demonstration of the interference between two cognitive processes: reading and color naming. In the current study, we used a novel variant of the Stroop test to measure whether this interference influences the acoustic properties of speech. Seventeen healthy control participants named the color of words in three categories: 1) congruent words (e.g. “red” written in red), 2) color-incongruent words (e.g. “green” written in red), and 3) vowel-incongruent words with phonetic properties that partially matched their text color (e.g. “rid” written in red). We hypothesized that the cognitive effort needed to inhibit reading in this third condition—saying “red”, not “rid”—could affect the acoustics of the speech that was produced. For example, the correct spoken response (“red”) could more acoustically resemble the inhibited word “rid”; alternatively, the acoustics could be influenced in the opposite direction, resembling “rad”, which would serve to accentuate the acoustic contrast between the spoken and inhibited words. A classic Stroop effect was evident when comparing reaction times between congruent words and color-incongruent words. Interestingly, we found no significant difference in reaction times between congruent and vowel-incongruent trials, but preliminary acoustic analyses of the first formant frequency (F1) showed that some subjects systematically modulated their productions in the presence of incongruent vowels. These changes in acoustic properties can lend insight into how the brain integrates multiple pieces of information to produce speech.

Topic Area: PERCEPTION & ACTION: Motor control

Response Inhibition Deficits Are Associated with Disrupted Intrinsic Connectivity of the Motor Network after Pediatric Traumatic Brain Injury

Poster A105, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Jaclyn Stephens[1,2], Cindy Salorio[1,2], Mary Beth Nebel[1,2], Stewart Mostofsky[1,2], Stacy Suskauer[1,2]; [1]Kennedy Krieger Institute, [2]Johns Hopkins School of Medicine

Poor response inhibition is a hallmark of pediatric traumatic brain injury (TBI). We assessed response inhibition with commission error rates on Simple (minimized cognitive demands) and Motivation (monetary reward) Go/No-Go tasks, comparing 17 children with chronic (> one year) TBI and 14 matched, uninjured peers. We used resting state fMRI to examine whole-brain intrinsic connectivity of the motor network as derived from the averaged time course of bilateral primary motor cortex seeds. Between-group connectivity contrasts were completed (voxel-level threshold $p<0.001$, family wise error correction) to identify regions of interest (ROI) for brain-behavior correlations. Independent sample t-tests compared Go/No-Go performance and connectivity at the ROI-level. Pearson correlations examined relationships between intrinsic connectivity at the ROI-level and Go/No-Go performance. Children with TBI had poorer performance on Simple ($p = .02$) and Motivation tasks ($p = .03$). They also had reduced functional connectivity between the motor network and left caudate voxels ($p = .02$) in whole-brain contrasts, lower connectivity between the motor network and left caudate ROI ($p = .02$), and trending lower connectivity between the motor network and right caudate ROI ($p = .07$). In the TBI group, lower motor network to left caudate connectivity related to poorer Simple task performance ($p = .03$), whereas lower motor network to right caudate connectivity related to poorer Simple ($p = .01$) and Motivation ($p = .02$) task performance. No brain-behavior relationships existed among controls. These results are coherent with previous pediatric TBI literature and suggest that disrupted intrinsic connectivity may underlie response inhibition deficits.

Topic Area: PERCEPTION & ACTION: Motor control

Touchscreen-based speech production without vocal tract sensory feedback

Poster A106, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Megan Thompson[1], John Houde[2], Hardik Kothare[2], Srikantan Nagarajan[2]; [1]UC Berkeley-UC San Francisco Joint Graduate Group in Bioengineering, [2]UCSF Biomagnetic Imaging Laboratory

Sensory feedback plays a crucial role in speech production in both healthy individuals and in individuals with speech disorders. This study investigates speech production in the absence of vocal tract somatosensory feedback by training subjects to use a touchscreen-based speech production platform. Contact with the screen produces different vowels depending on the touch location, with every possible vowel within a wide formant range producible. As subjects performed the experiment, both accuracy (distance between the target and response) and precision (distance between each response to the same target) rapidly improved within 30 trials. Further, post-training, subjects were able to respond to novel targets with much greater accuracy than pre-training target responses, indicating that the training generalized to other speech sounds. When the map was subjected to a post-training 150Hz F2 shift, subjects shifted their response to certain targets to compensate, just as speakers compensate to formant alterations in speech. Stable, rapid increases in both precision and accuracy, generalization to novel targets, and adaptation to changes imply the development of an internal sensorimotor map, allowing subjects to predict the auditory consequences of each touch and to develop the stereotyped responses necessary to achieve the desired feedback. This provides evidence that healthy adults are capable of rapidly learning a new platform of speech production without vocal tract feedback that bears similarities to vocal speech.

Topic Area: PERCEPTION & ACTION: Motor control

A Causal Study of the Role of Motor Planning in Musical Beat Perception

Poster A107, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Jessica Ross[1], John Iversen[2], Ramesh Balasubramaniam[1]; [1]University of California, Merced, [2]University of California, San Diego

It has been suggested that the motor system plays an essential role in the perception of musical rhythms. The Action Simulation for Auditory Prediction (ASAP) hypothesis proposes that the dorsal auditory stream is involved in bidirectional interchange between beat-based prediction in motor planning regions and auditory perception via parietal cortex (Patel & Iversen, 2014). We used a transcranial magnetic stimulation protocol, continuous theta burst stimulation (cTBS), that is known to down-regulate cortical activity for up to 60 minutes following stimulation, to test for causal premotor contributions to musical beat perception. cTBS target areas included posterior parietal cortex (PPC), which is part of the dorsal auditory stream, and supplementary motor area (SMA). We hypothesized that down-regulating PPC would interfere with accurate beat perception by disrupting auditory-premotor connections, while not interfering with non-predictive timing abilities. We predicted that down-regulating SMA, which is not part of the dorsal auditory stream but implicated in internally generated movements, would also interfere with accurate beat perception. Our preliminary data (n=7) suggest that down-regulating PPC raises accurate beat perception detection thresholds by 33% compared with no change after sham stimulation. We found that other timing abilities (interval perception and isochrony detection) were not impacted by cTBS to PPC or SMA. These results support that the dorsal auditory stream may play an essential role in accurate rhythm perception, but not in non-predictive timing.

Topic Area: PERCEPTION & ACTION: Motor control

Sensorimotor adaptation to real-time formant shifts is influenced by the direction and magnitude of shift.

Poster A108, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Hardik Kothare[1], Vikram Ramanarayanan[2], Benjamin Parrell[3], Srikantan Nagarajan[1], John Houde[1]; [1]University of California, San Francisco, [2]Educational Testing Service R&D, [3]University of Delaware

Alteration in auditory feedback engenders a change in speech production. The speech motor control system learns to anticipate and compensate for consistent feedback alterations. This sensorimotor adaptation persists temporarily even after feedback returns to normal. Does the nature of sensorimotor adaptation depend on the size and direction of the feedback alteration? To investigate this, we employed real-time auditory feedback alteration to shift the frequency values of the first and second formants (F1 and F2) of participants' speech. The experiment comprised six cases; the shift was towards a different vowel in each case. In each case, participants produced 90 repetitions of the nonsense word 'bep'. A case started with a non-altered block of 10 trials, followed by a block of 50 trials with a constant alteration and then by a non-altered washout block of 30 trials. We find that adaptation depends on the magnitude and direction of the auditory error rather than giving equal weight to any possible error. In general, smaller shifts lead to a relatively larger adaptation. A vector resolution analysis of the response vectors reveals that both the component orthogonal to the shift axis and the component parallel to the shift axis influence the magnitude of adaptation. All shifts, except the one from /ɛ/ to /u/, elicit a response of a compensatory nature. These results suggest that the adaptive feedback response in speech is complex and specifically more sensitive to errors in a local neighbourhood around speech motor targets.

Topic Area: PERCEPTION & ACTION: Motor control

The effect of deep brain stimulation of the subthalamic nucleus in Parkinson's disease on perceptual decision-making as a function of task difficulty and speed-accuracy instructions

Poster A109, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Yu-Ting Huang[1], Saryah Alhejazi[1], Artem Bunchuk[1], Dilan Athauda[1,2], Marwan Hariz[1,2], Ludvic Zrinzo[2], Tom Foltynie[1,2], Patricia Limousin[1,2], Maarten Speekenbrink[1], Marjan Jahanshahi[1]; [1]University College London, [2]National Hospital for Neurology and Neurosurgery

It has been proposed that the subthalamic nucleus (STN) is involved in information integration and the regulation of decision thresholds, and that deep brain stimulation (DBS) of the STN would disrupt the normal function of the STN thereby inducing impulsive behaviours during decision making (Frank et al., 2007b; Bogacz et al., 2008; Cavanagh et al., 2011). The empirical evidence have demonstrated inconsistent results of the effect of STN DBS on controlling speed and accuracy thresholds during perceptual decision making processes (Green et al., 2013; Pote et al., 2016). The aim of the present study is to investigate the effect of STN DBS in Parkinson's disease (PD) on 1) the adjustment of decision thresholds under speed and accuracy instructions, and 2) when dealing with decision conflict induced by different levels of coherence/task difficulty. Ten PD patients treated with bilateral STN DBS and twelve age-matched participants were recruited for the study. Reaction times (RTs) and error rates were measured in a motion discrimination task, the fast diffusion model was used to further analyse the behavioural data. The results showed that when under accuracy instructions, PD patients ON stimulation had faster mean RTs than OFF stimulation but there was no significant difference between PD patients ON and OFF stimulation on error rates. Parameters derived from the diffusion model showed that PD patients ON stimulation had higher decision thresholds and higher drift rate than OFF stimulation. The results thus contradict the hypothesis that STN DBS would lower decision thresholds and induce impulsive decisions.

Topic Area: PERCEPTION & ACTION: Motor control

Have a little faith in … your predictions: The development of confidence with proficiency in a time-estimation task - insights from feedback-related brain potentials

Poster A110, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Romy Frömer[1], Werner Sommer[1], Birgit Stürmer[2], Nick Yeung[3]; [1]Humboldt-Universität zu Berlin, [2]International Psychoanalytic University, [3]University of Oxford

Learning improves both, performance and the ability to predict the outcome of a given action. Feedback is crucial for the development of the internal models underlying these functions. As the nervous system is noisy, inevitably, errors in response production occur that can be detected based on predictions of the forward model. With learning, confidence in these predictions increases and should affect how feedback is processed. We propose that differences in confidence in the forward model's prediction underlie commonly observed dissociations of confidence and performance, e.g. as a function of personality differences along the neuroticism continuum. In a time estimation task with continuous performance feedback, we distinguished standard reward prediction errors (RPE), indexing outcome valence with regard to the goal and valence-free output prediction errors (OPE), indicating mismatch between prediction of the forward model and actual performance. As we expected, confidence increased with learning and differentiated increasingly well between accurate and inaccurate predictions. Model mismatch, indexed by OPE, and confidence jointly enhanced P3a amplitude to feedback. Expected individual differences were observed in confidence development with regard to performance, and outcome evaluation indexed by the feedback-related negativity (FRN). Low-neuroticism individuals showed larger confidence gains with increasing proficiency, and larger confidence and OPE effects on FRN in addition to RPE. This indicates more cognitive processing of feedback in low-neuroticism individuals, compared to affective processing in high neuroticism individuals. We conclude that confidence affects model evaluation and may enhance feedback salience, reflected in FRN amplitude in some individuals.

Topic Area: PERCEPTION & ACTION: Motor control

Neural correlates of aesthetic ratings of calligraphic characters and scenery photos in experts and novices of Chinese calligraphy.

Poster A111, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Denise H. Wu[1], Makayla S. Chen[1], Teresa K. Pegors[2], Daisy L. Hung[1,3], Ovid J.-L. Tzeng[3,4]; [1]National Central University, Taiwan, [2]Azusa Pacific University, USA, [3]Taipei Medical University, Taiwan, [4]National Chiao Tung University, Taiwan

Human's ability to appreciate beauty might have evolutionary value. Previous research showed that ratings of attractiveness in faces and places are associated with activation in brain regions supporting the specific processing of these stimulus categories as well as in the common reward system in the ventromedial prefrontal cortex (vmPFC). To explore the neural underpinnings of aesthetic processing of cultural artifacts rather than natural kinds, calligraphic Chinese characters with different degrees of beauty were employed. Experts and novices of Chinese calligraphy made aesthetic judgments on calligraphic characters and scenery photos while their brains were scanned simultaneously by fMRI. It was found that the activations in the left ventral occipital-temporal cortex (aka VWFA) were associated with the processing of and the perceived beauty in words. Interestingly, the association seemed to be stronger in novices than in experts of Chinese calligraphy. On the other hand, the activations in the parahippocampal place area (PPA) and in the middle occipital place area were associated with the processing of and the perceived beauty in scenes. In comparison, the association between the activations in the vmPFC and the perceived beauty either in words or in scenes was less robust. The present findings indicate that beauty is one fundamental characteristic of both cultural and natural kinds that is encoded in the brain, and support previous literature suggesting that encoding of beauty does not just take place within a common reward network, but can also be found in visual cortices associated with that category.

Topic Area: PERCEPTION & ACTION: Vision

On events and features: An ERP study on sequence effects in a choice/nogo Simon task

Poster A112, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Edmund Wascher[1], Katharina Hoppe[1]; [1]IfADo - Leibniz Research Centre for Working Environment and Human Factors

Spatial S-R correspondence affects performance even if the location of a stimulus is not task relevant (Simon effect: responses are faster when stimulus location and response location corresponds). The base explanation for this phenomenon is the automatic activation of a spatial code for the irrelevant stimulus location that interferes with the selection of the required response. This activation mechanism may be conditionally modified. In order to control for irrelevant information, after non-corresponding trials automatic response activation may be inhibited. Thus the Simon effect has been found to be eliminated. This finding, however, may be also explained on the level of feature integration. In a Simon task participants had to perform a left/right decision based on letter identity, but only when the letter was surrounded by a particular shape. Letters surrounded by another shape were nogo trials. EEG was recorded from 64 electrodes. Both the repetition of a letter (also after nogo trials) and the repetition of a response led to faster responses. Responses were in particular fast when all features were repeated. The pattern observed is inconsistent with both before mentioned theories. They indicate that priming due to feature repetition may explain most of the effects. This notion can be supported by an increase of N2pc amplitude with location repetition and a decrease of P3 amplitude with response repetitions. Thus, the causes for the adaptation of the Simon effect due to the correspondence in the previous trial may be more trivial than reported so far.

Topic Area: PERCEPTION & ACTION: Vision

Atypical laterality in visual sensory activation and interhemispheric transfer in Autism Spectrum Disorders

Poster A113, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Yukari Takarae[1], Won Suk Song[1], Clifford Saron[2]; [1]Center for Autism and Developmental Disabilities, UT Southwestern, [2]Center for Mind and Brain and M.I.N.D. Institute, UC Davis

Cerebral lateralization is a fundamental characteristic of human brain organization, and it is believed that such lateralization ensures the most efficient transcortical integration of information. Autism Spectrum Disorders (ASD) is known for 1) disturbances in normal lateralization and 2) reduced effective connectivity. While the former has been demonstrated as reduced lateralization in language and motor function, the current study adds evidence for abnormal lateral organization in visual processes. We performed 124 channel EEG recordings to examine laterality of sensory function during visuomotor tasks. The participants were 12 to 18 year old children; 18 with ASD and 17 with typical development (TD). Participants performed, in alternating blocks, an antisaccade (ANTI) task that required looking away from a suddenly appearing lateral target, or a prosaccade (PRO) task that required looking toward the target. Occipitoparietal activation was first observed on the contralateral hemisphere, starting approximately at 100 ms after target onset. This was followed by interhemispheric transfer of activation to the ipsilateral side, resembling patterns observed for lateral P1 responses in studies of TD adults. While TD participants showed similar amplitude of activation with both target locations, ASD participants showed greater initial contralateral activation to the left than to the right lateral target. Furthermore, amplitude of the subsequent ipsilateral activation was much reduced in ASD participants, but this was specific to the left target condition. These findings suggest deviations from the typical functional organization in visual processes in ASD, including possible left hemisphere dysfunction and additional connectivity disturbances via the corpus callosum.

Topic Area: PERCEPTION & ACTION: Vision

Aesthetic appreciation of cultural artifacts engages additional processes beyond a core domain-general system

Poster A114, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Edward Vessel[1], Ilkay Isik[1], Amy Belfi[2], Jonathan Stahl[3], G. Gabrielle Starr[2]; [1]Max Planck Institute for Empirical Aesthetics, Frankfurt am Main, Germany, [2]New York University, New York, NY, [3]Ohio State University, Columbus, OH

Aesthetic appreciation represents a fundamental mode of human interaction with the visual world, yet the processes that support such experiences are poorly understood. Imaging studies with artwork suggest that there is both an “early” process that links ventral visual pathway representations with liking and a later, prefrontal process that is only engaged by aesthetically moving stimuli and may recruit portions of the default-mode network (DMN). Given that individuals can be aesthetically engaged by a diverse array of visual objects (paintings, mountain vistas, etc.), we sought to test whether aesthetic appreciation of widely different visual domains relies on the same underlying processes. Behaviorally, we find that the degree of shared versus individual aesthetic preference differs systematically across domains. Preferences for faces and landscapes contained a high proportion of shared taste, while preferences for architecture and artworks, both artifacts of human culture, reflected strong individual differences. Using fMRI, we measured brain activity as 16 observers made aesthetic judgments about architecture, natural landscapes or artwork. Using multivariate pattern classification, we found a signature of “domain-general” information about aesthetic appreciation in a portion of the DMN in the medial prefrontal cortex (MPFC). A “searchlight” analysis revealed additional prefrontal regions whose activity only reflected information about the aesthetic appeal of either artwork or architecture. These results suggest that visual aesthetic engagement recruits a core set of domain-general processes, but that aesthetic evaluations of cultural artifacts rely more heavily on individual aesthetic sensibilities than do evaluations of landscape, and also engage additional processes in prefrontal cortex.

Topic Area: PERCEPTION & ACTION: Vision

Interplay between early visual sensory processing impairments and glutathione dysregulation in early-phase psychosis.

Poster A115, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Chrysa Retsa[1], Jean-François Knebel[1,2], Carina Ferrari[3], Raoul Jenni[3], Margot Fournier[3], Michel Cuenod[3], Stephanie Clarke[1], Philippe Conus[4], Kim Q. Do[3], Micah M. Murray[1,2,5,6]; [1]The Laboratory for Investigative Neurophysiology (The LINE), Lausanne University Hospital (CHUV), Lausanne, Switzerland, [2]The EEG Brain Mapping Core, Center for Biomedical Imaging (CIBM), Ecole Polytechnique Fédérale de Lausanne, Switzerland, [3]Center for Psychiatric Neuroscience, Department of Psychiatry, Lausanne University Hospital (CHUV), Lausanne, Switzerland, [4]Service of General Psychiatry, Department of Psychiatry, Lausanne University Hospital (CHUV), Lausanne, Switzerland, [5]Department of Hearing and Speech Sciences, Vanderbilt University, Nashville, TN, USA, [6]Department of Hearing and Speech Sciences, Vanderbilt University, Nashville, TN, USA

Early sensory impairments are part of the core dysfunctions in schizophrenia. Deficits in the P1 component of the visual evoked potential (VEP) have been demonstrated in chronic patients and first-degree relatives. However, the subsequent N1 component is reported to be unaffected in chronic patients. In the auditory modality, impaired

mismatch negativity (MMN) has been observed and may reflect NMDA hypo-function. Previous work has shown that add-on administration of the glutathione precursor N-acetyl-cysteine (NAC) improves the MMN and clinical symptoms in chronic schizophrenia patients. To date, it remains unknown whether NAC would also improve visual impairments and if its efficacy would extend to early-phase psychosis. We addressed these issues with a randomized, double-blind study of a sample (N=18) of early psychosis patients and 20 healthy controls from whom ERPs were recorded during a visual (Illusory contour) task. Patients were recorded twice: once prior to NAC/placebo administration and once after six months of treatment. Blood measures were likewise assessed of glutathione levels and key enzymes of glutathione metabolism. Analyses showed a P1 and an N1 reduction in the early psychosis patients compared to the healthy controls. Source estimation revealed reduced activity in patients in both frontal and occipital sources. Critically, NAC administration was found to improve the ERP deficits in the visual domain. In addition, further analyses suggest a linkage between the levels of the glutathione redox enzymes and the integrity of ERPs. Overall, these data indicate that NAC improves early sensory processing in this small sample of early psychosis patients.

Topic Area: PERCEPTION & ACTION: Vision

Behavioral Oscillations in Perceptual Organization

Poster A116, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Gideon Caplovitz[1], Gennady Erlikhman[1]; [1]Department of Psychology, University of Nevada Reno

Oscillatory patterns of brain activity at different frequencies are known to interact with perceptual processes. Following several recent behavioral studies in the domain of attention, we demonstrate that rhythmic patterns also exist in perceptual behaviors without explicit stimulus entrainment. Oscillations in reaction time and accuracy at 7Hz (theta-band) and 10-12Hz (alpha-band) have been previously linked to sensory and attentional processes respectively. However, virtually all studies have used an attentional cuing paradigm and so the exact relationship between oscillations in behavior and cognitive processes remains unclear. In a series of experiments, subjects performed a fat/thin illusory contour discrimination task which was followed by two successive masks. The interval between the two masks ranged from 16.7 ms – 533.3 ms in steps of 16.7 ms. Discrimination accuracy fluctuated by as much as 15% as a function of the inter-mask interval. Oscillations were observed at frequencies of 4-7 Hz, 9-12 Hz, and 20-24 Hz. These effects persisted regardless of whether the 2nd of the two masks were local (disrupting local perceptual processes) or global (disrupting illusory contour perception processes), suggesting that the oscillations did not reflect feedforward completion or feedback masking processes. The effects also persisted when a 2-interval forced-choice paradigm was used, indicating that the fluctuations in behavior were due to variations in the perception of the stimulus and not in response choice. Despite not having an explicit attentional cue, we hypothesize that the observed behavioral fluctuations reflect the rhythmic nature of perceptual sampling.

Topic Area: PERCEPTION & ACTION: Vision

Magnocellular-parvocellular pathway reciprocity in visual processing and the trait-like set point modulated by anxiety

Poster A117, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Yuqi You[1], Wen Li[1]; [1]Florida State University

Human visual processing is carried out by separate magnocellular (M-) and parvocellular (P-) channels showing distinct sensitivities to distinct physical properties of incoming visual stimuli. The psychological/functional relevance and interrelationship of M/P pathways remain unclear. Combining visual event-related potentials (VEPs) with Gabor patches selectively activating M- vs. P-pathways (N=47), we identified a positive-going P1 and a negative-going C2 at around 100 ms in response to M- versus P-selective stimuli. There was a highly significant anticorrelation between the absolute amplitudes of P1 and C2, indicating a reciprocal relationship between the strengths of M and P pathways. Furthermore, this reciprocity was observed across three time points (r's<-.71, p's<.001), two weeks apart, suggesting a trait-like neural set point that relates to individual differences in low-level visual processing. Moreover, this M-P reciprocity was modulated by trait anxiety measured by the Behavioral Inhibition Scale (BIS) at three time points: BIS scores correlated negatively with P1 amplitude (r's<-.36, p's<=.026), positively with C2 absolute amplitude (r's>.37, p's<=.01), and negatively with a M-P preference index (calculated as P1-C2; r's>-.27, p's<.068). In a follow-up experiment (N=49), we replicated this relationship between trait anxiety and M-P preference (r=-.35, p=.014) using low-spatial-frequency/low-contrast and high-spatial-frequency/high-contrast achromatic gratings as M- and P-selective stimuli. These findings together suggest that given threat can be differentially encoded via M/P pathways, the M-P set point may have evolved for maximal threat detection. Our data further indicate a potential neural marker for trait anxiety, characterized by a heightened P-over-M preference that promotes visual hypersensitivity to threat.

Topic Area: PERCEPTION & ACTION: Vision

Dissociating neural activity related to subjective visibility and objective performance with simultaneous EEG/fMRI

Poster A118, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Jason Samaha[1], Joshua LaRocque[1], Olivia Gosseries[1], Giulio Tononi[1], Bradley Postle[1]; [1]University of Wisconsin-Madison

An important question in cognitive neuroscience is whether the neural processes supporting stimulus discrimination are distinct from those underlying conscious stimulus awareness. To better understand the spatial and temporal dynamics of neural activity reflecting both how accurately a stimulus is processed and whether it is subjectively experienced, we recording signals from EEG simultaneously with fMRI while subjects performed a visual discrimination task. Backward-masked images of faces and houses were presented at each subject's threshold for subjective awareness. On each trial, response accuracy (two-alternative forced choice) and subjective visibility (sliding scale representing maximum to minimum visibility) was recorded. Analysis of the EEG data reveal that pre-stimulus oscillatory activity in the alpha-band, measured over posterior sensors, distinguishes between targets subsequently rated as high or low in visibility, but was not predictive of target discrimination accuracy. Further, high vs. low visibility could be successfully decoded from stimulus-evoked BOLD responses in visual and frontal cortices, but stimulus-specific patterns of activity that varied with awareness were present only in inferior temporal cortex. These data suggest that neural processes related to subjective visual awareness can be dissociated from processes driving objective discrimination accuracy.

Topic Area: PERCEPTION & ACTION: Vision

Individualized alpha-band rTMS to the inferior frontal junction selectively enhances visual search performance

Poster A119, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Bruce Luber[1], Greg Appelbaum[2], Lysianne Beynel[2], Sara H Lisanby[1]; [1]National Institute of Mental Health, [2]Duke University

The inferior frontal junction (IFJ) has been implicated in top-down processing during visual search in both human and non-human primate studies. Here we attempt to provide causal evidence for that role by applying repetitive transcranial magnetic stimulation (rTMS) to IFJ during a difficult visual search task using simulated aerial reconnaissance photos. In a within subjects design, subjects were given active or sham rTMS at either 1 Hz or at their individual peak alpha frequency (IAF, mean 11.5 Hz), applied either to right IFJ or right inferior parietal cortex (IPC: an area also implicated in visual search in prior TMS studies). IFJ or IPC were defined individually by selecting the voxel showing the maximal fMRI activation during the visual search task. The TMS coil placement was guided with neuronavigation using the subject's fMRI image overlaid on their structural MRI. In a group of thirteen healthy young adults, active IAF stimulation to IFJ resulted in significant speeding of reaction time (RT) compared to sham. There were no significant changes in accuracy, or in RT at IPC or with 1 Hz rTMS. The site- and frequency-specific enhancement of performance with excitatory rTMS applied immediately prior to task trials provides direct evidence for the involvement of IFJ in guiding visual search, and is a first step in using rTMS to optimize visual search performance in humans.

Topic Area: PERCEPTION & ACTION: Vision

Evaluation of the N1 as an Electrophysiological Marker of Surround Suppression in Healthy Adults

Poster A120, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Lisa Levinson[1], Lauren C. Shuffrey[1,2,3,4], Heather L Green[1], Dayna Moya Sepulveda[1], Grace Pak[1], Alexis Becerra[1], Karen Froud[1]; [1]Teachers College, Columbia University, [2]Columbia University Medical Center, [3]New York State Psychiatric Institute, [4]Center for Autism and the Developing Brain

Surround suppression is thought to reflect inhibitory neuronal mechanisms in the visual cortex. Behavioral direction discrimination performance in healthy adults is poor when presenting large, high-contrast moving visual stimuli, thought to reflect surround suppression of motion-selective neurons outside a neuron's classical receptive field. This suppression of activity is suspected to be driven by the brain's primary inhibitory neurotransmitter, γ-Aminobutyric acid (GABA) (Tadin et al., 2003; Aaen-Stockdale et al., 2009). To our knowledge, no prior studies have investigated an event-related potential (ERP) marker of surround suppression. We investigated surround suppression in 10 healthy adults 21–33 years of age, using a visual motion-processing task during electroencephalography (EEG) recording to derive the N1 ERP. Stimuli were generated using Psykinematix. They consisted of four, 1 cycle/degree vertical sine wave gratings featuring a center presentation Gaussian envelope drifting either right or left at a speed of 2°/sec. Stimulus size was either 5.0° (large) or 0.7° (small), and stimulus contrast was either 92% (bright) or 2.8% (faint). Participants manifested delayed processing, thought to reflect surround suppression, of large, high-contrast stimuli, indexed by N1 ERP latency ($p=.013$). Because surround suppression is contrast dependent, processing differences between stimuli sizes having low contrast were neither expected nor observed. The experimental paradigm required no participant response, making it readily implementable for various clinical populations in which surround suppression is potentially compromised due to an imbalance between excitatory and inhibitory neurotransmission.

Topic Area: PERCEPTION & ACTION: Vision

Tracking the Time Course of Visual Prediction: Graded Effects of Preactivation Shift Earlier Given Extended Preview Time

Poster A121, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Cybelle Smith[1], Kara D. Federmeier[1]; [1]University of Illinois, Urbana-Champaign

When and how is the brain able to make use of newly-learned information about objects and their associated contexts? We recorded EEG as 48 participants learned paired associations between visual scenes and novel objects from novel object categories. At test, participants indicated whether an object matched a previously viewed scene. Critically, at test, the scene was previewed for either 200ms (N=24) or 2500ms (N=24), prior to object onset. ERPs time-locked to object onset at test displayed a graded pattern of facilitation contingent on how closely the test object matched that presented with the scene at study. Critically, the time-course of this sensitivity varied with the amount of preview time, such that fine-grained distinctions based on object similarity and category structure were observed earlier in the long preview condition. With long previews, graded facilitations emerged during the N300 time window, as early as 200-300ms, suggesting that participants were able to anticipate structural features of the objects and object categories. Instead, when participants had little time to develop predictions, fine-grained distinctions emerged only later, beginning at ~300-400 ms. In addition, a later positivity (400-600ms) exhibited a similar graded pattern of effects, and may reflect integrative processing used to assess the degree of match between the presented object and the scene. With short previews, this later positivity was numerically larger and exhibited a larger contrast between matching and mismatching objects. Our findings suggest that the availability of predictive information systematically affects how processing unfolds when an object is encountered in a given context.

Topic Area: LONG-TERM MEMORY: Priming

Vocabulary learning benefits from REM after slow-wave sleep

Poster A122, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Laura Batterink[1], Carmen Westerberg[2], Ken Paller[1]; [1]Northwestern University, [2]Texas State University

Memory reactivation during slow-wave sleep (SWS) influences the consolidation of recently acquired knowledge. This reactivation occurs spontaneously during sleep but can also be triggered by presenting learning-related cues, a technique known as targeted memory reactivation (TMR). Here we examined whether TMR can improve vocabulary learning. Participants learned the meanings of 60 novel words. Auditory cues for half the words were subsequently presented during SWS in an afternoon nap. Memory performance for cued versus uncued words did not differ at the group level but was systematically influenced by REM sleep duration. Participants who obtained relatively greater amounts of REM showed a significant benefit for cued relative to uncued words, whereas participants who obtained little or no REM demonstrated a significant effect in the opposite direction. We propose that REM after SWS may be critical for the consolidation of highly integrative memories, such as new vocabulary. Reactivation during SWS may allow newly encoded memories to be associated with other information, but that can include disruptive linkages with pre-existing memories. Subsequent REM sleep may be particularly beneficial for integrating new memories into appropriate pre-existing memory networks. These findings support the general proposition that memory storage benefits optimally from a cyclic succession of SWS and REM.

Topic Area: LONG-TERM MEMORY: Semantic

Becoming a Martian archeologist: Motor interference affects conceptual judgments of learned vs. unlearned tools

Poster A123, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Heath Matheson[1], Sharon L. Thompson-Schill[1]; [1]Department of Psychology, University of Pennsylvania

Theories of embodied cognition propose that we recognize tools in part by reactivating sensorimotor representations of tool use. If motor representations play a causal role in tool recognition then performing a concurrent motor task should differentially modulate recognition of experienced vs. non-experienced tools. We sought to test the hypothesis that motor interference modulates conceptual processing of learned vs. non-learned objects by directly manipulating the motor experience of participants. To do so, we trained one group to use a set of novel, 3-D printed tools under the pretense that they were preparing for an archeological expedition to Mars; we trained a second group to report declarative information about how the tools are stored. With this design, familiarity and visual attention to different object parts was similar for both groups, though their qualitative interactions differed. After learning, participants made familiarity judgments of auditorily presented tool names while performing a concurrent motor task or simply sitting at rest. A reliable albeit modest interaction suggests that a concurrent motor task modulates familiarity judgments differently for the two groups, especially for unfamiliar objects. These results show that manipulation experience differentially influences conceptual processing of familiar vs. unfamiliar objects, suggesting that motor representations contribute to recognizing tools.

Topic Area: LONG-TERM MEMORY: Semantic

Neural Correlates for Trait Memory Differences

Poster A124, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Marc N Coutanche[1], Griffin Koch[1]; [1]University of Pittsburgh

Humans draw on an array of neural systems in the course of learning (and later remembering) the broad range of information encountered every day. Although healthy humans all have access to the same sets of brain systems, there is evidence that people differ in the extent to which they draw on one type of memory versus another. Some individuals tend to emphasize the factual components of past events (semantic), while others are more biased to forming memories that are rich in spatiotemporal and contextual features (episodic). The current study investigated the neural basis for trait differences in the relative use of semantic, episodic and spatial memory

systems, across individuals. We scanned the brains of 20 participants using magnetic resonance imaging (MRI), and related the volume of key brain regions and systems to scores on a survey of autobiographical memory, which quantifies self-reported episodic, semantic, and spatial memory usage. We have found that brain regions associated with different memory systems differ in relative volume across individuals in ways that systematically track individual variation in trait memory biases. Our findings include the result that individuals with stronger semantic memory characteristics have a larger percentage of cortical gray matter occupied by the temporal poles and right angular gyrus. These anatomical findings contribute additional evidence to identifying the anterior temporal lobes and angular gyrus as "semantic hubs". More generally, this study provides evidence that anatomical brain differences have a relationship with an individual's memory characteristics.

Topic Area: LONG-TERM MEMORY: Semantic

Influence of confirmed and violated expectations on recognition confidence in a semantic retrieval task

Poster A125, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Alexandra M. Gaynor[1], Elizabeth F. Chua[1,2]; [1]The Graduate Center, The City University of New York, [2]Brooklyn College, The City University of New York

When making confidence judgments about the accuracy of one's own memory, individuals rely on both mnemonic cues during retrieval and also on information-based cues, such as beliefs about competence or test difficulty (Koriat et al., 2008). Individuals have poorer performance and lower confidence in their responses when expectations about memory are violated during recognition tests (Jaeger, Cox & Dobbins, 2012). Additionally, invalid cues in episodic memory tasks have been associated with increased activation in prefrontal and parietal regions (O'Connor, Han & Dobbins, 2010). In an fMRI study, we used invalid and valid cues about question difficulty during a general knowledge task to determine how prefrontal and parietal activity is modulated by external cues during semantic retrieval. Each trial began with the presentation of a cue about the difficulty of the upcoming question ('Hard', 'Easy', or no cue), which remained onscreen during presentation of the general knowledge question with four possible answer choices. Each question was followed by a confidence judgment in which subjects rated their confidence in having chosen the correct answer. Cues were valid 50% of the time. Preliminary whole brain analyses showed greater dorsomedial prefrontal (dmPFC) activity during invalid cueing as compared to valid cueing during the confidence trial. These findings are consistent with past research implicating the dmPFC in a frontoparietal network that shows greater activity during invalid as compared to valid cueing, and may reflect conflict monitoring and cognitive control necessary to respond when external cues violate an individual's expectations.

Topic Area: LONG-TERM MEMORY: Semantic

Using ERPs to Dissociate the Neurocognitive Processes Underlying Knowledge Extension through Memory Integration in Adults

Poster A126, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Nicole L. Varga[1], Patricia J. Bauer[1]; [1]Emory University

To build a general knowledge base, it is imperative that individuals acquire, integrate, and further extend knowledge across experiences. For instance, in one episode an individual may learn that George Washington was the first president. In a separate episode s/he may then learn that Washington was the commander of the Continental Army. Integration of the information in memory may then support self-derivation of the new knowledge that the leader of the Continental Army was also the first president. Despite a considerable amount of fMRI research aimed at further elucidating the neuroanatomical regions supporting this ability, a consensus has yet to be reached with regards to the precise neurocognitive processes involved. In the present research, we capitalized on the high temporal resolution of event-related potentials (ERPs) to isolate the distinct processes associated with successful integration and further extension of new factual knowledge. Adults read novel, related stem facts and were tested for self-derivation of novel integration facts while ERPs were recorded. Consistent with current theoretical models, three temporally-staged processes were implicated during integration of a second, related fact: (1) detection of a deviation between newly and previously learned information, (2) interpretation of the mismatch, and (3) binding of the relation in memory. During the test for self-derivation, a single ERP was elicited, which presumably reflected recombination of previously integrated knowledge. Together, the present research provides an understanding of the time-course of neural processing associated with the formation of a knowledge base, as well as insight into the cognitive functions involved.

Topic Area: LONG-TERM MEMORY: Semantic

Abstract representations of object directed action in the left inferior parietal lobule

Poster A127, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Quanjing Chen[1], Frank E. Garcea[1], Robert A. Jacobs[1], Bradford Z. Mahon[1]; [1]University of Rochester

The ability to identify, grasp and use objects correctly according to their function requires the integration of distinct types of object knowledge, such as the goal or purpose of use of an object together with how an object is physically manipulated to accomplish that goal. Prior neuroimaging and neuropsychological research has shown that the left inferior parietal lobule is a critical substrate for representing object manipulation knowledge. In the present functional MRI study we used multivoxel

pattern analyses to test whether action information can be decoded from the inferior parietal lobule independent of the task (identification, overt pantomime) and at a level that abstracts away from specific objects. Participants pantomimed the use of objects, cued by printed words, or identified pictures of objects. Classifiers were trained and tested in a cross-item manner, such that decoding performance abstracted away from the object stimuli used for training. We found that action representations could be decoded from the left inferior parietal lobule across both object pantomiming and identification. By contrast, medial aspects of the ventral surface of the left temporal lobe represented object function across both tasks. These results suggest compulsory access to abstract action information in the inferior parietal lobule.

Topic Area: LONG-TERM MEMORY: Semantic

Memantine's Effects on the Reconsolidation of Long-term Methamphetamine Associated Memories

Poster A128, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Michael Hanna[1], Paige Braden[1], Brittanie Clarke[1], Hunter Goehring[1]; [1]Vanguard University

Relapse rates for those struggling with drug addictions are relatively high due to strong craving induced by exposure to cues that have been previously associated with drug administration. Drug associated memories are formed through the process of consolidation, the conversion of memories from a fragile state to a stable state. The reconsolidation hypothesis claims that when a stable, long-term memory is reactivated, it undergoes consolidation again in which the memory is in an unstable form. It has been shown that consolidation requires the activation of the NMDA glutamate receptor to initiate a cascade of cellular processes that leads to active synapses. In the current study, we aim to examine whether the NMDA receptor plays a role in the reconsolidation of long-term drug-associated memories. To address this question, we injected rats with the memantine, an NMDA receptor antagonist, in a conditioned place preference paradigm. Multiple injections of memantine immediately after reactivation of drug-paired memories attenuated preference for the drug-associated compartment. Our data also showed that the attenuating effects of memantine on drug-associated memories lasted long-term. Finally, we also show that the time frame for reconsolidation interference with memantine is between 0 to 6 hours. Our data suggest that the reconsolidation of drug-associated memories are dependent on the NMDA receptor, with implications for a potential novel pharmaceutical treatment for drug addiction.

Topic Area: LONG-TERM MEMORY: Semantic

The concreteness effect from memory illusions' perspective: The HA-DIM Effect

Poster A129, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Alejandro Marin-Gutierrez[1], Emiliano Diez Villoria[2], Angel Fernandez Ramos[2]; [1]Universidad de La Sabana, [2]Universidad de Salamanca- INICO

For quite often, researches have observed that concrete nouns are processed faster and more accurately than abstract nouns in a variety of cognitive tasks. This effect has been known as the Concreteness Effect, and its explanation has led to the assumption that there might be differences in the representation of concrete and abstract concepts in our conceptual system. Although the nature of these differences is still matter of controversy, some researchers have proposed that concrete and abstract concepts are organized according to qualitatively different organizational principles, where the organization of concrete concepts follows a semantic similarity principle whereas association with other concepts is what primarily organizes abstract concepts' representations. In order to test these assumptions, we have used the DRM paradigm, where association seems to play a fundamental role in the production of false memories. Thus, our main goal was to test the impact of association in creating concrete and abstract false memories, both behaviorally and also using ERPs. In two experiments, participants studied lists of words highly or weakly associated to a critical word (also known as critical lure) that was either abstract or concrete and, subsequently, participants took a recognition test. Results showed that false recognition rates were higher for abstract lures that were highly associated to their corresponding lists. ERPs replicated the behavioral data and showed an early N400 interaction effect that mirrored the behavioral results. This High Abstract Difference Illusory Memory (HA-DIM effect) is discussed in terms of Activation/Associative theories.

Topic Area: LONG-TERM MEMORY: Semantic

Lateralization in Superior Temporal Sulcus Animal Representations: Motion and Social-Interactive Roles

Poster A130, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

nadeem dabbakeh[1], Tyler Davis[1]; [1]Texas Tech University

Superior temporal sulcus (STS) represents aspects of biological categories and is involved with processing biological motion and social perception. Although a number of fMRI studies have found evidence that animal categories are represented in the STS, which aspects of animal categories this region is sensitive to has not been firmly established. In the current study, we sought to test how different aspects of animal categories are represented in STS using multivoxel pattern analysis. We scanned participants while they viewed animals and rated their size, swimming ability, potential as a pet, and predacity. Searchlight representational similarity analysis (RSA) revealed possible laterality in terms of which aspects of animals the STS represents. The similarity space in the left STS tracked differences between animals

on the swimming ratings, whereas both left and right STS tracked differences in pet ratings. Inconsistent with other recent results, we did not find significant associations between STS activation patterns and ratings of predacity. Altogether, these results suggest that the left STS may be involved in representing biological categories associated with motion, whereas the right STS may represent more social-relational properties of animals. These results are consistent with social neuroscience studies suggesting right lateralization of STS activation in theory of mind tasks and further suggest that judging social-relational aspects of animals, such as their worthiness as pets, may tap the same mechanisms used for human theory of mind judgments.

Topic Area: LONG-TERM MEMORY: Semantic

Busyness and brain structure: Middle-aged adults show strongest relationship between busyness and cortical thickness

Poster A131, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Sara B. Festini[1], Xi Chen[1], Denise C. Park[1]; [1]University of Texas at Dallas

Greater day-to-day busyness has been associated with superior cognitive function (Festini et al., 2016). However, it is unknown whether busyness is also related to brain structure. Given prior positive observed associations between education, occupation complexity, activity levels and cortical thickness, as well as increases in brain structure following training interventions, we hypothesized that greater busyness would be associated with greater cortical thickness. The present study used data from the Dallas Lifespan Brain Study (N = 298, ages 20-89). Busyness was assessed with the self-report Martin and Park Environmental Demands Questionnaire. Cortical thickness was measured with an automatized FreeSurfer protocol and manual edits. Analysis revealed a positive association between busyness and mean cortical thickness. Moreover, there was a significant age x busyness interaction, such that the only significant relationship between busyness and mean cortical thickness occurred in middle-age (45-64 years). Additional vertex-level analyses revealed that, after controlling for age, the busyness effects were strongest in the left superior frontal gyrus and right caudal middle frontal gyrus/precentral gyrus. Vertex-level assessment of only middle-aged adults indicated the largest effects of busyness were in the left superior frontal gyrus and right precentral gyrus. To summarize, greater busyness was associated with greater mean cortical thickness, particularly in frontal regions, and this relationship was strongest for middle-aged adults. Thus, we speculate that lifestyle engagement may exert the largest neural protective effects in middle-age and that by older ages, deterioration of brain structure and function may result in a weakening of the protective effects conferred by engagement.

Topic Area: OTHER

Group-to-individual (G2i) inferences in neuropsychological expert testimony: How the legal system understands averaged brain data

Poster A132, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Valerie Hardcastle[1], MK Kitzmiller[1], Shelby Lahey[1]; [1]University of Cincinnati

While the behavioral tests used by neuropsychologists have a long history of detailed studies validating their use as diagnostics on individuals, the same cannot be said for brain imaging protocols. Several legal scholars have raised concerns regarding the use of neuropsychological data in criminal trials. In particular, their concern is that clinicians diagnose brain deficits by comparing their patient's brain scan with averaged scans of normal individuals to pinpoint any differences that might be relevant to behavior. However individual differences can and often do swamp group effects. Consequently, data from these types of studies can make it difficult to diagnose any particular behavioral or cognitive deficiency in a single individual based on comparison with a group. However, it is only now that these data have been proffered often enough in court cases that we are able to analyze their actual use. This study analyzes 3,000+ published appellate decisions from Oct 2014-Oct 2016 in which brain data are cited in the decision. Of those, 326 relied on G2i inferences. Using mixed-method quantitative and qualitative analyses of the written decisions, we demonstrate the following: (1) G2i inferences support three broad diagnostic categories: Mental Disorders, Effects of Substance Use, and Minors/Developmental Disorders; (2) G2i inferences in legal cases appropriately rely on data triangulation from a variety of sources; and (3) Faigman et al.'s (2014) recommendations regarding admissibility standards and best practices for G2i inferences do not reflect actual use. We conclude that concerns regarding G2i inferences in a legal context are not warranted.

Topic Area: OTHER

Primary Learning and Secondary Learning are reciprocally woven to develop human intelligence

Poster A133, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Rose Ru-Whui Lee[1,2], Daisy Lan Hung[3], Ovid Jyh-Lang Tzeng[1,2,4]; [1]National Taiwan Normal University, [2]Academia Sinica, [3]Taipei Medical University, [4]National Chiao Tung University

A bioecological model of human intelligence (Bronfenbrenner & Ceci, 1994; Bronfenbrenner and Morris, 2007) is proposed from the perspective of the evolutionary theory, which emphasizes the interplay between the biological system of human information processing and the increasing complexity of environmental pressure. The model conceptualizes the evolution of human intelligence as a result of spiral escalation based on two important learning mechanisms, namely, the primary learning mechanism and the secondary learning mechanism. Furthermore, intelligence, as the vehicle for solving problems based on various cognitive abilities, is suggested as a coordinated outcome of both the primary and the secondary mechanisms, such as a transactional model of cognitive development (Tucker-Drob et al., 2013). Here, we reviewed the evidences of the neurobiological bases for the two types of learning mechanism and proposed five steps of advancing human intelligence, namely, imitation, borrowing and recycling, vast storage and fast retrieval of information (executive functions), transformation and deep learning, and connections (from thing-to-thing to knowledge-to-knowledge). The bioecological conceptualization of evolving human intelligence we proposed are in line with that the human cognitive ability functions as a natural information-processing system (Sweller and Sweller, 2006) and the level of fluid intelligence is associated with effective brain neural network connectivity (Finn et al., 2015). In the present study, an example of the development of writing system in Chinese is presented to illustrate the bioecological model of the evolution of civilization as results of the interplay between the two learning mechanisms and the environmental pressure for vast communication.

Topic Area: OTHER

Intraparietal sulcus codes for auditory quantities

Poster A134, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Shipra Kanjlia[1], Lisa Feigenson[1], Marina Bedny[1]; [1]Johns Hopkins University

Numerical thinking is supported by a fronto-parietal network of which the intraparietal sulcus (IPS) is a key node. During visual number tasks, different numerosities are coded by distinct populations of neurons in the IPS. Spatial patterns of activity in the IPS can distinguish between whether participants are viewing 4, 8, 16 or 32 dots (Eger et al., 2009). Here we asked whether there is also a spatial code in the IPS for quantities conveyed as auditory sequences. Participants (n=14) judged the quantity of auditory tones while undergoing fMRI. Participants heard a sample set of tones (either 4, 8, 16, or 32 beeps), followed by a 6s delay, and then a test set. They decided whether the first or second set had more tones. We asked whether we could decode how many tones participants heard based on the spatial pattern of activity in the IPS during the delay period. A linear support vector machine (SVM) classifier was trained to distinguish between every possible pairing of numerosities (e.g. 4 vs. 8 and 4 vs. 16). SVMs were trained on all but 1 run of data and tested on trials from the remaining run. Classification accuracy was averaged across possible number pairings and across runs. 54% trials were correctly classified by left and right IPS activity (lIPS: $p<0.01$ (using single sample t-test), $p<0.001$ (using permutation test); rIPS: $p<0.02$ (using single sample t-test), $p<0.001$ (using permutation test)). Thus, in addition to visual quantities, the IPS has a spatial code for auditory quantities.

Topic Area: OTHER

Levels of Mental Construal Involved in Processing Abstract and Representational Art

Poster A135, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Celia Durkin[1], Eileen Hartnett[2], Eric Kandel[3], Daphna Shohamy[4]; [1]University of California, San Diego, [2]Columbia University, [3]Columbia University, [4]Columbia University

Does art have the capacity to affect a viewer's state of mind and, if so, do different levels of artistic abstraction affect cognition in different ways? The current study is designed to begin addressing these questions. We hypothesized that abstract art and representational art evoke different cognitive states. To test this hypothesis, we applied to art Construal Level Theory, which has shown that distant future events are construed more highly than near future events. Here, we utilize temporal distance to measure mental construal evoked by abstract and representational paintings. Subjects were shown both abstract and representational paintings by the same artist and asked to assign each painting to a situation that was temporally near or distant (i.e. a gallery opening tomorrow vs. a gallery opening in a year). Building on prior findings of Construal Level Theory, we hypothesized that abstract art would elicit a higher mental construal, and would therefore be placed more often in a temporally distant category when compared to representational art. Results from three separate datasets were consistent with this hypothesis: abstract paintings were assigned to the temporally distant situation significantly more often than were representational paintings, indicating that abstract art evokes higher mental construal compared to representational art. Our data suggest that compared to representational art, abstract art may have differential effects on cognition, and that Construal Level Theory provides a useful new empirical approach to the analysis of cognitive states evoked by different levels of artistic abstraction.

Topic Area: OTHER

Automated meta-analysis of event-related potentials and their correlates through text-mining

Poster A136, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Thomas Donoghue[1], Bradley Voytek[1]; [1]University of California, San Diego

Event-related potentials (ERPs) have a rich history as a method to investigate the neural basis of cognition. Given the vastness of the literature, with over 400 000 ERP papers on Pubmed, there is the need for a systematic way to summarize and analyze the current status of ERP research. Here we present an automated text-mining

approach, using the Pubmed e-utilities as a form of meta-analysis to examine the relationship between ERP terms, cognitive domains and disease states. We curated dictionaries of terms, including over 30 previously described ERP components, and determined co-occurrence probabilities in published papers between ERP components and cognitive and disease terms to investigate what different ERP components are associated with. We also extracted all content words from articles found using the same ERP dictionary, allowing us to build a data-driven profile for each ERP, including the terms with which they are most affiliated, and a topic modeling of the words used when discussing them. This database can be used to confirm and quantify known associations, such as how early ERPs, like the N100, typically relate to sensory and attentional processes, whereas later components, such as the N400, are associated with cognitive processes such as semantics. This data has been combined into an easily searchable database, allowing for efficient look-up of the ERP profiles, efficiently summarizing a large body of research. This database can be used both as a learning and teaching tool, and as a method of inquiry into the previously hidden structure of the existing literature.

Topic Area: OTHER

Older adults at-risk for developing MCI show changes in brain signal complexity: A multiscale entropy analysis

Poster A137, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Joshua W. Villafuerte[1,2], Rachel N. Newsome[1,2], Sarah M. Carpentier[1,2], Morgan D. Barense[1,2], Jennifer D. Ryan[1,2], Cheryl L. Grady[1,2]; [1]University of Toronto, [2]Rotman Research Institute at Baycrest

Detecting Alzheimer's disease (AD) early in its progression is critical to effectively treating the neurodegenerative disease. Recent work assessing brain signal complexity using entropy-based indices in AD patients suggests complexity measures may prove useful in permitting earlier diagnosis. In the current study, multiscale entropy (MSE) analysis was used to investigate signal complexity in EEG acquired during an auditory oddball task in older adults at-risk for developing Mild Cognitive Impairment (MCI), relative to healthy young and older adults. At-risk individuals were undiagnosed and presented as healthy members of the community, but were classified as at-risk based on the Montreal Cognitive Assessment (MoCA), a brief, standardized neuropsychological test. We found an overall effect showing higher MSE at fine scales for at-risk adults, compared to higher sample entropy at coarser timescales in younger adults (healthy older adults in between). We also found a condition effect in healthy young and older adults who showed a difference in MSE between standard and deviant trials; at-risk adults did not show this pattern. Together, these results suggest that signal complexity may be usefully applied toward diagnosing pre-clinical Alzheimer's disease.

Topic Area: OTHER

Are there ripple effects from focal brain lesions to intact neural tissue?

Poster A138, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Yuan Tao[1], Jeremy Purcell[1], Brenda Rapp[1]; [1]Johns Hopkins University

The remote effects of focal brain lesions (termed "diaschisis" in the neurological literature) have long been interesting for clinical reasons and for understanding neural connectivity and modularity. Neuroimaging methods provide important opportunities to examine this topic and recent studies report remote effects of focal lesions. However, this work has largely involved modelling rather than studies of brain lesioned individuals. Given the neural response variability in healthy individuals, an important challenge is to evaluate the integrity of activation patterns at the individual subject level. In this study, we examined neural responses to face processing in 12 individuals who suffered left hemisphere strokes. The lesions affected left frontal, parietal or superior temporal areas, preserving the bilateral ventral temporal regions typically recruited in face processing, allowing us to examine activation patterns in these areas. Data analysis showed that the contrast of face > scenes in 17 individual controls yielded reliable activation in the right Fusiform and Occipital Face Areas and (less consistent) activation of their left hemisphere homologues. Seven of the brain-lesioned individuals showed normal activation patterns across the two hemispheres, with five exhibiting somewhat weaker activations. Overall, the finding of normal response patterns indicates that disruption of remote areas is not a necessary consequence of brain injury, indicating some degree of modular organization. Understanding the circumstances under which focal lesions may affect remote intact neural tissue remains an important topic that will require examining other measures of neural integrity including connectivity, lesion characteristics, and the functional relationship between lesioned and distant areas.

Topic Area: OTHER

Transcriptome analysis identifies blood biomarkers in the middle cerebral artery occlusion non-human stroke model

Poster A139, Saturday, March 25, 5:00 – 7:00 pm, Pacific Concourse

Sung S. Choi[1], Eui-Jin Lee[2], Sang-Hoon Cha[3], Sang-Rae Lee[4], Kyung Sik Yi[3], Da H. Kim[1], So H. Kim[1], Joo L. Park[1], Youngjeon Lee[4], Kyu-Tae Chang[4], Hong J. Lee[1]; [1]Biomedical Research Institute, Chung-Ang University College of Medicine, Seoul, Korea, [2]Institute of Catholic Integrative Medicine (ICIM), Incheon St. Mary's Hospital, College of Medicine, The Catholic University of Korea, Incheon, Korea, [3]Department of Radiology, Chungbuk National University Hospital, Chungbuk, Republic of Korea, [4]National Primate Research Center, Korea Research Institute of Bioscience and Biotechnology, Chungju, Chungbuk, Korea

Ischemic stroke leads to long-term disability and finally death worldwide. Many preclinical trials were tried to overcome this disease in stroke animal model including middle cerebral artery occlusion model. In ischemic stroke, blood-based biomarkers may be applied for the diagnosis of ischemic origin and subtype, prediction of outcomes and targeted treatment. We observed consistently healthy rhesus macaques subjected to middle cerebral artery occlusion. Transcriptome were analyzed from 3 monkey samples. Several thousands of genes showed the significant changes of their expression levels after reperfusion. Hypoxia, immune response, angiogenesis, autophagy-related genes were changed significantly in these blood biomarkers. These results suggested that these fundamental data may provide the biomarkers in acute stage of stroke.

Topic Area: OTHER

Cardiac Measures of Autonomic Arousal are Associated with ERP Measures of Selective Attention in Children and Adults

Poster B1, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Ryan Giuliano[1], Christina Karns[1], Theodore Bell[1], Leslie Roos[1], Seth Petersen[1], Elizabeth Skowron[1], Helen Neville[1], Eric Pakulak[1]; [1]University of Oregon

Neurovisceral integration theory stipulates that higher-order functions of the brain, in particular those indexing networks involving the prefrontal cortex, are intricately linked to the regulation of autonomic physiology. However, few studies include simultaneous neural and autonomic measures. To this end, we recruited young children and adults for a laboratory visit where we recorded cardiovascular measures of parasympathetic and sympathetic nervous system activity, respiratory sinus arrhythmia (RSA) and pre-ejection period (PEP) respectively, during an ERP dichotic listening measure of auditory selective attention. During the dichotic listening task, participants were simultaneously presented with two narrators reading different stories from speakers to their left and right, and ERPs were examined as mean amplitudes evoked by auditory stimuli embedded in stories they were asked to attend versus stories they were asked to ignore. Results demonstrated that for both children and adults, cardiac arousal was associated with better indices of selective attention. Among children, ERP amplitudes elicited by distracting stimuli were inversely associated with arousal, such that children with the smallest ERP response to distractor sounds also had the shortest resting PEP (i.e., higher sympathetic activity) and showed the greatest RSA withdrawal from rest to the task (i.e., parasympathetic deactivation). Among adults, ERP amplitudes elicited by to-be-attended sounds were associated with the degree of PEP shortening from rest (i.e., sympathetic activation). Overall these results suggest that greater cardiac arousal is associated with more efficient neural indices of selective attention, with higher arousal associated with more narrow attentional focus.

Topic Area: ATTENTION: Auditory

Attention sharpens prediction error, prediction determines behavior

Poster B2, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Alessandro Tavano[1], David Poeppel[1,2]; [1]Max Planck Institute for Empirical Aesthetics, Frankfurt am Main, [2]New York University

Attention to sensory stimuli is never uniformly distributed. In particular, attention scales up while we anticipate a stimulus that must eventually occur, improving task performance for longer awaited targets (temporal prediction). Within a predictive coding approach to perception, attention also increases the precision (signal-to-noise ratio) with which the mismatch between predicted and actual input is encoded by the brain (sensory prediction error). Here we tested whether prediction and prediction error interact in optimizing behavior or reflect distinct processes. We used the well-established auditory roving standard paradigm (Haenschel et al., 2005), in which the frequency of isochronously delivered, 50-ms pure tones changes unpredictably after a varying number of same tone standard repetitions. Perceived loudness was equalized (Impulse A-weighting). We recorded electroencephalographic data from 26 participants. The analysis focused on evoked brain responses to frequency deviants. Attention to stimuli selectively enhanced the neural encoding of small rather than large frequency differences, as reflected in the deviant N1 response. This supports the precision account and supercedes the traditional attention-capture account based on prediction error magnitude. Participants were faster in responding to longer awaited pitch changes, which also resulted in larger deviant N1 responses, highlighting the effect of temporal prediction. There was no interaction with prediction error magnitude. These results were replicated in a second experiment in which frequency was kept constant and loudness was roved. We conclude that prediction and prediction error partition concurrent but distinct influences of attention on behavior.

Topic Area: ATTENTION: Auditory

Spectral analysis of passive listening EEG paradigms reveals consistent patterns of activation in severely brain-injured patients

Poster B3, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Zoe M. Adams[1], William H. Curley[1], Mary M. Conte[1], Nicholas D. Schiff[1,2,3]; [1]Feil Family Brain and Mind Research Institute, Weill Cornell Medicine, NY, [2]Department of Neurology, Weill Cornell Medicine, NY, [3]The Rockefeller University, NY

Language-based EEG paradigms can identify covert cognitive processes in patients with disorders of consciousness (DOC). Assessment of cognitive capacity in DOC patients is challenging because of motor output limitations and state fluctuations during wakefulness. To address these confounds, we measured responses to several

passive (narratives) and active (via motor imagery, see Curley et al., this meeting) listening paradigms in multiple, randomized testing blocks to better capture when DOC patients are most alert. We recorded the EEG in 10 minimally conscious state (MCS) patient subjects (PSs) and 15 age-matched healthy controls (HCs). All subjects listened to natural speech (Fwd) and time-reversed (Bkwd) versions of the same stories. EEG analysis employed power spectral estimates and statistical comparisons of the Fwd and Bkwd conditions (Two Group Test; $p \leq 0.05$). In both HCs and PSs, the majority of responses showed that the Fwd condition elicited increases in alpha power when compared to the Bkwd condition. In PSs, the majority of significant responses were located in right centro-parietal, right fronto-central, and left parieto-occipital channels. These regions are consistent with expected language activation areas in HCs and thus suggest higher-level processing of the narrative's semantic content in PSs. A subset of these patients were also positive responders to active listening paradigms that always occurred within the same testing block as the narrative, supporting testing for select times when patients are most responsive to language. Our findings indicate that passive language search stimuli identify preserved language-response networks in the injured brain and require repeated assessments.

Topic Area: ATTENTION: Auditory

Long-term memory guides auditory spatial attention: An event-related potential study

Poster B4, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Jacqueline Zimmermann[1,2], Claude Alain[1,2], Morris Moscovitch[1,2]; [1]University of Toronto, [2]Rotman Research Institute, Baycrest

Numerous studies show that long-term memory (LTM) can influence the deployment of visuo-spatial attention. Here, we tested whether LTM can also bias auditory spatial attention. In an initial learning phase, we created associations between audio-clips and the location of a faint auditory (pure tone) target. Participants were presented with 2.5 second audio-clips (e.g., birds chirping). Half of the audio-clips, referred to as valid scenes, contained a difficult-to-detect target tone in the left or right ear. The other half did not include a target (neutral scenes). Immediately following the learning phase, a memory test showed that participants formed strong memory contingencies between audio-clips and embedded target locations. Following either 1 or 24 hour retentions, event-related potentials were measured during the subsequent testing phase, where participants were cued with valid or neutral audio-clips from the learning phase, and pressed a button indicating location of the target. The target appeared either at a previously learnt location (for valid scenes) or at an unlearned location (neutral scenes). Participants were faster in judging the target's location when they had previously learned its location within that scene (valid scenes) than when no contextual memory existed (neutral scenes). Memory-guided changes in attention were as strong after 24 hours as after 1 hour delays. Memory-guided performance gains were accompanied by specific changes in neuroelectric activity associated with allocation of attention to expected target locations, differing from responses to unlearned locations. Our findings provide converging evidence that LTM does bias auditory spatial attention, which in turn promotes signal detection.

Topic Area: ATTENTION: Auditory

The effects of 24-hour sleep deprivation on ERP indices of selective attention and working memory

Poster B5, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Malayka Mottarella[1], Eve Wiggins[1], Seth Eggleston[1], Kendra Good[1], Ryan Giuliano[2], Courtney Stevens[1]; [1]Willamette University, [2]University of Oregon

The present study examined the effects of 24-hour sleep deprivation on separate event-related brain potential (ERP) indices of selective attention and working memory. Forty-four adult participants were randomly assigned to either 24-hour sleep deprivation a sleep-as-usual condition. The morning following either sleep deprivation or sleep-as-usual, participants completed ERP selective auditory attention and visual working memory tasks. In the selective attention task, participants attended to one of two auditory stories, played simultaneously to different ears and varying in narrator gender and content. ERPs were timelocked to 100 msec probe stimuli superimposed upon the 'attended' and 'unattended' stories. In the working memory task, participants indicated whether a colored probe square was present in the study array, which varied in set size (2, 4, or 8 squares). ERPs were time-locked to the presentation of the study array, with delay activity in the interval preceding presentation of the probe square compared across set sizes. Results indicated the sleep deprivation affected both selective attention and working memory. While the sleep-as-usual group showed a robust effect of selective attention on the N1, the 24-hour sleep deprivation group showed no effects of selective attention on early neural processing. In the working memory task, group differences were also observed and were largest at the smallest set sizes. Taken together, these data suggest that sleep deprivation impairs the earliest stages of processing affected by selective attention as well as aspects of visual working memory.

Topic Area: ATTENTION: Auditory

A Mobile Cognition Approach To Attention: Exploring Modulations Of P300 Event-Related Potentials In The Real-World

Poster B6, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Simon Ladouce[1], David I. Donaldson[1], Paul Dudchenko[1], Magdalena Ietswaart[1]; [1]University of Stirling, Scotland (UK)

Knowledge about the neural correlates of attentional processing comes largely from controlled lab-based research. Far less is known about how these processes respond in complex real-world environments, but recent developments in mobile EEG now allow neural measurement in motion. In a first set to establish this approach we used mobile EEG to examine attention, assessing whether classic P300 Event-Related Potential auditory odd-ball effects could be measured during walking. To demonstrate viability, Experiment 1 (n=11) contrasted standing still and walking conditions. Robust P300 effects were measurable both in standing and walking conditions, but the P300 was significantly smaller during walking. We replicated and extended this finding in Experiment 2 (n=24), again contrasting P300 during walking and standing still. In addition, we controlled the contribution of the mechanics of walking by adding a wheelchair condition, and controlled the influence of visual input related to moving through the environment by adding a treadmill condition. P300 amplitude was reduced when participants were in motion, regardless of the mode of travel. By contrast, P300 effects recorded while participants walked on a treadmill were equivalent in magnitude to those measured standing still. These data confirm that the reduction of attention was not due to walking per se, but rather to movement through the environment. Together, the findings demonstrate the potential of a real-world mobile cognition approach to brain imaging, reduce methodological concern about motion artefacts preventing measurement, and reveal detectable reductions in attentional processing when participants are engaged in real-world behaviour.

Topic Area: ATTENTION: Auditory

Temporal Expectation Weights Visual Signals Over Auditory Signals

Poster B7, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Marcia Grabowecky[1], Melisa Menceloglu[1], Satoru Suzuki[1]; [1]Northwestern University

Temporal expectation occurs when temporally structured sensory information explicitly or implicitly predicts the onset or duration of future events, and influences behavioral responses. Less is known about temporal expectation effects on multisensory processing. We investigated how temporal expectation influenced auditory-visual interaction, using an auditory-visual congruity effect as a measure of crossmodal interaction. On each trial, participants received a modality cue indicating whether a target letter, B or D, would be presented auditorily or visually. The task was to identify the letter in the cued modality as rapidly and as accurately as possible. Each target was simultaneously accompanied by a congruent or an incongruent letter presented through the other modality. Temporal expectation was block-wise manipulated: in the short-interval-expected block, short-interval stimuli were presented 80% of the time and the long-interval stimuli 20% of the time; in the long-interval-expected block, the probabilities were reversed. For auditory identification, an incongruent visual stimulus produced stronger interference when the bimodal stimulus was presented with expected than with unexpected timing. In contrast, for visual identification, an incongruent auditory stimulus produced weaker interference when the bimodal stimulus was presented with expected than with unexpected timing. The fact that temporal expectation made visual distracters more potent and visual targets less susceptible to auditory interference suggests that temporal expectation increases perceptual weight on visual signals.

Topic Area: ATTENTION: Multisensory

Attention to detail predicts adaptation to statistics of sensory environment

Poster B8, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Jennifer K. Toulmin[1], Ryan A. Stevenson[2,3], Ariana Youm[1], Samantha Schulz[2,3], Morgan D. Barense[1,4], Susanne Ferber[1,4]; [1]University of Toronto, [2]Western University, [3]Brain and Mind Institute, [4]Rotman Research Institute at Baycrest

Successful interactions with our environment necessitate effective integration of sensory inputs across different modalities. Individuals with Autism Spectrum Disorder (ASD) show difficulty with multisensory integration. We hypothesised that this may be related to a decreased ability to learn statistical relationships between multiple sensory inputs, possibly owing to their default preference for local over global information. We tested 63 typically-developed adults on a statistical-learning paradigm in which participants were first adapted to consistent temporal relationships between audiovisual stimulus pairs (audio-leading, synchronous, visual-leading) and then had to perform a simultaneity judgement task with audiovisual stimulus pairs varying in temporal offset from auditory-leading to visual-leading. Participants' responses at each offset were fit with a Gaussian curve to extract their Point of Subjective Simultaneity (PSS). Participants also completed the Autism Quotient (AQ) to assess the extent to which five domains associated with ASD presented in each individual: social skills; attention switching; communication; imagination; and attention to detail. We correlated our measure of statistical learning (i.e., the post-adaptation shift in PSS) with each subscale and found that a significant shift in PSS in the visual-leading adaptation condition correlated with the "attention to detail" subscale ($p<0.001$, $r=-0.45$). Thus, less adaptation was related to increased severity of the "attention to detail" ASD trait. These findings suggest that individuals presenting with more pronounced "attention to detail" and thus a greater focus on local aspects of sensory inputs show a decreased ability to learn the statistical temporal relationship between audiovisual inputs, likely impacting their ability to integrate multisensory stimuli.

Topic Area: ATTENTION: Multisensory

Task instruction modulates alpha band event-related spectral perturbation to ambiguously located auditory stimuli

Poster B9, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Daniel M. Roberts[1], Craig G. McDonald[1], Carryl L. Baldwin[1]; [1]George Mason University

Recent work has suggested a biasing of visual spatial attention towards the location of an auditory stimulus, even if the task requires no visual detection or discrimination. This effect, termed the auditory-evoked contralateral occipital positivity (ACOP) is observable as a lateral occipital ERP component beginning at around 260 ms following auditory stimulus onset. Additionally, the same experimental conditions have been associated with event-related alpha suppression over lateral occipital electrode locations, with suppression of greater magnitude contralateral to the side of the presented auditory stimulus. However, the factors that influence the ACOP and lateralized alpha suppression are currently unclear. The current investigation sought to identify potential top-down influences on the ACOP and alpha suppression by manipulating participant beliefs about the spatial location of sounds via task instruction. Participants monitored centrally presented auditory noise stimuli for the presence of an embedded pure tone. In addition, lateralized tones were presented from locations that were ambiguous with respect to front or back direction. Between blocks, top-down beliefs of tone location (front vs. back presentation) were manipulated via task instruction. ACOP and event-related alpha band lateralization to left vs. right tones replicated past work. In addition, a main effect for alpha suppression was observed for task instruction, such that greater alpha power suppression was observed for front instruction blocks relative to back instruction blocks, to the same physical stimuli. It is suggested the suppression of alpha power over lateral occipital electrodes to auditory stimuli may be influenced in part by participant beliefs of sound location.

Topic Area: ATTENTION: Multisensory

An attentional mechanism for minimizing cross-modal distraction

Poster B10, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Lauren Grant[1], Daniel Weissman[1]; [1]University of Michigan

Prior findings suggest that coping with distraction relies on cognitive control processes that increase attention to task-relevant processing, decrease attention to task-irrelevant processing, or both. Consistent with this view, the congruency effect in unimodal Stroop-like tasks, a measure of distraction, is often smaller after more distracting incongruent trials than after less distracting congruent trials. It remains unclear, however, whether, and under what conditions, the control processes underlying this congruency sequence effect (CSE) minimize cross-modal distraction. The contingent attentional capture hypothesis predicts a cross-modal CSE when a distracter possesses a target-defining feature. In contrast, the perceptual conflict hypothesis predicts a cross-modal CSE when there is perceptual conflict between a distracter and a target. To distinguish between these hypotheses, we conducted two experiments wherein an auditory distracter word preceded a visual target that appeared in one of two formats (i.e., word or arrow). We observed robust, cross-modal CSEs. Moreover, the pattern of CSEs that we observed was more consistent with the contingent attentional capture hypothesis than with the perceptual conflict hypothesis. These findings reveal a novel attentional mechanism for minimizing cross-modal distraction.

Topic Area: ATTENTION: Multisensory

The effects of cross-modal processing on attentional asymmetries during visual search in right-hemispheric patients with and without neglect

Poster B11, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Rebecca E. Paladini[1], Sonja Kesselring[1], Julia Frey[1,2], Flurin Feuerstein[1], Urs P. Mosimann[1,4], Tobias Nef[1], Thomas Nyffeler[1,2], René M. Müri[1,3], Dario Cazzoli[1]; [1]University of Bern, Bern, Switzerland, [2]Luzerner Kantonsspital, Luzern, Switzerland, [3]Inselspital, University Hospital Bern, and University of Bern, Bern, Switzerland, [4]Private Hospital Wyss, Münchenbuchsee, Switzerland

In cross-modal visual search tasks, spatial congruency between auditory cues and visual targets are known to improve healthy participants' search performance. Multisensory processing may also influence the spatial deployment of attention in neurological patients with right-hemispheric lesions affecting attentional networks, particularly in those with left-sided neglect. The aim of this study thus consisted in investigating the effects of cross-modal processing on the performance in a visual search task in patients with right-hemispheric lesions, with or without left-sided neglect. Two groups of patients (with and without left-sided neglect) and a group of age-matched healthy controls completed a visual search task with spatially congruent, incongruent, non-informative, and without auditory cues. Moreover, a pure sound-localization control task was administered. As expected, without auditory cues, neglect patients showed a worse performance for left- than right-sided targets in visual search. Additional auditory cues affected search performance exclusively in the left visual field: spatial congruency improved search performance, and incongruence deteriorated it. Crucially, these effects were modulated by sound-localization accuracy, as measured by the control task. In healthy participants and right-hemispheric patients without neglect, auditory cues affected search performance both in the left and the right visual field. However, the magnitudes of these effects were different, showing small left/right asymmetries in healthy controls and more substantial ones in right-hemispheric patients without neglect. Overall, the present findings show that multisensory processing differentially modulates asymmetries in spatial attentional deployment in patients with right-hemispheric lesions with or without neglect, further clarifying the interactions between cross-modal processing and spatial attention.

Topic Area: ATTENTION: Multisensory

Spatial attentional asymmetries in a cross-modal visual search task and the role of the frontal eye field

Poster B12, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Dario Cazzoli[1], Rebecca E. Paladini[1], Lorenzo Diana[1], Giuseppe Zito[2], Urs P. Mosimann[1,3], Thomas Nyffeler[1,4], René M. Müri[1,5], Tobias Nef[1]; [1]University of Bern, Bern, Switzerland, [2]Imperial College, London, United Kingdom, [3]Private Hospital Wyss, Münchenbuchsee, Switzerland, [4]Luzerner Kantonsspital, Luzern, Switzerland, [5]Inselspital, University Hospital Bern, and University of Bern, Bern, Switzerland

During visual search, visuospatial attentional deployment can also be influenced by stimuli in other sensory modalities, such as additional auditory stimuli. Recent accounts propose that multisensory processing can have asymmetrical effects on spatial attentional deployment. Moreover, the frontal eye field (in particular the right FEF, rFEF) is thought to maintain spatial saliency maps of relevant stimuli for both visual and auditory modalities, and might thus play a central role in these multisensory processes. The aim of the present study was to investigate potential asymmetries in the spatial deployment of visual attention, as triggered by additional auditory information during visual search. Moreover, we aimed at assessing the role of the rFEF, by applying continuous Theta Burst Stimulation (cTBS), an inhibitory transcranial magnetic stimulation protocol. Healthy participants were asked to find a target within a visual array, accompanied by spatially valid, invalid, neutral, or no auditory stimuli, before and after cTBS application over the rFEF. The results revealed that, in comparison to the purely visual condition, spatial congruency between the multisensory visuo-auditory information elicited a behavioural facilitation in search performance. Conversely, spatial incongruence had detrimental effects, and triggered spatial asymmetries in behavioural performance, particularly when visual targets were placed in the periphery of the search field. Importantly, inhibitory cTBS over the rFEF seemed to significantly reduce these asymmetries. The findings are discussed within the framework of current accounts postulating a modulation of hemispheric asymmetries and spatial attentional deployment by multisensory processing, and suggest a central role of the rFEF in these processes.

Topic Area: ATTENTION: Multisensory

Dissociations between neural responses to external visual and auditory stimuli as a result of internal visual and auditory mind-wandering

Poster B13, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Sophie Forster[1], Charlotte Kemp[1], Giulia Poerio[2], Ben Dyson[1]; [1]University of Sussex, UK, [2]University of York, UK

Experience-sampling studies suggest that we spend around half of our waking lives engaging in task-unrelated mind wandering, which may often include rich sensory mental imagery. Here we examined how the sensory contents of mind wandering impact upon external perceptual processing. During EEG recording, participants were presented with an alternating visual fixation cross and an auditory noise burst, and instructed either to simply focus on this alone (direct attention; DA), or to engage with task-unrelated thought scenarios designed to elicit either auditory (AMW) or visual (VMW) mind wandering. Self-report of internal imagery confirmed that greater auditory imagery was generated for AMW and greater visual imagery was generated for VMW. Exogenous neural responses to the visual fixation cross (P1-N1-P2) and auditory noise (N1-P2-N2) were examined at parietal-occipital and fronto-central electrodes, respectively. For visual neural responses, latencies were faster during DA relative to any kind of mind wandering (AMW or VMW) whereas mean amplitudes for both P1 and N1 were reduced during VMW relative to AMW. For auditory neural responses, N2 mean amplitude was reduced during AMW relative to VMW. These data represent a dissociation between the modality-specific attenuation of exogenous responses to external stimuli as a result of the sensory nature of internal task-irrelevant imagery. The contribution of slower wave neural activity is also discussed. The study provides support for the notion that external perception and mental imagery draw on common, limited capacity, resources and, as such, may interfere with each other.

Topic Area: ATTENTION: Multisensory

Effects of acute stress on intertemporal choice and altruism in younger and older adults

Poster B14, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Erika P. Sparrow[1], Bonnie A. Armstrong[1], Julia Spaniol[1]; [1]Ryerson University

Recent work on aging and decision making suggests that aging is associated with an increase in altruism and a decrease in impulsivity and temporal discounting (i.e., the tendency to devalue delayed outcomes). However, it is unclear whether these patterns hold up when choices are made under stress, as is often the case in real-world decision scenarios. The current study used an intertemporal choice task in which younger and older adults received a financial endowment before making a series of consequential intertemporal decisions involving gains, losses, and charitable donations (e.g., donate $5 now or $7 in 30 days?). Prior to their choice task, participants underwent an acute psychosocial stress induction (Trier Social Stress Test). Stress responsivity was assessed using salivary cortisol measurement. Among older adults, cortisol responders (CRs) showed greater discounting of delayed gains and losses relative to non-responders (NRs). Older CRs also showed reduced altruism, operationalized as the difference in the proportion of larger-later choices for donations compared to losses. Among younger adults, CRs showed reduced discounting of delayed losses, and greater altruism, compared with NRs. Choice patterns of NRs in both age groups replicated results in a previous study with no stress induction. These findings are the first to demonstrate differential effects of acute stress on intertemporal choice and altruism in younger and older adults, and they highlight the need for more research on the impact of stress on decision making across the lifespan.

Topic Area: EMOTION & SOCIAL: Development & aging

Interoceptive sensitivity is associated with affect, personality, and memory in older adults

Poster B15, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Marcus Haustein[1], Natalie Denburg[1]; [1]University of Iowa

Interoception can be defined as the perception of signals from within the body, whether visceral or proprioceptive. Interoceptive sensitivity, then, is how sensitive an individual is to those signals. Interoceptive sensitivity has been found to be associated with emotional and cognitive variables among younger adults, but little is known about whether these relationships persist in older adults. In the present study, we take an exploratory approach to discover how interoceptive sensitivity relates to emotion and cognition in neurologically normal adults, aged 59-91 years old. Participants (N = 53) were recruited from an existing registry of older adults living independently in the Iowa City/Johnson County area. A heartbeat-counting task was used to measure interoceptive sensitivity, and self-report questionnaires measuring affect, personality, and mindfulness skills were administered. Neuropsychological data from prior research with these participants were also available for analysis. Data analysis with Pearson partial correlations revealed several relationships: 1) higher interoceptive sensitivity was associated with lower levels of positive affect; 2) higher interoceptive sensitivity was associated with lower levels of trait extraversion; and 3) higher interoceptive sensitivity was associated with stronger anterograde memory ability. These results suggest that, among older adults, interoceptive sensitivity is facilitative for aspects of cognition but perhaps disruptive for certain aspects of emotional experience. This study also lays the framework for future studies examining how interoceptive awareness may influence higher-order cognitive abilities (e.g., decision-making) in normal elderly.

Topic Area: EMOTION & SOCIAL: Development & aging

The effects of aging on false-belief reasoning abilities: an EEG study with older and younger adults

Poster B16, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Elisabeth E.F. Bradford[1], Victoria E.A. Brunsdon[1], Heather Ferguson[1]; [1]University of Kent, U.K.

A critical part of our day-to-day lives is our ability to understand the mental states (beliefs, desires, knowledge) of the people we interact with, often referred to as possession of a 'Theory of Mind' (ToM). One of the litmus tests of ToM is understanding of false-beliefs –awareness that another individual is in possession of an incorrect belief, and would be expected to act in a manner consistent with this. Prior research with young adults has shown key differences in how true-belief versus false-belief stories are processed; however, it is not currently clear whether this differentiation continues across the lifespan. This study explored how true and false-belief situations are processed by younger (18-35 years) and older (65+ years) adults. Electroencephalography (EEG) measures were taken whilst participants listened to short stories in which a character is described as having a true or false-belief about an object's location, before acting in a manner consistent or inconsistent with their belief-state (i.e. where they look for an object). Analysis revealed that when the character held a true-belief about an object's location, the N400 waveform was more negative-going for belief-inconsistent versus belief-consistent actions, in both younger and older adults. However, when the character held a false-belief about an object's location, older adults showed the opposite pattern, with more negative-going waveforms for belief-consistent than belief-inconsistent actions, which was not the case for the younger adults. Results suggest potential differences in the processes underlying belief-reasoning across the lifespan.

Topic Area: EMOTION & SOCIAL: Development & aging

Structural Connectivity between the Left Basal Ganglia and Left Insula Predicts Initiation of Substance Use in Adolescence

Poster B17, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Kelly C. Martin[1], Katherine O'Connell[2], Valerie L. Darcey[1,2], Emma J. Rose[3], Diana H. Fishbein[3], John W. VanMeter[1]; [1]Georgetown University, Center for Functional and Molecular Imaging, Washington, DC, [2]Georgetown University, Interdisciplinary Program in Neuroscience, Washington, DC, [3]The Pennsylvania State University, University Park, PA

Adolescence is marked by dynamic changes in brain development and great inter-individual variability in initiation of substance use. We examined white matter connectivity between different parts of frontal cortex and the basal ganglia, a region implicated in reward processing. Substance-naïve pre-adolescents (age 11-13 yo; n=135) were recruited to the Adolescent Development Study, a prospective, longitudinal study of neurodevelopmental trajectories mediating risk for substance use. Results reported herein compared those initiating substance use 18 months later (Users; n=11) to those who remained substance-naïve (Nonusers; n=24; currently analyzed). Probabilistic tractography was performed using the diffusion tensor imaging (80 directions, 3T) collected at the baseline to derive streamline counts, a measure of "connectivity strength," using the left and right basal ganglia as seed regions to 22 frontal cortex regions from the Find atlas (Shirer et al., 2012). Non-parametric statistics revealed that prior to use, Users had greater connectivity strength than Nonusers between the left basal ganglia and the left insula ($p=.027$). There were no significant differences for the right basal ganglia. These results indicate that differences in structural connectivity between the left basal ganglia and ipsilateral insula may predict subsequent initiation of use. Recently Fareri (2015) found that functional connectivity between the insula and striatum follows a parabolic trajectory with much higher connectivity during childhood than either adolescence or adulthood. The greater connectivity observed in the User group may indicate a developmental delay between two nodes of the salience network, which has been implicated in adult substance use disorders.

Topic Area: EMOTION & SOCIAL: Development & aging

STRESS-MEDIATED ALTERATIONS OF AMYGDALAR ACTIVATION AND CORTICAL NETWORK COHERENCE ASSOCIATED WITH SEROTONIN TRANSPORTER POLYMORPHISMS

Poster B18, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

David Beversdorf[1], Neetu Nair[1], John Hegarty[1,2], Katherine Lane[1], Bradley Ferguson[1], Patrick Hecht[1], Michael Tilley[3], Jeffrey Johnson[1], Shawn Christ[1]; [1]University of Missouri, [2]Stanford University, [3]Central Methodist University

Impaired cognitive processing is associated with disrupted coherence within neuronal networks, and stress can impair cognitive performance. We previously found greater cognitive impairment due to stress in subjects with at least one copy of the short (S) allele (lacking a 44bp repeat in the promoter region as compared to the long (L) allele) of the serotonin transporter gene (SERT), which results in lower SERT expression with those with the S/S or S/L genotype than those with L/L genotype. Altered amygdalar activity is also associated with this SERT-associated variability in stress response. To determine whether stress-susceptibility affects coherence in response to stress, and how amygdalar reactivity relates, graph metrics were collected with fMRI during the resting state in 35 subjects (17 with S-allele). Subjects attended counterbalanced sessions exposed to the Montreal Imaging Stress Task (MIST), or the non-stressful controlMIST condition. ROIs were assessed for global connectivity patterns. During subsequent MIST resting phases, the subject was interrupted exposure to angry/fearful or neutral expression faces for amygdalar activation, alternating with MIST/controlMIST epochs. ANOVA revealed a gene x stress condition interaction for functional clustering of neighboring nodes with among graph metrics ($p=0.039$), with the significant alteration in clustering driven by those with the S-allele ($p=0.016$). Stress induced resting-state connectivity changes in the same gene-dependent manner as previously demonstrated for effects on cognitive performance. Ongoing mediation analysis is revealing how amygdala reactivity relates to this effect. Future research will be needed to further understand the mechanism by which stress impairs performance on cognitive flexibility tasks.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

Everyday moral reasoning: the role that persons play in the neural processing of social and non-social events that elicit gratitude or distress

Poster B19, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Christina Karns[1]; [1]University of Oregon

In any given day, there are a multitude of positive or negative events that may occur. How does the brain process the valence of these events differently when they occur due to the actions of another person or simply to chance? FMRI was used to examine these questions in a task where 32 female participants read short second-person vignettes about everyday problems. The scenarios were constructed so that the final sentence revealed an outcome that was either positive or negative and was caused by another person or not. When a person caused the outcome of the scenario, regardless of valence, responses were larger throughout the ventral and medial prefrontal cortex and posterior parietal cortex, as well as the superior temporal gyrus (STG) ($p < .001$, $k > 20$, FWE $p < .05$) overlapping with regions identified during a separate theory of mind localizer task (conjunction $p < .001$, $k > 10$, FWE $< .05$). Importantly, the involvement of a person in the outcome affected the degree of valence processing in reward-related and social-reasoning brain regions. Valence and person interacted only in the most ventral aspect of the medial prefrontal cortex, along with the anterior middle frontal gyrus, posterior parietal cortex and left and right STG ($p < .001$, $k > 20$, FWE $p < .05$). These results demonstrate the interaction of neural social and reward networks in the context of everyday moral reasoning and social situations that elicit gratitude or distress.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

Early frontal responses to emotional valence in an Affective Go-NoGo task: Theta-band changes in ventral ACC

Poster B20, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Mario Liotti[1], Killian Kleffner[1], Ashley C Livingstone[1], Megan Liau[1]; [1]Simon Fraser University

The impact of Affect on Executive Function has been studied using tasks like the emotional Stroop (eStroop) and the Affective Go/NoGo. fMRI studies in such tasks show that changes in cognitive conflict requirements affected activity in lateral PFC and dorsal ACC, while changes in emotional salience activated medial PFC and ventral ACC (BA25, Moran et al, 2006). Similarly using ERPs, conflict generated by negative valence words reduced the amplitude of the N2, a component indexing cognitive control. However, no ERP wave has been so far associated to processing of emotional salience in the Affective Go-NoGo. Recently, our lab reported an early ERP modulation to task-irrelevant emotional valence in eStroop tasks (Early Anterior Positivity, EAP; 170-290msec; Taake et al, 2009). The present study recorded EEG in 21 undergraduates during an Affective Go/NoGo to test: 1) the presence of similar EAP modulations to emotional valence in such task; 2) if these effects localize to ventral ACC, 3) the corresponding frequency composition of source/scalp activity. Results show a Valence by Task interaction ($F=4.5$, $p<.05$) due to a difference in response to Valence for No-Go ($F=5.09$, $p<.01$), but not Go trials ($F=.76$, $p>.05$). Beamforming source analysis indicated that this effect is related to increases in theta-band activity generated by Ventral ACC (BA25) unique to Negative word processing. A clear functional dissociation emerged between Go trials,

where Emotion valence affected the N2 index of cognitive control, and No-Go trials, where Emotion valence effects were restricted to the earlier EAP index of emotional salience.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

Anodal Transcranial Direct Current Stimulation over Right Dorsolateral Prefrontal Cortex Alters Decision Making During Approach-Avoidance Conflict

Poster B21, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Evangelia G. Chrysikou[1], Claire Gorey[2], Robin L. Aupperle[3,4]; [1]University of Kansas, [2]University of South Florida, [3]Laureate Institute for Brain Research, [4]University of Tulsa

Approach-avoidance conflict refers to situations associated with both rewarding and threatening outcomes. The approach-avoidance conflict (AAC) task was developed to measure approach-avoidance conflict decision-making. Approach behavior during this task has been linked to self-reported anxiety sensitivity and has elicited anterior cingulate, insula, caudate, and right dorsolateral prefrontal cortex (dlPFC) activity, with right lateral PFC tracking the extent of approach behavior. Guided by these results, we used excitatory transcranial direct current stimulation (tDCS) to demonstrate the causal involvement of right dlPFC in approach-avoidance conflict decision-making. Participants received anodal tDCS at 1.5mA over either left or right dlPFC or sham stimulation, while performing the AAC task and a control short-term memory task. Analyses of variance revealed that for individuals with high anxiety sensitivity excitatory right (but not left or sham) dlPFC stimulation elicited measurable decreases in approach behavior during conflict. Excitatory left (but not right or sham) dlPFC simulation improved performance on the control task. These results support a possible asymmetry between the contributions of right and left dlPFC to approach-avoidance conflict resolution during emotional decision-making. Increased activity in right dlPFC may contribute to anxiety-related symptoms and, as such, serve as a neurobehavioral target of anxiolytic treatments aiming to decrease avoidance behavior.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

Emotional Response Inhibition in Healthy Older and Younger Adults

Poster B22, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Jill Waring[1], Taylor Greif[1], Manon Masson[1], Kenzie Dye[1], Michael Hase[1]; [1]Saint Louis University

Cognitive control and inhibition typically decline with aging, yet control over responses to emotional information remains largely intact in later life. Poor inhibitory control over attention and responses to negative information may be one root of affective disorders like depression and anxiety. The goal of this study was to examine healthy older (OAs) and younger adults' (YAs) emotional response inhibition, with relationship to anxiety and emotion regulation. Participants completed a Go/No-Go task of response inhibition to emotional (happy and fearful) and neutral facial expressions, standardized neurocognitive measures, and self-report measures of emotion regulation, anxiety, and depression. As hypothesized, OAs and YAs had more false alarms for happy versus fearful non-target ("no-go") faces. We also observed that YAs with higher trait anxiety had a greater total number of false alarms, yet OAs did not show the same relationship. OAs reporting higher emotional reappraisal had fewer false alarms to fearful faces in particular. These results elucidate changes in emotional response inhibition across the lifespan, and provide insight into its relationship with emotion regulation and anxiety.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

Experience sampling of emotional states induced during Pavlovian fear conditioning

Poster B23, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Daniel Stjepanović[1], Kevin S. LaBar[1]; [1]Center for Cognitive Neuroscience & Dept of Psychology and Neuroscience, Duke University, Durham, NC, USA

Pavlovian fear conditioning provides a powerful tool for the study of memory and emotion processes. While animal models and human neuroimaging have suggested an overlap in the neural representation of fear learning and fear induction, it remains unclear to which extent fear-conditioning elicits the subjective experience of fear or other emotions. In the present study, participants self-reported their emotional states intermittently while undergoing differential fear conditioning to colored shape stimuli. We found that participants were significantly more likely to endorse fear, anger and surprise states following the presentation of an aversively-reinforced CS+ stimulus, relative to a CS- stimulus that is never reinforced. We replicated and extended these results in two independent samples (total N=150), with validation of fear learning via skin conductance response. First, we implemented a reversal learning paradigm by swapping the association between the CS stimuli and the aversive shock. Results indicated that participants' emotional state ratings tracked the identity of the stimuli, such that ratings to the new CS+ replicated our earlier results. Secondly, we implemented an instructed learning paradigm by providing participants with explicit knowledge of when CS+ stimuli would be reinforced. According to theoretical models, this should reduce surprise. As predicted, endorsement of surprise no longer differed from the unreinforced CS-, but the CS+ continued to elicit greater endorsement of fearful and angry states. Our results indicate that Pavlovian fear conditioning does elicit subjective fear in humans, though as part of a broader polyaffective state profile that varies as a function of experimental design.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

The role of the medial prefrontal cortex (mPFC) in the generalization of conditioned fear

Poster B24, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Kelsey Spalding[1]; [1]University of Iowa

Fear generalization, the generalization of fear to innocuous stimuli, is a characteristic component of pathological anxiety. Neural models of fear generalization suggest the involvement of the medial prefrontal cortex (mPFC). However, conflicting findings complicate our understanding of the role of the mPFC in pathological anxiety. To address some of the important unanswered questions in this area, a detailed review and synthesis of results from human and non-human animal investigations of conditioned fear generalization was conducted. Empirical articles were identified through March 2016, and selected if they used fear conditioning, measured fear generalization, and included a measure of activity in the mPFC or manipulation of mPFC functioning (23 articles included). Results indicate the role of the mPFC varies based on the region of the mPFC involved, the type of conditioning used, and the timing of the generalization test. In cued fear conditioning, the ventral mPFC plays an important role in the inhibition of fear generalization, whereas dorsal mPFC is important for the activation of generalized fear. In contextual fear conditioning, the mPFC appears to play a critical role in support of remote fear memories as they become hippocampally-independent, leading to loss of specificity and subsequent generalization. However, the mPFC appears to play a role in reducing generalization in recent fear memories. Results indicate that some anxiety disorders are associated with increased fear generalization and ventral mPFC hypoactivation. A better understanding of the role of the mPFC in fear generalization could lead to sharpened and more effective pharmacological interventions for pathological anxiety.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

Neural Activation Accompanying Emotional Judgments of Faces by Latino Youth-At-Risk for Bipolar Disorder

Poster B25, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Kareem Al-Khalil[1], Hugo Sandoval[2], Michael Escamilla[2], Karl Kashfi[3], Luis Ramos-Duran[2], Ivette Noriega[1], Desiree Walisky[1,3], Ravi Rajmohan[3], Michael O'Boyle[1,3]; [1]Texas Tech University, Lubbock, [2]Texas Tech University Health Sciences Center Paul L. Foster School of Medicine, El Paso, [3]Texas Tech University Health Sciences Center, Lubbock

Individuals with bipolar disorder (BD) are known to exhibit difficulties with emotional processes, particularly with regard to detecting emotions depicted in human faces (Adleman, et al., 2013). Moreover, this deficiency is under explored in those of Latino descent, who are considered to be at high risk for BD (Sandoval, et al, 2016). In this study 5 Latino youth-at-risk (YAR) and 5 Latino not-at-risk (YNAR) controls (matched for age and sex) underwent functional magnetic resonance imaging (fMRI) while making same/different judgments of chimeric face pairs that depicted a variety of emotions. YAR were less accurate (76%) than the YNAR (95%) when making these facial determinations ($x2 = 14.56$, $p < .001$); reaction times did not differ between groups. Additionally, the YAR showed a larger number and more diffuse locations of brain activation, with hyper-activation of the fusiform gyrus, along with greater activation of several regions comprising the Automatic/Internal Emotional Regulatory Network (e.g., thalamus, putamen, pallidum and cingulate; see Maletic & Raison, 2014). These findings indicate that Latino YAR for BD have difficulty in processing faces and detecting their corresponding emotions. Such difficulties are reflected in compensatory brain activations that are likely designed to bolster face processing and the extraction of their emotional valence. These results are discussed in light of their use as potential neural markers of BD in at-risk Latino youth, even for those who do not yet clinically manifest BD symptomatology.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

Tempo of Self-Selected Happy Music on Posterior to Frontal Theta Asymmetry

Poster B26, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Christine Rapadas Jimenez[1], Trevor C. J. Jackson[1], Mark W. Geisler[1]; [1]San Francisco State University

Music has been used to investigate neural substrates of emotion (Koelsch et al., 2006). Frontal cerebral asymmetries have been studied via electrophysiological brain wave amplitudes in relation to music-evoked valence and approach-related affect (Altenmüller et al., 2002; Daly et al., 2014; Davidson, 1984; Schmidt & Trainor, 2001). Greater posterior compared to frontal theta activity (Pz - Fz) has also been associated with approach affective states derived from emotionally salient tasks (Walden et al., 2015). In the present study, we explored the tempo (beats per minute) of participant's self-selected music in relation to cortical activation. Posterior to frontal theta (4-8 Hz) asymmetries were found during a music listening task that lasted 45s (theta power was analyzed from a time period of 22-45s [Krumhansl, 1997; Sammler et al., 2007]). Results showed that greater posterior compared to frontal theta activation was associated with faster tempos. Larger posterior to frontal theta ratios for participants (N = 19; 6 male) were associated with faster tempos of self-selected happy song excerpts. For the same participants, posterior to frontal theta ratios were not associated with tempos of self-selected sad song excerpts. Ratios were computed with averaged amplitude values from electrode sites, $100[(P3 + P4) – (F3 + F4)/(P3 + P4) + (F3 + F4)]$. These results corroborate the findings by Walden et al., 2015, such that fast tempo stimuli with positive valence may be associated with approach and reward mechanisms.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

Effects of intelligence mindset on performance are mediated by dlPFC and caudate

Poster B27, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Christina Bejjani[1], Samantha DePasque[2], Jamil Bhanji[3], Elizabeth Tricomi[3]; [1]Duke University, [2]UCLA, [3]Rutgers University, Newark

Intelligence mindset (i.e., individual beliefs about whether intelligence is a fluid or fixed trait) has been associated with academic achievement and motivation, yet the neural mechanisms through which it affects learning remain poorly understood. We have found that intelligence mindset predicts performance and striatal activation during a paired-associate word-learning task that manipulated the predictability of feedback receipt. These relationships were particularly salient for participants whose competence had previously been threatened via a low score on a purported IQ test. For those with fixed views of intelligence, who believe that their performance reflects their abilities in an unchangeable way, a competence threat may result in maladaptive learning strategies, particularly when faced with the threat of failure induced by negative feedback. Here, we examined the neural correlates driving the performance effects associated with intelligence mindset. BOLD activity within the dorsolateral prefrontal cortex and caudate head mediated the extent to which participants respectively learned from negative and positive feedback. When feedback receipt was intermittent, those with fixed views of intelligence tended to recruit the dlPFC and caudate more than when feedback receipt was definite. Our results suggest a context-dependency for learning strategy and recruitment of attentional resources as guided by intelligence mindset. Understanding more about the role of feedback context in learning has important implications for interventions focused on improving educational outcomes through the promotion of fluid intelligence mindsets.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

Age Differences in the Neural Correlates of Selective Memory for Emotion: An Event-Related Potential Study

Poster B28, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Sara Gallant[1], Carson Pun[1], Lixia Yang[1]; [1]Ryerson University

Prior research has shown that young and older adults are similarly able to successfully remember and intentionally forget information that varies in emotional tone (Gallant & Yang, 2014). The goal of the present study was to elucidate the neural mechanisms underlying these behavioural effects. Using an item directed forgetting (DF) task, young and older adults encoded positive, negative, and neutral words that were cued as either to-be-remembered (TBR) or to-be-forgotten (TBF), while brain activity was recorded using electroencephalography. Behavioural effects replicated our prior findings with equivalent DF of emotional words across young and older adults. In the brain, age differences emerged across both word- and cue-related activity. Specifically, older adults showed an enhanced late positive potential (LPP) to positive words relative to young adults, suggesting these words may have received greater allocation of attention. In response to cues, young adults showed the expected pattern of enhanced frontal positivity for TBF relative to TBR cues; however, older adults showed a similar pattern of frontal activation for both TBR and TBF cues. These results suggest that, despite age-related similarities in behavioural performance, the neural mechanisms at work during intentional forgetting of emotion differ across young and older adults.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

Sleep deprivation impairment of flexible attentional control is dependent on dopaminergic genotype

Poster B29, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Paul Whitney[1], John Hinson[1], Brieann Satterfield[1], Hans Van Dongen[1]; [1]Washington State University

Sleep deprivation (SD) profoundly impacts performance on a wide variety of tasks, but differentially affects distinct aspects of cognition. Our prior studies demonstrated that the most well-known effect of SD on cognition, instability in vigilant attention, does not explain SD impairment when feedback must be used to flexibly adjust behavior to changing circumstances. Here we adopt the dual modes of control framework to examine SD effects on both stable and flexible control of attention, and to identify potential biomarkers of susceptibility to SD effects. In a controlled laboratory study of SD, subjects performed a battery of cognitive tests, including a variant of the AX Continuous Performance Task (AX-CPT) to assess multiple aspects of attentional control. Our variant provided standard AX-CPT trials followed by a switch in stimulus–response mappings during the session to allow measurement of both stable (pre-switch) and flexible (post-switch) attentional control. In addition, we examined a common genetic polymorphism related to dopamine, DRD2 C957T, which affects striatal D2 receptors involved in flexible reallocation of attention. We report two novel findings: first, both stable and flexible attentional control were strongly impaired by SD in most of our subjects; second, subjects with one variant of the DRD2 C957T polymorphism were highly resilient to SD effects on flexible attentional control. The genetic biomarker identified in this study should predict resilience to SD in tasks requiring rapid updating of information and adaptation to changing environmental contingencies.

Topic Area: EXECUTIVE PROCESSES: Goal maintenance & switching

Activity flows over task-evoked networks shape cognitive task activations across task switches

Poster B30, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Michael Cole[1], Takuya Ito[1], Douglas Schultz[1], Ravi Mill[1]; [1]Rutgers University-Newark

We recently found that activity flow – the movement of activations (e.g., from visual to motor regions in a visual-motor task) – over resting-state networks accurately predicts held-out task activations. This suggests that activity flow over the brain's stable intrinsic network architecture shapes task activations. This result is surprising, however, given that routes of activity flow are thought to change across task context. For instance, the need to switch tasks – from a given visual stimulus causing a left button press to causing a right button press – would require the relevant neural population in visual cortex to switch where it sends its activity. We hypothesized that such shifts in activity flow are reflected in task-evoked functional connectivity changes to the intrinsic network architecture. Supporting this, we found enhanced prediction accuracies of held-out task activations when activity flow was estimated over task-evoked networks (relative to resting-state networks). This suggests that task-evoked functional connectivity describes the task-related network updates underlying shifts in activity flow. Further, using a computational model we found this effect could be explained in terms of "population thresholds" (nonlinear sigmoid functions). Specifically, incoming activity flow during tasks placed a given region's activity closer to its threshold, such that the probability that any other incoming activity would produce a response in the region was increased (i.e., a functional connectivity shift). Overall, these results demonstrate a role for task-evoked functional network changes in shaping task activations and therefore cognitive processing, with nonlinearities in neural populations supporting this network mechanism.

Topic Area: EXECUTIVE PROCESSES: Goal maintenance & switching

Dissociable Patterns of PFC-Cerebellum Connectivity WIth Implications for Hierarchical Models of Executive Function

Poster B31, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Joseph Orr[1], Bryan Jackson[1], Jessica Bernard[1]; [1]Texas A&M University

To date, investigations of executive function (EF) have focused on the prefrontal cortex (PFC), and prominent theories of EF are framed with respect to this brain region. Multiple theories describe a hierarchical functional organization for the lateral PFC, with anterior portions controlling more abstract, higher-order behaviors (e.g., goal updating) and more posterior portions controlling more concrete, lower-order behaviors (e.g., response updating). However, recent evidence has indicated that the cerebellum (CB) also plays a role in EF. Posterior CB regions (Crus I & II) show structural and functional connections with the PFC, and further, resting networks including these CB regions are associated with individual differences in EF in healthy adults. However, it is unclear whether the cerebellum shows a similar functional gradient as does the PFC. To shed light on this issue we investigated high-resolution resting-state data from 64 participants in the Human Connectome Project. We compared functional connectivity from Crus I and Crus II to the rest of the brain using the CONN toolbox. Group-level statistics were carried out with nonparametric permutation tests (10,000 permutations) with a cluster-formation threshold of $p<.00001$ and cluster-mass corrected to $p<.001$ FWE. Results shows that Crus I showed stronger connectivity than Crus II with the anterior PFC, dorsal MFC, and frontal operculum. Crus II showed stronger connectivity than Crus I with the posterior ventrolateral PFC. These results suggest that the posterior cerebellum shares a similar organization as the lateral PFC. Ongoing follow-ups are being conducted with 225 participants focusing on executive function behavioral correlations.

Topic Area: EXECUTIVE PROCESSES: Goal maintenance & switching

Evolutionary Purpose Of A Left-Lateralized Task-Switch Mechanism: Insight From A Novel Behavioral Procedure

Poster B32, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Nicole M Bowlsby[1], Barbara J Rutherford[1]; [1]University of British Columbia Okanagan

Imaging of the neurologically intact suggests that neural circuitry to support task switches is lateralized to the left hemisphere. Behavioral consequences to the neurologically intact remain under-investigated. Further limiting understanding is that the few previous studies utilized procedures with task demands that were unnatural and inconsistent with imaging investigations. The current research uses a novel behavioral procedure with two goals: (1) address the gap of behavioral evidence; (2) facilitate understanding of brain-behavior relationships with a procedure that invokes task demands comparable to imaging. Three experiments present visual targets at fixation, and weight processing to one or other hemisphere by simultaneous presentation of a lateralized visual distractor. Two experiments present spatial or rhyme tasks in a valid cuing paradigm to establish baseline performance and lateralization under a condition of maximal predictability. The third experiment mixed the tasks and varied predictability by preceding targets with valid or invalid cues. Baseline tests found faster and more accurate responses to the spatial task, and left-lateralization of speed of spatial processing and rhyming accuracy. Mixed-task speed and accuracy converged to show stronger left-lateralization for rhyming. Notwithstanding differences in strength of lateralization, speed costs from invalid cues were symmetrical in each hemisphere for each task. In contrast, accuracy costs were not: Only the right hemisphere showed significant costs from invalid cuing, and costs were present regardless of task. The findings expand on imaging evidence to suggest that lateralization of the switch mechanism evolved in part to facilitate accuracy in a world of changing task demands.

Topic Area: EXECUTIVE PROCESSES: Goal maintenance & switching

Inflexible Cognitive Control Processes in Children with Autism Spectrum Disorder

Poster B33, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Jeremy Hogeveen[1], Matthew Elliott[1], Christine Wu Nordahl[1], Marie K Krug[1], Marjorie Solomon[1]; [1]University of California-Davis

Adaptive behavior relies on the ability to flexibly alternate between 'reactive' and 'proactive' cognitive control modes according to their task-relevance. In reactive mode, attention, perception and action are mobilized online in response to changes in the environment (slamming the brakes to avoid a car accident), whereas proactive control is deployed in advance of changes in the environment and in line with one's goals (lightly tapping the brakes to signal traffic slowing to other drivers). Prior studies indicated that individuals with autism spectrum disorder (ASD) demonstrated impaired proactive control relative to typically-developing participants (TYP). The present study further investigated reactive and proactive control in ASD using a continuous performance test modified for children (AX-CPT; Chatham, Frank, Munakata, 2009). Twenty-eight children ages 8-14 with ASD and 34 age and IQ-matched TYPs completed the AX-CPT, wherein the majority of trials were targets ('AX' trials) and a minority were nontargets ('AY', 'BX', 'BY'). Nontargets were used to isolate control modes: 'BX' trials should be difficult for individuals relying on reactive control ('X' probe matches the target) and 'AY' trials should be difficult for individuals relying on proactive control ('A' cue matches the target). Interestingly, we observed a significant cue*probe*diagnosis interaction: ASD was associated with delayed responding on both 'BX' and 'AY' trials relative to TYP. Therefore, whereas previous work suggested an overreliance on reactive control in lieu of proactive control in ASD, the present study suggests that individuals with ASD demonstrate a diminished ability to adaptively shift between control modes to meet task demands.

Topic Area: EXECUTIVE PROCESSES: Goal maintenance & switching

Differential conflict adaptation between cognitive control and sentence comprehension versus production

Poster B34, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Malathi Thothathiri[1], Daniel Evans[1]; [1]The George Washington University

Competition between representations occurs during both language comprehension and production. Cognitive control assists competition resolution across different domains. Using a conflict adaptation paradigm, we investigated whether cognitive control plays a causal role in competition resolution during sentence comprehension and production. Stroop and sentence trials were pseudorandomly intermixed. Critical trial pairs consisted of congruent (C) or incongruent (I) Stroop trials followed by congruent (C) or incongruent (I) sentence trials, resulting in four conditions (CC, IC, CI, II). Conflict adaptation would be demonstrated by finding that triggering cognitive control on a previous incongruent Stroop trial influences a subsequent incongruent sentence trial (a previous x current trial type interaction). In the comprehension experiment, participants (N=24, Mage=18.9) heard congruent and incongruent sentences and selected a matching picture out of 4 options (C: The rabbit was chased by the fox; I: The fox was chased by the rabbit). Looks to different pictures were modulated by the previous Stroop trial, demonstrating conflict adaptation (Participants: $t(23)=-3.28$, $p<.01$. Items: $t(17)=-3.04$, $p<.01$). In the production experiment, participants (N=24, Mage=18.7) described congruent and incongruent scenarios. We detected lower accuracies, longer latencies and longer durations for descriptions of incongruent than congruent scenarios (all p's<.05), but these effects as well as eye movements were not modulated by the previous Stroop trial. Individual differences in conflict resolution during production did not correlate with Stroop performance (Skipped Pearson r=-.05) but did correlate with Number-Letter task-switching performance (r=.42). Thus, sentence comprehension and production may differentially recruit different control functions such as inhibition and switching.

Topic Area: EXECUTIVE PROCESSES: Goal maintenance & switching

Investigating the Functional Structure and Dynamics of the Prefrontal Cortex

Poster B35, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Savannah Cookson[1,2], Eric Schumacher[1]; [1]Georgia Institute of Technology, [2]University of California, Berkeley

Prefrontal cortex (PFC) is involved in many cognitive processes important for complex, flexible human behavior (Duncan & Owen, 2000). Recent research has posited two axes of functional organization in PFC – a rostrocaudal axis (Badre 2008) and a dorsoventral axis (O'Reilly, 2010) – and suggested a possible interaction between the two. However, it remains unclear what underlies this apparent interaction, and how this may relate to other PFC organizing principles. The present experiment aimed to address these questions in a novel "hierarchical precuing" task that combined a traditional cuing procedure with a hierarchical mapping structure. Participants made one of four possible judgments about pairs of stimuli based on simple featural characteristics shared by the pair. Two judgments related to spatial features of the stimuli, and two to nonspatial features. One spatial and one nonspatial judgment was mapped to each hand. Cues presented at the start of each trial allowed for preparation at different levels of complexity. We then analyzed fMRI data recorded during task execution to investigate how different combinations of cue information, task processing domain, and response hand interacted to influence the distribution of activity within a set of regions of interest. Importantly, the timing of our task allowed us to independently analyze activity at the cue and the stimulus, separating preparation and execution activity. We found that the three manipulations revealed organizational activity patterns that developed differently from the cue to the stimulus event, suggesting that PFC functional organization may change dynamically based on immediate task demands.

Topic Area: EXECUTIVE PROCESSES: Goal maintenance & switching

Assessing the role of norepinephrine in attentional flexibility: A pupillometry study

Poster B36, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Rebecca D. Calcott[1], Jason Hubbard[1], Elliot T. Berkman[1]; [1]University of Oregon

Activity of the locus coeruleus-norepinephrine (LC-NE) system adjudicates the tradeoff between exploiting the current resource (stability) and exploring the environment for other opportunities (flexibility). In particular, large phasic LC-NE responses to task-relevant stimuli indicate exploitation mode, whereas high tonic LC-NE activity indicates exploration mode. The present study examined the role of phasic LC-NE activity on the ability to shift attentional focus, which is currently unknown. Subjects' (N=67) pupil size was tracked continuously to measure LC-NE function during an attention shifting task. Subjects responded to a letter in a target color and ignored a distractor letter. Periodically, the color of the target letter switched from the previous trial, and these switch trials were contrasted with non-switch trials to index attentional flexibility. Switch trials occurred in blocks of two types: On Perseveration-Inhibition blocks, switches involved the distractor color becoming the new target color and vice-versa, whereas on Pure Updating blocks, switches involved both target and distractor becoming novel colors. Phasic pupil dilation was indexed by the task-evoked change in pupil size from baseline. Overall, pupil dilation was larger for non-switch trials compared to switch trials. Additionally, on Perseveration-Inhibition blocks, reaction time switch costs were greatest on trials with large pupil dilations, whereas the opposite pattern emerged on Pure Updating blocks, where switch costs were larger on trials with smaller pupil dilations. These findings suggest that the task context determines whether large phasic pupil dilations facilitate attentional shifts. A follow-up experiment will explore the effects of tonic (pre-trial) pupil size on attentional flexibility.

Topic Area: EXECUTIVE PROCESSES: Goal maintenance & switching

Knowledge of temporal delay instantiates distinct neural pathways for proactive cognitive control

Poster B37, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Jacqueline Janowich[1], James Cavanagh[1]; [1]University of New Mexico

Dot Pattern Expectancy evaluates expectancy in cognitive control. We performed two experiments elucidating the role of temporal delay on proactive initiation of control, each using EEG to resolve neural mechanisms of control initiation. In Experiment 1 (n=25), we manipulated delay length between informative cue and test probe block-wise, such that delay length was known/regular. Participants performed less accurately on trials demanding a modified response to an unexpected probe in Short versus Long Delay, but equally well between delay lengths for trials requiring the maintenance of a cued response rule, suggesting stronger use of Proactive control in Short versus Long delay. Frontal N2 amplitude, associated with task/response switching, showed a significant interaction between delay and regular/control-demanding cue type, with pronounced N2 for short, control-demanding cues, indicating a distinct signal for temporally-imminent control needs. To resolve how this temporally-mediated preparatory activity is modulated by predictability, and explore how control is optimized during unknown delay, in Experiment 2 (n=24) we varied delay length on a trial-wise basis, with cues "delay-informative" or "delay-unknown" by trial. Known short delays evoked similar accuracy decrements as in Experiment1, but this was ameliorated in unknown short delays, indicating less preparation of prepotent response. In addition, accuracy for maintenance/control-demanding trials was greater in Long versus Short delay, irrespective of delay knowledge. EEG Contingent Negative Variation (CNV) varied significantly by cue type, helping to explain the lesser prepotent response for regular cues and successful maintenance of control-demanding cues. Overall, distinct mechanisms were initiated for high/low control demands over known/unknown delays.

Topic Area: EXECUTIVE PROCESSES: Goal maintenance & switching

Reward identity prediction error signaling in human orbitofrontal cortex

Poster B38, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

James D. Howard[1], Thorsten Kahnt[1]; [1]Northwestern University

Goal-directed behavior requires flexible neural representations of the complex associations between task structures, stimuli, and rewards. Recent studies have highlighted a critical role of the orbitofrontal cortex (OFC) in signaling these variables, including a conjunction between the value and identity of expected rewards. However, while the origin of predictive value signals is well-described by the firing of dopaminergic neurons in response to value-based prediction errors (PEs), whether and how violations in reward identity inform learning of expected outcome representations remains unknown. Here we implemented a transreinforcer reversal learning task in which hungry human participants (N=23) chose between two visual conditioned stimuli to receive either high-intensity (i.e. high-value) or low-intensity (i.e. low value) versions of sweet or savory food odors (2 value x 2 identity) while undergoing functional magnetic resonance imaging (fMRI). Critically, the stimulus-reward associations were intermittently changed throughout the task to independently induce either value or identity PEs. A regression model revealed that in addition to the value of rewards, changes in reward identity had a significant effect on choice behavior, prompting us to develop a modified Q-learning model that discounted value calculations by a weighted identity PE term. Group-level analysis of fMRI data regressed against model-derived identity PE estimates revealed robust activity in lateral posterior OFC, while orthogonal value PE evoked fMRI responses in the basal ganglia. These findings suggest that violations in reward identity may elicit an identity "teaching signal" in OFC that is used to construct representations of expected reward identity to guide goal-directed behavior.

Topic Area: EXECUTIVE PROCESSES: Goal maintenance & switching

Self-Monitoring after Traumatic Brain Injury

Poster B39, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Leslie Burton[1]; [1]University of Connecticut

After traumatic brain injury (TBI), disorders of metacognition/self-monitoring have frequently been reported. It has been suggested that the frontal lobes play a special role in an integrated sense of self, including functions of self-monitoring. Seventeen TBI patients were asked to discriminate their own performance on the Benton Face Recognition task(BFRT). This task involves viewing a target face and choosing the same person from a set of faces situated below which may vary in terms of lighting and orientation. After each trial, the patients were asked to evaluate their own performance by rating their confidence about their accuracy on a scale of 1 (not very confident) to 3 (very confident). Participants were also administered the Wisconsin Card Sort (WCST), as an index of frontal lobe functioning. The participants were separated into groups of higher (3, 4, 5 categories on the WCST) and lower (0, 1, 2 categories) inferred frontal functioning. Correlations between accuracy on the Benton Face Recognition Test and confidence ratings indicated that the group with better frontal functioning showed the expected relationship between higher accuracy and greater confidence, whereas the group with poorer frontal functioning showed no notable relationship between these variables. The 2 groups did not differ on overall scores on the BFRT. These findings are important because face recognition is a skill typically done by posterior cortical areas, and does not necessarily require frontal lobe processing. These data add support to the idea that the frontal lobes do have a special role in metacognition/self-monitoring.

Topic Area: EXECUTIVE PROCESSES: Monitoring & inhibitory control

Predictors of metacognition in dreaming and waking: State versus trait factors

Poster B40, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Tracey Kahan[1], Birgit Koopmann-Holm[1]; [1]Santa Clara University

Prior research shows stable similarities and differences in metacognitive skills reported for experiences sampled from dreaming and waking (see Kahan & LaBerge, 2011, for a review). The present study investigates whether 'state' or 'trait' factors best predict metacognition in dreaming and waking. In a two-week, home-based study, 170 undergraduates (112 females) provided written reports of two morning-awakening dreams and two waking experiences, following the experience-sampling protocol utilized in prior studies. For each experience sampled, participants used two psychometrically validated questionnaires to rate the metacognitive, affective, cognitive, and sensory features of the reported experience ['state variables']. During the initial orientation, participants also completed measures of trait mindfulness, self-consciousness, and decentering ['trait variables']. Multiple regression analyses revealed 'state' variables were stronger predictors of metacognitive skills in both waking and dreaming than were 'trait' variables. Consistent with past research, clear cross-state continuities were observed: the strongest predictors of participants' ratings of metacognition in dreaming were their ratings of the same skills in waking; similarly, ratings of metacognition in waking were best predicted by ratings of metacognition in dreaming. A novel and particularly provocative pattern was that negative emotion in dreaming was among the significant predictors of self-regulation and monitoring internal experience in dreaming, whereas positive emotion in dreaming was a significant predictor of monitoring the external environment in both dreaming and waking. Ratings of emotion in waking did not predict metacognitive skills in either state. Our findings bear on recent proposals that a core function of dreaming is the processing of negative emotion.

Topic Area: EXECUTIVE PROCESSES: Monitoring & inhibitory control

Modulation of Event-related Potential Markers of Sustained Response Inhibition in Intensive Meditation Training

Poster B41, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Anthony P. Zanesco[1,2], Brandon G. King[1,2], Chivon E. Powers[2], Kezia R. Wineberg[2], Rosanna De Meo[2], Clifford D. Saron[2]; [1]University of California, Davis, [2]UC Davis Center for Mind and Brain

The limited capacity of attention forms a central motivation for dedicated mental training across various contemplative traditions. Previously, we reported improvements in attentional performance across a 32-minute Response Inhibition Task (RIT) following three-months of full-time focused-attention meditation. Here, we examine ERP correlates of these training-related improvements in sustained attention. 88-channel EEG was collected from training participants (N = 30) and matched, wait-list controls (N = 30) before, during, and after an initial intensive retreat (Retreat1), and again during a second retreat (Retreat2), when controls underwent formally identical training. During the RIT, participants made continuous discriminations and inhibited frequent responses (90%) to difficult-to-discriminate and rarely-occurring (10%) line target stimuli (1-2 s variable ISI). Second order blind source identification was used to remove putative sources of noise in the EEG. In Retreat1—when target discrimination difficulty was manipulated between assessments—control participants showed reduced amplitudes of evoked global field power (GFP) to correct inhibition of target responses (hits) at 417-490 and 507-552 ms post-stimulus between pre- and mid-assessments. Interestingly, we observed no comparable changes in training participants, potentially reflecting reduced sensitivity to changing stimulus parameters. In Retreat2, when discrimination difficulty was instead held constant across assessments, we observed a significant training-related increase in GFP amplitude from pre- to mid-assessment at 305-350 and 430-535 ms post-stimulus.

Taken together, these results highlight electrophysiological markers of stimulus processing and response inhibition, respectively, that are sensitive to effects of training and stimulus parametrization, and that likely underlie previously reported behavioral improvements in the RIT.

Topic Area: EXECUTIVE PROCESSES: Monitoring & inhibitory control

EEG Reveals Deficits in Cognitive Control Following Brain Injury

Poster B42, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

James Cavanagh[1], James Broadway[1], Kevin Wilson[1], Rebecca Rieger[1], Andrew Mayer[2]; [1]University of New Mexico, [2]Mind Research Network

Many of the disabling aspects of mild Traumatic Brain Injury (mTBI) include lingering deficits in cognitive control. It is widely known that mTBI can damage white matter tracts, but it remains unknown how structural brain damage translates into cognitive deficits. This experiment utilized EEG to define the dysfunctional neural operations that contribute to cognitive problems following mTBI. Acute-stage (< 2 weeks) mTBI patients (N = 12) and healthy age-matched controls (N = 14) completed a dot-probe expectancy version of the AX Continuous Performance Task. It was hypothesized that patients would exhibit diminished proactive control and increased reactive control, which are widely considered to reflect sub-optimal strategic decision abilities. While there were no overt behavioral differences between groups in response time or accuracy, EEG markers of control successfully differentiated groups. Patients had significantly lower P3b amplitudes to the cue indicating the need for proactive control ("B"), as well as increased P3a amplitudes to the probe that required maximal reactive control ("aY"). These findings demonstrate how even in the absence of overt performance deficits, EEG signatures of cognitive control can differentiate mTBI patients from healthy controls. These findings motivate the development of a biomarker for identifying which patients will spontaneously recover from their injury and which patients are at risk of lingering deficits in cognitive control.

Topic Area: EXECUTIVE PROCESSES: Monitoring & inhibitory control

ERP Evidence for Conflict in Contingency Learning

Poster B43, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Chris Blais[1], Peter S Whitehead[2], Gene A Brewer[1]; [1]Arizona State University, [2]Duke University

The proportion congruency effect refers to the observation that the magnitude of the Stroop effect increases as the proportion of congruent trials in a block increases. Contemporary work shows that proportion effects can be driven by both context and individual items, and are referred to as context-specific proportion congruency (CSPC) and item-specific proportion congruency (ISPC) effects, respectively. The conflict-mediated Hebbian learning account posits that these effects manifest from the same mechanism, while the parallel episodic processing model posits that the ISPC can occur by simple associative learning. Experiment 1 examines the neural correlates of the CSPC and finds that the N2 over frontocentral electrode sites approximately 300 ms after stimulus onset predicts behavioral performance. There is a strong consensus that this N2 signal is associated with conflict detection in the medial frontal cortex. Experiment 2 assesses whether the same qualitative electrophysiological pattern of results holds for the ISPC. We find that the spatial topography of the N2 is similar but slightly delayed with a peak onset of approximately 330 ms after stimulus onset. Taken together, the results from both experiments indicate that a single common mechanism, conflict-mediated Hebbian learning, drives both the ISPC and CSPC.

Topic Area: EXECUTIVE PROCESSES: Monitoring & inhibitory control

Tip-of-the-Tongue States Enhance Processing to Feedback

Poster B44, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Janet Metcalfe[1], Paul A. Bloom[1], Judy Xu[1], Matti Vuorre[1], David Friedman[1]; [1]Columbia University

The tip-of-the-tongue (TOT) state refers to the subjective feeling that the retrieval of an unrecalled target word is imminent. While our pilot research indicates that TOT states are associated with increased curiosity and answer-seeking, the underlying neural mechanisms are not yet well understood. Here, we made use of electroencephalography (EEG) to investigate neurocognitive responses to feedback to a series of 150 general information questions. For questions in which subjects (n=26) were unable to answer verbally within 3s, we first prompted subjects to indicate whether they were in a TOT state or not, then displayed the correct answer as feedback. Feedback while in the TOT state, as compared to feedback after not knowing the answer, evoked enhanced late positivity in central-posterior electrodes from 250-700ms post-onset. Additionally, when tested again on the same questions, subjects recalled a higher proportion of answers for questions in which they had been in the TOT state. These findings suggest both that feedback to the TOT state drives increased cognitive processing, and that this differential processing can improve recall.

Topic Area: EXECUTIVE PROCESSES: Monitoring & inhibitory control

Model-based differentiation of networks of reward and impulsivity in cannabis use disorders

Poster B45, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Ariel Ketcherside[1], Joseph Dunlop[2], Francesca Filbey[1]; [1]1School of Behavior and Brain Sciences, University of Texas at Dallas, [2]SAS, Cary, NC

Substance use disorders are characterized by impairments in cognitive control as well as enhanced reward salience of drug-related cues. However, the degree of overlap between the neural networks underlying these constructs remains unknown. To that end, we examined the influence of impulsive and cue reactive neural and behavioral factors in chronic cannabis users to determine if they represent a joint and uniform feature of cannabis abuse and severity or differing etiologies or subtypes of chronic users. In order to determine independent contributions of impulse-driven cannabis use and incentive reward-driven cannabis use, we modeled behavioral data on self-report assessments of reward and impulsivity. We then tested this model on functional connectivity data collected during control (via Stop Signal Task) and reward (via cue-elicited craving task) conditions in 62 (74% male) chronic cannabis users. The results showed that the factor structure of behavior measures of impulsivity and reward seeking behavior predicts differential functional connectivity patterns during separate tasks of reward and control. These findings demonstrate independent contributions of impulsivity and reward processes in cannabis users, which should be considered in the prognosis and treatment of cannabis use disorders.

Topic Area: EXECUTIVE PROCESSES: Monitoring & inhibitory control

Cortical markers show differences in areas sustaining inhibitory control between children and adults

Poster B46, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Marine Moyon[1], Katell Mevel[1], Lisa Delalande[1], François Orliac[1], Sonia Dollfus[2,3], Olivier Houdé[1,4], Carole Peyrin[5], Wim De Neys[1], Nicolas Poirel[1,4], Grégoire Borst[1], Gregory Simon[1]; [1]LaPsyDÉ, UMR 8240, CNRS, Université Paris Descartes, Université de Caen Normandie, France, [2]ISTS, UMR 6301, CNRS, CEA, Caen, France, [3]CHU de Caen, Service de Psychiatrie, Centre Esquirol, Caen, France, [4]Institut Universitaire de France (IUF), Paris, [5]LPNC, UMR 5105, CNRS, Université Pierre Mendès France, France

Because inhibitory control (IC) efficiency in childhood is a strong predictor of academic successes later in life, capturing its neurodevelopmental outcome is crucial. In order to provide a better overview of the gray matter ontogenetic changes accompanying IC development, we analyzed various markers (thickness, surface, volume, curvature) from anatomical MRI brain images collected in 23 healthy children (10,7 ± 0,86 years old, 11 girls) and 40 adults (25,8 ± 5,9 years old, 19 women). We focused on these particular quantitative markers as they respond to different genetic constraints and may point toward different developmental mechanisms (Panizzon et al., 2009). In order to perform multiple linear regression analysis with a Stroop score, we used Freesufer software to extract measures from three regions of interest (ROI) selected for their involvement in IC: left and right medial orbito-frontal (MOF), left anterior cingulate cortex (ACC). At behavioral level, a significant Stroop effect was seen in children ($p<.001$) and adults ($p<.001$), for which adults were better inhibitors than children ($p<.001$). Whereas no correlation was seen in ACC, IC efficiency was significantly associated to a broader cortical surface in left ($p<.05$) and right MOF ($p<.01$) in the best adult inhibitors only. The present results showed a distinct pattern of brain anatomical properties in children and adults in inhibitory areas. Following the postero-anterior gradient hypothesis of brain development, children may have a still diffuse and immature frontal network, not allowing them to reach the performances of the adults.

Topic Area: EXECUTIVE PROCESSES: Monitoring & inhibitory control

Bilingualism, Self-Control, and Impulsivity do not Predict Flanker, Simon, or Stroop-Like Interference: Gender Does

Poster B47, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Kenneth Paap[1], Regina Anders[1], Roman Mikulinsky[1], Shigeaki Masuda[1], Rodriguez Gersom[1], Mason Lauren[1]; [1]San Francisco State University

More than 130 university students (60% bilinguals) completed four computer-controlled tasks reputed to measure different types of inhibitory control (flanker, Simon, spatial-Stroop, vertical Stroop), the self-control scale developed by Tangney, Baumeister, & Boone (2004), and three of the UPPS impulsive-behavior subscales (premeditation, urgency, perseverance) developed by Whiteside et al. (2001). As usual there is little convergent validity between the measures of inhibitory control derived from the computerized tasks and the pattern is only somewhat consistent with standard taxonomies regarding S-S versus S-R compatibility. Neither bilingualism, nor self-control, nor impulsivity predicted the interference scores in the computerized tasks. In contrast gender, frequency of playing video games, ability in team sports, and frequency of working-out did predict the interference scores. Men were much faster on incongruent trials, but only slightly faster on congruent trials. Other failed predictors include music training, music performance, SES, mindfulness, meditation, immigrant status, and attitude toward distraction. The Simon and spatial-Stroop tasks were identical to those used by Blumenfeld and Marian (2014) and the absence of any main effects or interactions involving bilingualism constitute a failure to replicate the bilingual advantages in stimulus-stimulus inhibition they reported. The overall results are consistent with the conclusion that these nonverbal interference tasks do not provide valid measures of general inhibitory control and furthermore do not associate with commonly used measures of self control or impulsivity. The results and conclusion call into question the degree to which the male advantage in interference scores should be generalized to executive functioning outside the laboratory.

Topic Area: EXECUTIVE PROCESSES: Monitoring & inhibitory control

Prefrontal dopamine metabolism predicts neurostimulation-linked working memory training gains

Poster B48, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Kevin Jones[1,2], Jaclyn Stephens[1,3], Marian Berryhill[1]; [1]University of Nevada, Reno, [2]Georgetown University Medical Center, [3]Kennedy Krieger Institute

There is growing awareness that individual differences predict opposing effects on cognitive performances paired with transcranial direct current stimulation (tDCS). One possible explanation is that the effects of tDCS likely depend on individual variations in WM-relevant genetic polymorphisms, such as Catechol-O-methyltransferase (COMT val158met), Dopamine Transporter (DAT), and Brain-Derived Neurotrophic Factor (BDNF val66met). This is particularly relevant as some polymorphisms have a greater impact on cognition in older adults, a population particularly motivated to maintain WM. One hundred and thirty-seven healthy older adults provided saliva samples for genotyping and received longitudinal anodal frontoparietal tDCS (sham, 1 mA, 1.5 mA, or 2 mA) paired with 10 sessions of Visual and Spatial WM training. At baseline, significant group differences in WM performance were predicted by COMT genotype ($p = .002$). One month after training, there was a significant interaction of COMT genotype, tDCS intensity and WM task ($p = .037$). Specifically, the COMT val/val adults who received 1.5 mA, showed greater improvement on the Visual WM task, where they were initially weaker, than on the Spatial WM task, where they were initially stronger. Conversely, the COMT met/met adults in the 1.5 mA tDCS group showed the reverse pattern. Neither DAT nor BDNF were predictive of tDCS-linked WM benefits. These data suggest that intrinsic frontal dopamine activity predicts the nature of WM improvement after longitudinal tDCS. Variations in the COMT polymorphism predicted baseline WM performance and interacted with tDCS specific to WM task demands.

Topic Area: EXECUTIVE PROCESSES: Working memory

Interacting long-range networks govern control over working memory

Poster B49, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Elizabeth L. Johnson[1], Callum D. Dewar[1,2], Anne-Kristin Solbakk[3], Tor Endestad[3], Torstein R. Meling[3], Robert T. Knight[1]; [1]University of California, Berkeley, [2]University of Illinois, [3]University of Oslo

We investigated how frontal regions exert control over sensory mechanisms in working memory (WM). The electroencephalogram (EEG) was recorded in 14 patients with unilateral lesions localized to lateral prefrontal cortex (LPFC; age 46 ± 16) and 20 age-matched controls while they completed a visual WM task. On each trial, subjects encoded two colored shapes in specific spatiotemporal positions in preparation for a subsequent test on the identity of each shape in the pair, or on the spatial or temporal relationship between the shapes in the pair. The test prompt was presented mid-delay to initiate executive control processes (processing period). Patients exhibited impaired accuracy (87% vs. 95%, $p<0.00005$), which indicates a causal but not unitary role for LPFC in WM. Processing was marked by anterior slow (1-8 Hz) power increases and anterior-to-posterior directional connectivity alongside central-posterior alpha-beta (8-20 Hz) power decreases and posterior-to-anterior connectivity (all $p<0.001$). Early in processing, we observed more hemispheric asymmetry, with decreased low theta (3-4 Hz) power at the lesion site, and less anterior-to-posterior connectivity in patients (all $p<0.05$, corrected). We then observed that LPFC lesions could be reliably identified from parieto-occipital alpha-beta power for the remaining processing period. These results reveal an LPFC source for theta rhythms underlying executive control, a dissociable alpha-beta suppression network for WM, and a cause-and-effect relationship between LPFC theta activity and parieto-occipital alpha-beta suppression. Our findings contradict modular views of LPFC in WM, and instead demonstrate that WM is governed by the flexible recruitment of bidirectional, interacting long-range networks.

Topic Area: EXECUTIVE PROCESSES: Working memory

Decoding the content and the rule during visuomotor working memory

Poster B50, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Romain Quentin[1], Jean-Remi King[2], Etienne Sallard[1], Nathan Fishman[1], Ethan Buch[1], Ryan Thompson[1], Leonardo Cohen[1]; [1]National Institute of Neurological Disorders and Stroke (NINDS/NIH), [2]New York University (NYU)

Working memory is required for learning, reasoning, updating information, and performing everyday visuomotor tasks. Intra-cortical recordings in nonhuman primates and fMRI studies in humans demonstrated the involvement of the frontal cortex during working memory. However, whether such frontal involvement reflects the encoding of information content itself or the rule allowing one to recall this content is unknown. We developed an original working memory task in which two visual stimuli with different orientations and spatial frequencies were presented to the participant. After a short delay, a post-cue instruction indicated which visual feature (spatial frequency or orientation) of which stimulus (left or right) the participant had to remember. A group of 20 healthy adults performed this task while MEG signal was recorded. Multivariate pattern analysis showed first that both spatial frequency and orientation could be decoded from MEG early visual responses. In addition, we observed how trained classifiers generalized across time to get information on the dynamic representations of working memory states. Our results demonstrate that both the cued item and the type of cue (rule) can be decoded more than one second after their presentation. Moreover, the generalization across time showed a stable representation. These results demonstrate our ability to observe the dynamics of these representations and emphasize the crucial role of the rule maintenance during working memory task.

Topic Area: EXECUTIVE PROCESSES: Working memory

More power to complexity: event-related desynchronization in the alpha-band responds to complexity and not numerosity of objects in visual working memory (VWM)

Poster B51, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Shriradha Geigerman[1], Anthony V McVey[1], Alexandria B Cook[2], Haoxiang Yang[3]; [1]Georgia Institute of Technology, [2]Georgia State University, [3]Northwestern University

We tested (a) the flexible resources hypothesis which states that resources in VWM are distributed based on complexity of objects (experiment 1), and (b) whether memory representations of more complex stimuli are less precise (experiment 2). In experiment 1, the number of stimuli (Chinese characters) was varied between two, three, and four, along with the complexity (number of strokes) of the characters. Change detection data showed that complexity of the characters, and not their numerosity, had an inverse effect on accuracy of memory performance and a direct effect on event-related desynchronization index (ERD) in the ∞ band (10 Hz) of electroencephalograms of college-aged adults, indicating greater excitation in the thalamo-cortical circuits in response to higher levels of complexity. In experiment 2, imprecision of memory was tested based on the assumption that participants can only make difficult detections between study and test characters if underlying memory representations are precise. Participants remembered sets of three objects at different complexity levels and were then tested using change detection probes varying in difficulty levels. Results showed an increase in ERD index only until the mid-level of complexity. It is likely that task-sensitivity of VWM contents led to maintenance of representations at an optimum level of excitation to help detections at all levels of difficulty. Detection difficulty reduced accuracy of memory performance similarly across all complexity levels, ruling out the proposed relationship between precision and complexity. In conclusion, our data supported the flexible resources hypothesis. The relationship between complexity and precision is still unclear.

Topic Area: EXECUTIVE PROCESSES: Working memory

Working memory capacity related to dorsolateral prefrontal activity in monkeys

Poster B52, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Hua Tang[1], Xue-Lian Qi[1], Mitchell Riley[1], Christos Constantinidis[1]; [1]Wake Forest School of Medicine

The information that can be stored in the working memory of humans and non-human primates is severely limited. Little is known about how activity of single neurons relates to working memory capacity and the nature of this limitation. To investigate this question, we trained two monkeys to perform a spatial working memory task. The monkeys viewed a sample display with 1 to 5 white squares. After a delay period of 1 s, a second display appeared with the same number of stimuli, either at identical locations, or with one item appearing at a different location. The subjects were required to judge whether the two stimulus displays were the same or not. Overall performance declined as the number of stimuli increased. The subjects' estimated capacity in the task reached an asymptote at approximately 3.5 and 2 items respectively. We recorded a total of 266 neurons from the dorsolateral prefrontal cortex and 71 neurons from the posterior parietal cortex. We focused particularly on neurons with significant selectivity for different stimulus locations (ANOVA, $p<0.05$). Prefrontal delay period activity increased as a function of the number of stimuli, for up to 3 items. For displays with 4 or more stimuli, which exceeded the subjects' behavioral capacity, persistent activity decreased (ANOVA, $p<0.01$). Posterior parietal delay period activity did not show any systematic relationship with the number of stimuli. These results suggest that prefrontal delay period activity is predictive of the subjects' capacity limit and provide mechanistic insights on the working memory capacity limitation.

Topic Area: EXECUTIVE PROCESSES: Working memory

Abnormal brain network activity underlying internal speech in schizophrenia

Poster B53, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Nicole Sanford[1,2], Todd Woodward[1,2]; [1]University of British Columbia, [2]BC Children's Hospital Research Institute

Introduction: Functional brain networks underlying internal thought have been implicated in schizophrenia, and particularly auditory hallucinations. However, comparing networks between different studies is imprecise. The present functional magnetic resonance imaging (fMRI) study used a multivariate approach to investigate task-correlated networks common to working memory and language tasks. We expected schizophrenia patients to exhibit abnormal brain activity underlying internal speech and rehearsal. Methods: Chronic schizophrenia patients, bipolar disorder patients, and healthy controls completed one of two tasks: (1) a thought-generation task (TGT), involving listening to or internally generating a definition, or (2) a working memory task (WM), involving remembering a letter string over a four-second delay or no delay. Constrained principal component analysis and mixed-model ANOVA were used to extract task-correlated networks and investigate effects of group, condition, and post-stimulus time. Results: Five networks were extracted. One included activations in dorsal anterior cingulate, insula, Broca's area, and visual cortex, which responded during the delay phase of WM and thought generation in TGT. This network was inactive when effortful inner speech was not required. Recently-hallucinating schizophrenia patients exhibited hyper-suppression of this network between trials in TGT. Conclusions: Hyper-suppression of an internal speech-related network in hallucinating patients could reflect a neurological distinction between controlled internal speech and spontaneous hallucinatory voices, with the latter suppressing the former during reduced cognitive demand. A clinical implication is the possibility of diminishing hallucinations by strengthening this network through cognitive training. Consolidating studies allowed a direct evaluation of spatial and temporal replication of networks underlying the two tasks.

Topic Area: EXECUTIVE PROCESSES: Working memory

Selective Attention and Load Effects in Parietal Cortex: A complex picture of working memory

Poster B54, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Brandee Feola[1], Donald J. Bolger[1,2], Toby Hamovitz[3], Lesley Sand[1], Amber M. Sprenger[3], Sharona M. Atkins[1,2], Michael R. Dougherty[3]; [1]Human Development and Quantitative Methodology Deparment, University of Maryland, College Park, [2]Department of Neuroscience and Cognitive Sciences Department, University of Maryland, College Park, [3]Psychology Department, University of Maryland, College Park

Whereas traditional frameworks of working memory have argued for separate components for executive processes and storage/maintenance, more recent models have suggested that working memory is an emergent process from selective attention. Recent evidence from neuroimaging has supported the notion that selective attention and memory load rely on a shared rather than distinct neural networks. The current study aims to disentangle the neural basis of working memory and attention by examining neural activity related to increasing working memory load compared to increases in distracting information. Eight-five participants completed a modified delayed match-to-sample task (DMTS) in a 3T Siemens Trio scanner. Three different colored cues were presented indicating whether participants were to attend to all (red and blue) stimuli, only red stimuli (filter), or not respond (nogo). Array stimuli appeared in a 4x4 grid consisting of 2 red dots and between 0-4 blue dots. After a delay, participants indicated if a target was present in a specific location. Results revealed traditional prefrontal and parietal regions for the task for both attend-all and filter conditions (relative to nogo trials). The right inferior parietal region showed typical increases with load in the attend all condition, but did not increase with distractors in the filter condition. These load effects in the IPL positively correlated with alternative measures of working memory (n-back, corsi-blocks). Moreover, a response to distractors in the IPL positively correlated with incongruency effects on the Flanker task (ANT executive) suggesting that this region is sensitive to individual differences in maintenance and selective attention.

Topic Area: EXECUTIVE PROCESSES: Working memory

Top-down modulation of threatening representations in visual working memory

Poster B55, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Bo-Cheng Kuo[1], Yei-Yu Yeh[1]; [1]National Taiwan University, Taiwan

Recent studies have shown that top-down attention can bias task-relevant representations in visual working memory (WM). Accumulating evidence has also revealed the effects of emotional arousal on attentional processing. However, it remains unclear whether top-down attention can regulate emotional memoranda in WM. In this study, we investigated the neural mechanisms of top-down modulation on threatening representations during WM maintenance with functional magnetic resonance imaging (fMRI). Participants were instructed to remember a threatening object and a neutral object in a cued variant delayed response WM task. Retrospective cues (retro-cues) were presented to direct attention to the hemifield of a threatening object (i.e., cue-to-threat trials) or a neutral object (i.e., cue-to-neutral trials) during a retention interval prior to the probe test. We found greater neural responses in extrastriate visual areas and amygdala for cue-to-threat objects compared to cue-to-neutral ones. We also showed that retro-cues elicited activity in a large-scale network implicated in attentional control and led to spatiotopic modulation of activity in extrastriate visual areas. Importantly, directing attention towards threatening representations compared to neutral representations during WM maintenance can result in greater regulation of functional connectivity between prefrontal cortex and early visual areas. Together, these results provide new insights into top-down modulations of threatening representations in WM.

Topic Area: EXECUTIVE PROCESSES: Working memory

Three-Dimensional MOT task as an assessment tool for attention and working memory: a comparison with traditional measures

Poster B56, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Chiara Perico[1,2], Jocelyn Faubert[3], Armando Bertone[1,2,4]; [1]Perceptual Neuroscience Laboratory for Autism and Development, [2]School/Applied Child Psychology, Department of Education and Counselling Psychology, McGill University, [3]Laboratoire de psychophysique et de perception visuelle, École d'optométrie, Université de Montréal, [4]Human Development, Department of Education and Counselling Psychology, McGill University

Performance on a three-dimensional multiple object tracking (3D-MOT) task is considered to be an accurate measure of real-world dynamic attention. Working memory (WM) is an important component of 3D-MOT task completion since target items are tracked amongst distractors over a set period of time. 3D-MOT performance is also consistent with developmental expectations, with performance improving with age that is associated with developing WM capabilities. This study aimed to assess whether 3D-MOT can be used to characterize WM ability at different periods of development by comparing it to that of traditional neuropsychological assessment methods. Sixty-four participants, placed in child(n=9), adolescent (n=22), adult (n=33) groups, were assessed on a 3D-MOT tasks comprised of four conditions with increasing WM load (3 target items out of 8 distractor items were tracked for 5, 8 12 and 15 seconds). All participants also completed the Paced Auditory Serial Addition Test (PASAT) WM task; attention (Connors CPT-3 & CATA) and WASI-2 IQ measures also collected. Results indicated that all groups showed a reduction in 3D-MOT

performance (defined as the average speed at which target spheres were successfully tracked) with increasing WM load. Importantly, performance on the 3D-MOT and the PASAT WM task declined in a similar rate with increasing WM load for adolescents and adults, but not for children, consistent with developing WM capacity. These group differences seem to reflect the differential ability typically observed on traditional attention and WM tasks, thus suggesting that dynamic 3D-MOT tasks are sensitive enough to characterize WM ability across developmental stages.

Topic Area: EXECUTIVE PROCESSES: Working memory

Leveraging the Test Effect to Improve Maintenance of the Gains Achieved Through Cognitive Rehabilitation

Poster B57, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Rhonda Friedman[1], Sarah Snider[1], Kevin Jones[1]; [1]Georgetown University

Reports of successful treatments for language impairments in persons with aphasia subsequent to stroke are growing. Unfortunately, treatment gains often fade soon after the treatment ends. This study employs the Test Effect, a validated principle of learning taken from the fields of psychology and education, in an attempt to improve long-term maintenance of treatment effects in stroke rehabilitation. Seven individuals with mild to severe anomia subsequent to stroke trained semiweekly on problematic words over the course of three months. Training sessions consisted of two 'study' blocks and two 'test' blocks. Once learned, words were assigned to one of four over-training conditions: test only, study only, test and study, or no over-training (drop-out). Participants returned for post-testing at one month, four months, and one year post-treatment. Over-training provided a significant boost to maintenance. This was particularly true for test over-training, which was consistently superior to drop-out for all participants at all time points. Further, the effect of testing on maintenance was greater than the effect of studying. There was a significant advantage for over-tested items as compared to over-studied items at one month (ChiSquare (7, 852) = 28.00, $p < .0001$), four months (ChiSquare (6, 744) = 8.63, $p = .004$), and one year (ChiSquare (4, 474) = 9.12, $p = .003$) following the end of training. Importantly, findings were consistent across participants regardless of degree of anomia. Our results suggest that continued testing of learned material could be an effective means to reinforce treatment gains in cognitive rehabilitation protocols.

Topic Area: LANGUAGE: Other

Network-level analysis of language abilities in chronic aphasia

Poster B58, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

And Turken[1], Timothy Herron[1], Brian Curran[1], Krista Parker[1], Juliana Baldo[1], Nina Dronkers[1]; [1]VA Northern California Health Care System, Medical Research, [2]UC Davis Medical School

Using brain imaging data from a large group of chronic stroke patients with left hemisphere injury, we examined how the loss and sparing of language abilities in aphasia relates to cerebral network disconnection. Lesion data from 210 patients were analyzed in relation to whole-brain tractography-based structural and resting fMRI-based functional connectivity maps from 40 demographically-matched controls and well as 100 high-resolution datasets from the Human Connectome Project. HARDI diffusion MRI and resting fMRI data were also acquired from 38 of the stroke patients. Regional gray matter loss, the loss of intra-cerebral structural connections, the information processing capacity of spared structural connections, and the resting-state functional connectivity networks affected by the lesion were quantified for each patient. Western Aphasia Battery (WAB) performance measures were correlated with regional gray matter loss, intra-hemispheric cortico-cortical structural disconnection, and damage to six major resting-state networks. Partial least squares (PLS) regression related Western Aphasia Battery performance profiles to patterns of gray matter loss, white matter structural disconnection and disruption of resting-state networks. Our primary findings and conclusions are: 1) Cortical network disruption is a better predictor of chronic aphasia severity than damage to individual cortical regions or white matter tracts; 2) The structural and functional connections associated with the left mid-posterior MTG are critical for auditory language comprehension; and 3) Analysis of whole-hemisphere connectivity patterns is more informative than focusing on individual white matter connections, as each connection can support more than one language ability and each ability relies on on more than one cerebral connection.

Topic Area: LANGUAGE: Other

Attentional Control during Language Comprehension: Connecting Brain to Behavior

Poster B59, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Megan Boudewyn[1], Cameron Carter[1]; [1]University of California, Davis

Attention is critical to the construction of mental representations of language context during comprehension. In this study, we investigated the consequences of momentary lapses in attention during listening comprehension on neural activity and behavior, measured using electrophysiology (EEG) and comprehension questions, respectively. Participants (N=22) listened to two full-length stories while EEG was recorded, and completed multiple choice questions about the stories afterwards. Listening was periodically interrupted by attention probes, in which participants were asked whether their attention immediately preceding the probe's appearance was focused on the story. Results suggested that participants spent a substantial amount of listening time off-task, endorsing attention lapses on over 20% of probes. EEG activity in the alpha band (9-12 Hz) was significantly increased just prior to the endorsement of an attention lapse compared to the endorsement of on-task listening

($p<0.05$). This is consistent with our previous work that has linked relative increases in alpha activity during comprehension to momentary lapses in attentional engagement to language stimuli. Importantly, in the current study, comprehension accuracy for content presented just prior to the attention probes was significantly decreased for probes on which an attention lapses was endorsed compared to probes on which on-task listening was endorsed ($p<0.05$). Thus, our results connect changes in neural activity in the alpha band to episodes of mind-wandering during listening comprehension, and in turn to decreased comprehension accuracy. These results demonstrate how alpha can be used to track attentional engagement during language comprehension, and illustrate the dependence of successful language comprehension on attention.

Topic Area: LANGUAGE: Other

The influence of dialogue context on the relationship between language production and comprehension

Poster B60, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Kaitlyn Litcofsky[1], Janet van Hell[1]; [1]Pennsylvania State University

Language production and comprehension are typically studied separately. Yet, both are engaged in dialogue, where one individual expresses their thoughts through speech and the other listens to that output for comprehension. This pattern reverses continually, and every speaker is also a listener. The Interactive Alignment model (Pickering & Garrod, 2004) claims that production and comprehension are linked across interlocutors. Here, we examined how production and comprehension are linked within an individual, and how dialogue context impacts that relationship, using electrophysiological and behavioral methods. Alignment with an interlocutor should strengthen the alignment between production and comprehension within the individual, as compared to a monologue context. Participants completed two cross-modal syntactic priming tasks of active/passive sentences: production-to-comprehension in which they listened to sentences while EEG (Electroencephalography) was recorded (measure: Event-Related Potentials, ERPs) and comprehension-to-production in which they described simple pictures (measures: syntactic choice, average reaction time, average syllable duration). In dialogue, participants interacted with a confederate. In monologue, participants completed the task alone. For production-to-comprehension, ERPs revealed a sustained N400 priming effect at the main verb of target passive sentences both in monologue and dialogue. For comprehension-to-production, priming of the proportion of passives produced was found both in monologue and dialogue. The similar patterns of cross-modal syntactic priming in production and comprehension observed within an individual suggest that there are shared mechanisms underlying these processes. Moreover, these basic mechanisms are manifested similarly in monologue and dialogue contexts.

Topic Area: LANGUAGE: Other

Neural correlates of word frequency effects in bilinguals

Poster B61, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Myriam Oliver[1], Manuel Carreiras[1,2], Pedro M. Paz-Alonso[1]; [1]BCBL. Basque Center on Cogntion, Brain and Language, [2]IKERBASQUE, Basque Foundation for Science, Bilbao, Spain.

Neuropsychological and neuroimaging research have extensively demonstrated the involvement of left-lateralized perisylvian regions in reading processes. While word-frequency effects have been widely investigate in monolingual adult readers, we do not much about word-frequency effects in bilinguals, whose might show variations relative to monliguals in the recruitment of the reading regions and networks typically showed to be involve in word-frequency effects. In the present fMRI study, we sought to investigate differences in the regional engagement and functional dynamics among regions along the reading network in bilinguals and monolinguals as a function of word frequency (high-frequency versus low-frequency) and reading demands (semantic versus. perceptual tasks). A total of 56 right-handed bilingual and monolingual young adults with Spanish as their L1 participated. Region-of-interest (ROI) analyses revealed that the superior temporal gyrus (STG) was more strongly engaged for monolingual than bilingual participants across low- and high-frequency word reading. Moreover, regions whithin the inferior frontal gyrus (IFG) were more strongly engaged for low-frequency than high-frequency word reading across bilingual and monolingual individuals. Also, our data revealed a stronger recruitment of the ventral-occipitotemporal (vOT) region as a function of reading demands, being more engaged for the semantic versus the perceptual reading task across stimuli and participants. Functional connectivity analyses revealed group differences in coactivation between left IFG and STG, and also between left IFG and vOT as a function of reading demands. Our data provide evidence of functional changes between the left-perisylvian reading network as a function of being bilingual or monolingual for word frequency effects.

Topic Area: LANGUAGE: Other

Language experience and phonological rule modulate pre-attentive lexical tone perception

Poster B62, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Wen-Jui Kuo[1], Claire H. C. Chang[1], Tzu-Hui Lin[1]; [1]Institute of Neuroscience, National Yang-Ming University, Taipei, Taiwan

In this study, two experiments were set up to investigate how language experience modulates lexical tone perception. Specifically, we examined whether early tone perception is more left-lateralized with experience in tone language and tested the hypothesis that tones often exchanged by language-specific rule are perceptually more similar. In Experiment 1, we measured mismatch negativity (MMN) responses of native Mandarin speakers to tone pair often exchanged by phonological rule, i.e. sandhi, and tone pair that are not. In Experiment 2, MMN responses to sandhi and non-sandhi tone pairs from both skilled and unskilled speakers of Taiwanese were measured. Our results not only showed no left-lateralization of MMN to lexical tone, but that language experience resulted in greater right-lateralization, probably due to higher demand on tone discrimination. Another finding is that MMN to non-sandhi tone pair peaked earlier than sandhi pair. This effect was only observed in skilled speakers with syllable unambiguously belongs to the language in interest in Experiment 2, supporting that language-specific rule modulated pre-attentive tone perception. Current study manifested that human brain adapts to the demands of specific language extensively and demonstrated the flexibility of human language system.

Topic Area: LANGUAGE: Other

Using fNIRS to Investigate Speech-Language Tasks

Poster B63, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Nicholas Wan[1], Allison Hancock[1], Ronald Gillam[1]; [1]Utah State University

Multiple authors have claimed that functional near-infrared spectroscopy (fNIRS) is a useful imaging technique for tasks that involve speech production because data are minimally susceptible to motion artifacts. This study was designed to test how speech processes related to articulation and voicing influence patterns of cortical hemodynamics and their interpretation and if it is possible to further reduce motor-related activity from the speech-language signal. Participants completed three reading tasks (oral reading, silent mouthing, and silent reading) while undergoing fNIRS imaging. We compared three measures of the hemodynamic response function (amplitude, periodicity, and slope) for each task across five regions of interest (ROIs): primary motor cortex (M1), supplementary motor area (SMA), inferior frontal gyrus (IFG), superior temporal gyrus (STG), and inferior parietal lobule (IPL). There were significant main effects for task for M1, SMA, and IPL. Greater detail of how ROIs are functionally connected were computed via Granger Causality, revealing stronger networks between motor areas during oral reading and stronger networks between language areas during silent reading. These results suggest that motion artifacts related to speech processes have minimal effects on fNIRS measures of the hemodynamic response function across the parasylvian region. Regression was used to reduce shared variance between tasks involving jaw movement in order to reveal an underlying activity similar to silent reading. This technique was successful, strongly correlating with silent reading. This suggests it is possible to further reduce non-speech- and non-language-related activity from the speech-language network, improving the signal quality from fNIRS recordings.

Topic Area: LANGUAGE: Other

Violating linguistic prediction in musicians and non-musicians

Poster B64, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Allison R. Fogel[1], Edward W. Wlotko[1], Gina R. Kuperberg[1,2,3], Aniruddh D. Patel[1]; [1]Tufts University, [2]MGH/HST Athinoula A. Martinos Center for Biomedical Imaging, [3]Massachusetts General Hospital

Prediction is thought to play an important role in the processing of both music and language, leading to recent interest in the possible relationship between neurocognitive mechanisms of prediction across the two domains. While there is evidence that individuals with musical training show enhancements in some aspects of language processing (such as prosody and affect), the impact of musical training on predictive tendencies in language has not been well explored. Here we asked whether musicians are more sensitive than non-musicians to words that violate strong linguistic predictions. Because prediction is vital for successful music processing, it is possible that musical training may be associated with stronger prediction of upcoming information in general, or with changes in other aspects of cognition (such as working memory) that in turn impact predictive tendencies in language. Previous studies have reported individual differences in the neural effects of violating very strong lexical predictions, as indexed by a late ERP component that follows the N400, known as the frontal positivity. We investigated whether this late frontal positivity would differ between individuals with and without musical training. Contrary to our hypothesis, no relationship was observed between the amplitude of the frontal positivity and musical training. However, cognitive testing of a subset of these participants revealed a relationship between musical training and visual statistical learning performance. These results suggest that, while musical training does not impact the strength of an individual's lexical predictions in language, it may enhance an individual's ability to learn statistical regularities from the environment.

Topic Area: LANGUAGE: Other

ERP Measures of Anodal Transcranial Direct Current Stimulation Effects on Second Language Vocabulary Acquisition

Poster B65, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

He Pu[1], Sarah Perlo[1], Katherine Gawlas[1], Joshua Manning[1], Marianna Eddy[1,2], Katherine J. Midgley[3], Phillip J. Holcomb[1,3]; [1]Tufts University, [2]U.S Army Natick Soldier Research, Development, and Engineering Center, [3]San Diego State University

Anodal transcranial direct current stimulation (tDCS), which increases cortical excitability of the stimulated neural regions, has been used successfully during artificial word learning (Floel et al., 2008; Meinzer et al., 2014). These previous studies have shown anodal tDCS of Wernicke's area to positively impact word learning, improving translation and recall accuracy performance. In the present study, we tested whether such improvements could be seen during second language (L2) vocabulary acquisition as measured by both behavioral and ERP recordings. As ERP studies on L2 acquisition have shown N400 growth following learning (e.g. Yum et al., 2014), we anticipated larger N400 growth if anodal tDCS successfully facilitates acquisition. Using a double-blind, sham-controlled manipulation, 20 native English speakers (mean age = 21.3, SD = 3.1) learned 100 Spanish words in two sessions across one week. Participants received either active anodal (2 mA) or sham HD-tDCS to Wernicke's area for 20 minutes coinciding with each Spanish vocabulary learning session. Behaviorally, we found no effect of anodal tDCS on post-learning translation accuracy, failing to replicate the previous work on anodal tDCS effects on artificial vocabulary learning. ERP analysis of N400 amplitude growth showed that only the sham and not the active group produced a significant effect of learning (larger N400s to L2 words after learning). This apparent learning inhibition in the anodal group's ERPs offers some evidence against the trend of anodal tDCS facilitation effects on learning. Possible explanations of these ERP results will be discussed.

Topic Area: LANGUAGE: Other

Visual cortex entrains to low-frequency amplitude variability in sign language

Poster B66, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Geoffrey Brookshire[1], Jenny Lu[1], Howard Nusbaum[1], Susan Goldin-Meadow[1], Daniel Casasanto[1]; [1]The University of Chicago

Despite immense variability across languages, children can learn any human language, including sign languages. What neural mechanisms allow people to learn and understand language across sensory modalities? When people listen to speech, electrophysiological oscillations in auditory cortex entrain to slow (<8 Hz) fluctuations in the acoustic envelope. Entrainment to the speech envelope may reflect mechanisms specialized for auditory perception. Alternatively, entrainment may be a general-purpose cortical mechanism that optimizes sensitivity to rhythmic information regardless of modality. We test these proposals by examining cortical entrainment to rhythmic fluctuations in the visual amplitude of sign language. First, we develop a metric to characterize visual amplitude at each time-point. We demonstrate quasi-periodic fluctuations in the amplitude of sign language, and show that oscillations tend toward lower frequencies in sign than in spoken language. Next, we test for entrainment of neural oscillations to visual oscillations in sign language, using electroencephalography (EEG) in fluent speakers of American Sign Language (ASL) as they watch videos of ASL. We find significant cortical entrainment to visual oscillations in sign language. Coherence to sign language emerges only below 5 Hz, and peaks at about 1 Hz. Although coherence to speech is strongest over auditory cortex, we find the strongest coherence to sign at occipital and parietal sites. These results demonstrate that cortical coherence to linguistic stimuli does not depend on neural processes specific to auditory perception of speech. Low-frequency oscillatory entrainment may reflect a general cortical mechanism that maximizes sensitivity to informational peaks in time-varying signals.

Topic Area: LANGUAGE: Other

ERP correlates of early phonological processing in deaf and hearing readers: Do they reflect the same underlying mechanisms?

Poster B67, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Eva Gutierrez[1,2], Marta Vergara[1], Eva Rosa[3], Ana Marcet[1], Amelia Maña[1], Manuel Perea[1]; [1]University of Valencia, Spain, [2]University College London, [3]Catholic University of Valencia San Vicente Mártir

The poor reading skills often found in deaf readers are typically explained on the basis of underspecified print-to-sound mapping, and the accompanying poorer use of spoken phonology. Studies using explicit phonological tasks have shown that deaf readers can use phonological codes when required. However, studies investigating the automatic use of phonological codes have not provided a clear answer of whether deaf and hearing readers use these codes in the same manner. The present ERP study used a masked sandwich priming technique to maximize the chance of detecting an automatic pseudohomophone effect in a group of deaf readers. Data from a group of hearing readers of similar age, socioeconomic variables and reading habits was also collected. EEG was recorded while participants performed a lexical decision to targets (CORAL) preceded by a pseudohomophone (koral) or an orthographic control (toral). Behavioral and electrophysiological effects of phonological priming were found in both groups. In line with previous research, hearing participants exhibited lower amplitudes for the pseudohomophone condition in both N250 (left anterior) and N400 (widely distributed) components. Deaf participants showed a difference in the same direction, but the phonological effect had a right-frontal distribution in both components. Furthermore, the N400 was shorter. These findings reveal that deaf readers use phonological codes early during visual-word recognition, but they might use them in a different manner than hearing readers. We will discuss the nature of these phonological influences and their relationships to reading ability in the context of current models of lexical access.

Topic Area: LANGUAGE: Other

Cortical plasticity of sentence processing after classroom-based training experience

Poster B68, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Zhenghan Qi[1], Michelle Han[1], Jennifer Minas[1], Amy Finn[2], John Gabrieli[1]; [1]Massachusetts Institute of Technology, [2]University of Toronto

Foreign language learning by adults typically takes place in a classroom setting, which simultaneously exposes learners to new and complex rules in phonology, morphosyntax, orthography, and vocabulary. The present study investigates how neural substrates underlying foreign sentence processing is reshaped by an intensive four-week Mandarin course in 24 adult native speakers of English. We employed a sentence-picture matching fMRI task in English, Mandarin and a miniature artificial language (MAL) that learners were never exposed to. Before training, participants' in-scanner accuracy in both Mandarin and MAL conditions was not significantly different from 50% chance level. After training, participants showed greater gain in Mandarin than both English and MAL (F's (1,23) > 6.8, p's < .02). fMRI contrast between Mandarin and MAL changed significantly over the course of training. Before training, Mandarin sentences elicited greater activation in the right superior temporal gyrus (STG) than MAL sentences, indicating participants' initial sensitivity to the tonal feature of Mandarin. After training, Mandarin sentences showed greater increased activation at left inferior frontal gyrus, superior parietal lobule, posterior STG and inferior temporal gyrus. Moreover, activation at left IFG in response to Mandarin as opposed to MAL prior to learning is associated with learners' future success in acquiring holistic Mandarin skills assessed at the end of the course (voxel-wise $p < 0.001$, cluster-wise $p < 0.05$). These results highlight the dynamic plasticity of left language network at an ecologically valid learning environment and reveal the key role of left IFG in preparing learners for effective learning.

Topic Area: LANGUAGE: Other

The brain dissociates between different levels of prediction during language comprehension

Poster B69, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Gina R. Kuperberg[1,2,3,4], Edward W. Wlotko[1,5], Simone J. Riley[1], Margarita Zeitlin[1], Maria Luiza Cuhna-Lima[1]; [1]Tufts University, [2]Massachusetts General Hospital, [3]Athinoula A. Martinos Center for Biomedical Imaging, [4]Harvard Medical School, [5]Moss Rehabilitation Research Institute

Comprehenders continually use context to generate probabilistic predictions. We asked whether and how these predictions influence neural processing of incoming words. Mini-discourse contexts varied in their constraint for a specific lexical item or event structure. Event-related potentials were recorded to nouns that fulfilled lexical predictions, that violated lexical predictions but were plausible, or that violated the preceding verb's selectional restrictions ('They cautioned the SWIMMERS / TRAINEES/ DRAWER' following a context about lifeguards and sharks). Semantic facilitation was reflected by a selective reduction of the N400 on predictable nouns. Plausible nouns that violated lexical predictions selectively elicited a late anteriorly-distributed positivity, whereas nouns that violated selectional restrictions elicited a late posteriorly-distributed positivity. These dissociable neural signatures of prediction violations at different levels of representation provide support for a hierarchical generative architecture in which bottom-up information is continually evaluated against top-down predictions at multiple levels of representation to support ongoing comprehension.

Topic Area: LANGUAGE: Semantic

Cerebral Asymmetries in Metaphor Comprehension: Examining the Influence of Task

Poster B70, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Natalie Kacinik[1,2], Kole Norberg[1,3]; [1]Brooklyn College, CUNY, [2]The Graduate Center, CUNY, [3]Kingsborough Community College, CUNY

Right hemisphere (RH) involvement in comprehending metaphors remains unclear. Most neuroimaging (Rapp et al., 2012; Yang, 2014) and a prior divided visual field (DVF) study (Kacinik & Chiarello, 2007) have found that the RH is generally not more important the LH. However, investigations using brain-lesioned participants (Brownell et al., 1990; Lundgren et al., 2011) or TMS (Pobric et al., 2008; Kacinik et al., 2014 CNS poster) do support the RH as preferentially involved in metaphor comprehension, indicating that RH importance for understanding metaphors may not be fully evident until RH processes have been impaired. Although the studies by Kacinik and colleagues used the same stimuli, the DVF and TMS experiments involved different tasks (lexical decision vs. relatedness judgments, respectively), which may have contributed to the discrepant results. The current study thus involved presenting the same stimuli in a DVF paradigm with lateralized target words and asked participants to deciding whether the word was related to the meaning of the preceding sentence or not. Participants were slightly faster at responding to metaphorically related words in the LVF/RH than the RVF/LH, but the effect was not statistically significant. There was also evidence of a speed-accuracy trade-off since they made more errors to metaphorically related targets in the LVF/RH than in the RVF/LH. These findings, in conjunction with our previous work, suggest that there is normally little to no evidence of preferential RH involvement in metaphor comprehension, but that the potential importance of RH contributions becomes more evident when those processes are disrupted.

Topic Area: LANGUAGE: Semantic

Motor cortex in figurative language comprehension: a TMS study

Poster B71, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Yury Shtyrov[1,2], Elena Kulkova[2], Matteo Feurra[2], Andriy Myachykov[2,3]; [1]Aarhus University, Denmark, [2]NRU Higher School of Economics, Moscow, [3]Northumbria University, Newcastle upon Tyne

The embodied cognition view postulates that comprehension of concrete action-related language involves the brain's motor systems. It remains unclear, however, whether they similarly contribute to the processing of figurative and abstract language. Here, we used TMS of primary motor cortex (M1) to investigate its involvement in concrete and figurative language processing. Participants read literal ('she took the bag'), idiomatic ('she took the chance') and metaphoric ('she took the proposal') sentences incorporating action-related words as well as action-unrelated and abstract sentences. Single-pulse TMS was delivered to left M1, right M1 or control site (vertex). Sentence comprehension was assessed using a semantic judgement task (SJT). While SJT reaction times were generally affected by TMS, this effect diverged between sentence types and hemispheres depending on the action reference. In the left hemisphere, comprehension of metaphoric and abstract sentences was inhibited by TMS regardless of the action verb inclusion. Literal and idiomatic sentences showed a similar pattern for action-unrelated stimuli while faster RTs were observed for literal and idiomatic expressions incorporating action words, suggesting a facilitatory effect of M1 TMS on their comprehension. Right-hemispheric TMS significantly facilitated processing of literal action-related sentences relative to action-unrelated ones, while RTs for other sentence types did not depend on action reference. Our data suggest that motor-related semantics engages motor cortex in the processing of both literal and idiomatic semantics, this effect being underpinned by differentially lateralised cortical networks. Metaphors, however, do not show similar reliance on action semantics, likely due to referential connections outside the motor cortex.

Topic Area: LANGUAGE: Semantic

Lesion Analysis of Single-Word Auditory Comprehension in 109 Patients

Poster B72, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Juliana Baldo[1], Carl Ludy[1], Brian Curran[1], And Turken[1], Nina Dronkers[1,2]; [1]VA Northern California Health Care System, [2]University of California, Davis

In the current study, we sought to better understand the neural basis of single-word auditory comprehension. Previous studies have produced mixed results with respect to the brain regions involved in this process, primarily implicating various areas in the left middle and superior temporal gyri (MTG and STG). From our database, we identified 109 chronic left hemisphere stroke patients (10 female) who met strict inclusion and exclusion criteria. Single-word auditory comprehension data from the Western Aphasia Battery were analyzed retrospectively and correlated with patients' lesion sites using voxel-based lesion symptom mapping (VLSM). For the auditory comprehension task, patients were asked to point to 60 different objects, drawings, and body parts (e.g., cup, flower, right shoulder). Patients' language and auditory comprehension deficits ranged from very mild to severe. For the VLSM analysis, we used a relatively conservative method (permutation testing) to generate a significant t-value cutoff score with which to evaluate the significance of the findings. The analysis only included voxels in which at least five patients had lesions, and statistical power was high in the left MTG and STG, the focus of the study. The results of the VLSM analysis showed that the maximum t-value of 7.51 was located in the left posterior MTG (-40, -70, 8). Additional significant voxels were primarily focused along the axis of the left MTG, from middle to posterior MTG. These data indicate a critical role for the left MTG, most specifically the posterior left MTG, for the processing of single words.

Topic Area: LANGUAGE: Semantic

Linguistic and Non-Linguistic Semantic Processing in Individuals with Autism Spectrum Disorders: An ERP Study

Poster B73, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Emily Coderre[1], Mariya Chernenok[1,2], Barry Gordon[1,3], Kerry Ledoux[1]; [1]Cognitive Neurology/Neuropsychology, Department of Neurology, The Johns Hopkins University School of Medicine, [2]Center for Mind and Brain, University of California, Davis, [3]Department of Cognitive Science, The Johns Hopkins University

Individuals with autism spectrum disorders (ASD) experience difficulties with language, particularly with higher-level functions such as semantic integration. Some studies have suggested that this semantic integration deficit is specific to language. However, this appearance of specificity may have been caused by the use of cross-modal stimuli to compare linguistic and non-linguistic semantic processing. Using a semantic priming task with EEG, we compared within-modality lexico-semantic processing (pairs of written words) and visuo-semantic processing (pairs of pictures) in adults with ASD and adults with typical development (TD). Both groups showed an N400 effect (i.e. larger negative amplitude for unrelated than related stimulus pairs) in response to picture pairs, indicating intact visuo-semantic processing in the ASD group, as predicted. However, in contrast to previous studies, the ASD group also showed successful lexico-semantic processing, with similar N400 effects between groups for word stimuli. Nonetheless, subtle differences in the timing and topography of the N400 effect suggested different lexico-semantic processing mechanisms between groups. Specifically, an earlier frontal negativity, interpreted as an N300, was observed for the TD group while a later right-lateralized parietal N400 effect, interpreted as an N400RP, was observed for the ASD group. The N300 has been attributed to expectancy-based processes in semantic priming, while the N400RP has been attributed to semantic matching and more strategic processes of post-lexical semantic integration. These findings suggest that the two groups used different strategies to achieve successful lexico-semantic processing: an expectancy-based strategy for the TD group and a controlled post-lexical integration strategy for the ASD group.

Topic Area: LANGUAGE: Semantic

The impact of minimal context on predictions generated during sentence comprehension

Poster B74, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Edward W. Wlotko[1,2], Bram Vandekerckhove[2], Connie Choi[2], Minjae Kim[2,4], Gina R. Kuperberg[2,3,4,5]; [1]Moss Rehabilitation Research Institute, [2]Tufts University, [3]Massachusetts General Hospital, [4]Athinoula A. Martinos Center for Biomedical Imaging, [5]Harvard Medical School

We examined the impact of minimal context on the brain's responses to fulfilled or unfulfilled predictions during language comprehension. Proper names were paired with verbs that were either predictive or not predictive of a specific direct object noun (John evacuated...vs. John departed...). Nouns were either predictable (John evacuated the BUILDING), unpredictable but plausible (....the SUBWAY), or they violated selection restrictions of the verb (...the PASTE). We observed semantic facilitation on predictable nouns, as reflected by a selective reduction of the N400 amplitude. However, unlike context effects observed in discourse contexts, later positivities were not robustly elicited on nouns that either violated the verb's lexical predictions or its selection restrictions. Thus, minimal context based on the lexical properties of a verb may not provide enough time or promote a rich enough representation of context for the brain to generate and commit to specific lexical or event structure predictions during online comprehension.

Topic Area: LANGUAGE: Semantic

The effects of aphasia on nonverbal counting tasks

Poster B75, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Alexander Kranjec[1,2], John Verbos[1], Sarah Wallace[1]; [1]Duquesne University, [2]Carnegie Mellon University

Both English-speakers whose access to number language is artificially compromised by verbal interference and the Pirahã (an Amazonian tribe without exact number words) appear to rely on analog magnitude estimation for representing non-symbolic exact quantities greater than 3. Here, participants with left-hemisphere damage from stroke and resulting aphasia performed the same 5 nonverbal matching tasks from previous studies. Nonverbal matching performance was poorest when targets were not visible during response (71% correct) and best when targets were presented as subitizable groups of 2 and 3 (98% correct). Coefficients of variation for particular tasks, and significant correlations between target magnitude with both error rate and size across tasks, suggest use of analog magnitude estimation for verbally impaired participants. Western Aphasia Battery-Revised subtest scores were reliably correlated with performance across counting tasks suggesting ways that diverse forms of language impairment may contribute to errors on nonverbal counting tasks. A subset of participants completed additional numeric tests (numeral elicitation, confrontation naming with Arabic numerals, and free counting tests) and tests of nonverbal semantic processing and short-term memory (pyramid and palm trees, and semantic category probe tests) in order to better understand errors on nonverbal matching tasks. Results indicate that deficits reflected by major impairments on verbal counting tests and more general semantic impairments can both contribute to errors in the representation of exact-quantity. This study suggests ways that investigations of neurological populations may help us to better understand the bases for language-related effects on nonverbal processing across diverse neurotypical populations.

Topic Area: LANGUAGE: Semantic

Pragmatic humor influences semantic prediction and conflict resolution in online comprehension: Evidence from ERPs

Poster B76, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Megan Zirnstein[1], Amy Kinsey[2], Rhonda McClain[2], Sybrine Bultena[3], Dorothee Chwilla[3], Judith F. Kroll[1,2]; [1]University of California, Riverside, [2]Pennsylvania State University, [3]3Donders Institute for Brain, Cognition, and Behaviour, Radboud University, Nijmegen

Comprehenders are capable of forming expectations for the meanings of upcoming words, and accommodating potential processing costs due to prediction error, reflected, for example, by a late, frontally-distributed and positive event-related potential (ERP) found in response to unexpected words, even during the comprehension of jokes (Coulson & Williams, 2005). However, when the context is pragmatically constrained (e.g., by speaker identity) little evidence is found for this type of prediction cost (e.g., a child speaker saying: "Every evening I need some… wine"; van Berkum et al., 2008; Foucart et al., 2015). The current study attempts to clarify this discrepancy in the literature by assessing the influence of humor when pragmatic constraint is violated and prediction errors occur. Participants viewed pairs of pictures and sentences while their EEG was recorded. Pictures depicted the identity of the individual communicating the following sentence (e.g., the Queen of England) and ERPs were time-locked to critical words embedded in the sentence (e.g., "Every day, I drink…") that were either expected (tea), unexpected (juice), or both unexpected and humorous (gin). Results showed a frontally-distributed positivity in response to both unexpected conditions. However, this effect was larger in pragmatically humorous contexts. The presence of prediction error costs may reflect attempts to revise mental models for future predictive processing (Kuperberg & Jaeger, 2015) or to suppress a previous prediction (Zirnstein et al., in submission), processes which may both be susceptible to the presence of humor.

Topic Area: LANGUAGE: Semantic

Precursors and Processes of Prediction: A Word-Stem Completion ERP Study

Poster B77, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Ryan J. Hubbard[1], Kara D. Federmeier[1]; [1]Beckman Institute, University of Illinois, Urbana-Champaign

Prior behavioral and electrophysiological research has demonstrated that individuals generate predictions about upcoming information during language processing. Although there is a large body of work examining the consequences of prediction when an expected or unexpected word is encountered, much less is known about the processes that occur as predictions are being formed. Here, we used a novel paradigm to investigate the neural processes associated with encountering more and less constraining language cues. First, over 100 individuals completed 330 3-letter word stems with the first word they could think of. This gave us probability distributions for each completion for each stem, allowing us to calculate entropy for the word stems. We could then manipulate both the constraint (entropy) of the stem and the predictability (probability) of the completion. In a separate ERP experiment, subjects were shown a stem, told to generate a completion, and then shown either a high probability completion, a low probability completion, or a pseudoword that started with the same letters as the stem; participants reported whether the presented completion was the one they had generated. N400 responses to the completion were graded with probability (even for words that were not predicted), such that high probability < low probability < pseudoword, aligning with results manipulating cloze probability in sentences. Importantly, at the presentation of the word stem, the N400 was modulated based on entropy, with low entropy stems eliciting smaller N400s. Thus, prior to any confirmation of predictions, the N400 was affected by the predictability of upcoming information.

Topic Area: LANGUAGE: Semantic

Neurocognitive effects of sentential constraint in visual word recognition

Poster B78, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Nyssa Bulkes[1], Darren Tanner[1]; [1]University of Illinois at Urbana-Champaign

Prior work using event-related brain potentials (ERPs) shows neural sensitivity to visual anomalies in highly constraining environments (Kim & Lai, 2012). This work describes a feed-forward feedback architecture that is sensitive to constraint information, which uses context to inform the visual system about which features to expect in the upcoming input (i.e. spelling, orthography). Specifically, when embedded in highly constraining sentences, unexpected orthography modulates the N170 component, an effect which has also been tied to domain-general feature-detection processes (e.g. facial recognition). In a series of two experiments, we show that unexpected pseudohomophones (i.e. “metir” in place of expected “meter”) and targets containing letter transpositions (i.e. “meetr”) modulate the N170 amplitude. Additionally, these targets elicit a P600, indexing reanalysis and integration of these anomalies downstream, an effect that is shorter in duration for illegal strings (i.e. “czlxn”). However, it is unknown whether, in language processing, these responses are contingent upon strong top-down, contextual cues, or whether visually anomalies of any kind elicit this early sensitivity. Data from our second study show that, when embedded in neutral contexts, visual anomalies do not elicit an N170 component, but just a P600. These results have implications for neurocognitive models of visual word recognition, highlighting the N170 as an index of feature detection only in cases where comprehenders can form expectations for the visual system. Our data suggest that, when constraint is weak, the visual system abstains from form-based anticipatory expectations.

Topic Area: LANGUAGE: Semantic

Harry Potter and the Chamber of WHAT?: Real-time semantic access is a function of the individual’s knowledge

Poster B79, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Melissa Troyer[1], Marta Kutas[1]; [1]University of California, San Diego

Understanding the meaning of a word relies on rich sources of contextual information. However, models of language comprehension often neglect a critical source of variability: the comprehender’s knowledge. We used event-related brain potentials to test the extent to which real-time semantic access, inferred from N400 effects, is a function of comprehenders’ knowledge. As a test case, we chose the world of Harry Potter. Young adults who varied in knowledge of Harry Potter read sentence pairs which were Predictable (true to the stories) or Unpredictable (not true to the stories), e.g., ‘Harry has a patronus. It takes the form of a STAG (Predictable)/LIZARD (Unpredictable).’ Participants additionally read stories about general topics ending in a Predictable or Unpredictable word. As expected, knowledge about Harry Potter did not influence processing of sentences about general topics. By contrast, for Harry Potter stories, the size of the N400 effect varied with the participant’s knowledge: the most knowledgeable participants exhibited the largest effects, and the least knowledgeable participants exhibited the smallest (or no) effects. These effects were driven by responses to predictable items, which were graded according to knowledge. We conclude that real-time semantic access relies on the individual’s domain-specific knowledge. The results underscore the importance of considering knowledge-based individual differences in models of online language comprehension. Future studies aim to disentangle whether these knowledge-dependent effects are determined strictly by the proportion of experimental items any given individual knows, or are additionally influenced by an individual’s depth or breadth of knowledge about the domain.

Topic Area: LANGUAGE: Semantic

Adult Second Language Learning and Semantic Integration as Revealed by EEG and Eye-tracking

Poster B80, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Kiera O'Neil[1], Ana Zappa[2], Jean-Marie Pergandi[2], Aaron Newman[1], Daniel Mestre[2,3], Cheryl Frenck-Mestre[2,3]; [1]Dalhousie, [2]Aix Marseille Université, [3]Centre National de la Recherche Scientifique

The current study used a computerized learning paradigm to test second language (L2) learning. Native French speakers learned Brazilian Portuguese vocabulary during a 6-day study. On each of 3 learning days, participants learned 3 verbs and 12 nouns in 30-minute sessions. Both EEG and eye-tracking were used as learning assessments, as it has been argued that combining EEG assessment with eye-tracking can provide a more complete picture of second language processing, given that studies using one or the other method can show different results. We found an N400 effect for mismatch trials compared to correctly matched audio-visual trials at post-training, meanwhile no modulation of the N400 was observed pre-training. More importantly, unlearned images that were semantically related to learned words produced a reduction of the N400 component compared to mismatched pairs. This semantic priming effect suggests that the words in the new language were rapidly integrated with existing semantic networks, rather than existing as an isolated second language lexicon. We also assessed semantic integration via a visual world paradigm in which learned L2 targets were presented in an array with semantically related competitors, and unrelated distractor images. In line with our EEG findings, semantically related images are expected to compete with target items, providing further evidence for rapid integration of L2 words into existing semantic networks. Our results indicate that L2 vocabulary can be rapidly acquired by adult learners and newly acquired vocabulary quickly forms connections to related words within the existing lexicon.

Topic Area: LANGUAGE: Semantic

Representational similarity in the brain and computational language processing: New clues about the neural encoding of word meaning.

Poster B81, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Francesca Carota[1,2,3,4], Hamed Nili[2,5], Nikolaus Kriegeskorte[2,3], Friedemann Pulvermüller[1,2,4]; [1]Humboldt Universit ät zu Berlin, Germany, [2]MRC Cognition and Brain Sciences Unit, Cambridge, UK, [3]University of Cambridge, Downing Street, Cambridge, CB2 3EB United Kingdom, [4]Freie Universität, Berlin, Germany, [5]University of Oxford, Oxford, UK

Language comprehension engages a distributed network of fronto-temporal, parietal and sensorimotor regions, but it is still unclear how meaning of words and their semantic relationships are represented and processed within these regions and to which degrees lexico-semantic representations differ between regions and semantic types. We used fMRI and Representational Similarity Analysis, RSA, to relate word-elicited multi-voxel patterns to latent semantic similarity among categories of action (face-, arm-, leg-related verbs) and object (animal-, food, tool-related nouns) words, as assessed by distributional statistics performed on text corpora (Latent Semantic Analysis, LSA). In left inferior frontal (BA 44-45-47), left posterior middle temporal and left precentral cortex, the similarity structure of brain response patterns conformed to the semantic similarity among action-related verbs, as well as - across lexical semantic categories - between action verbs and tool-related nouns and, to a degree, between action verbs and food nouns, but not between action verbs and animal nouns. Instead, posterior inferior temporal cortex exhibited a reverse response pattern, which reflected the semantic similarity among object-related nouns, but not action-related words. These results show that semantic similarity among categories of is encoded by a range of cortical areas, including multimodal association (e.g., anterior inferior frontal, posterior middle temporal) and modality-preferential (premotor) cortex and that the representational geometries in these regions are partly dependent on semantic type, with semantic similarity among action-related words crossing lexical-semantic category boundaries. Furthermore, these findings suggest that distributional information about word co-occurrence is relevant to shape word representations in the brain.

Topic Area: LANGUAGE: Semantic

A neurocomputational model of lexical-semantic memory based on feature representation of concepts

Poster B82, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Cristiano Cuppini[1], Eleonora Catricalà[2], Elisa Magosso[1], Stefano Cappa[2], Mauro Ursino[1]; [1]University of Bologna, Italy, [2]IUSS, Pavia, Italy

The lexical-semantic representation of concepts is object of active research in cognitive neuroscience, but the fundamental neural mechanisms are still debated. Several frameworks conceive concepts as sets of semantic features. However, the contribution of the different features in concept identification remains still to be identified. Aim of this work is to investigate, through an attractor neural network, the role of different semantic features in concept identification, simulating both normal and neurodegenerative conditions. The model includes semantic and lexical layers, coding for object features and word-forms respectively. Synapses are created using Hebb rules of potentiation and depotentiation. The main novelty consists in the use of a fixed presynaptic threshold and a post-synaptic threshold that increases with the frequency of features (linked to its saliency). This allows the formation of Semantic networks (auto-association) and lexical-semantic networks (hetero-association) with asymmetrical synapses, able to store for any given concept the effective saliency of each feature. The model was tested with two taxonomies: animals and tools, taken from a database of concept features, including shared and distinctive features with different saliency. The trained network solves object-recognition and object-naming tasks, providing a different role for salient vs. marginal features in concept identification. In case of damage, superordinate concepts are preserved better than the subordinate ones. Interestingly, the degradation of salient features, but not of the marginal ones, prevents object identification. The model suggests that Hebb rules, with adjustable post-synaptic thresholds, can provide a reliable semantic representation of objects, exploiting the statistics of input features.

Topic Area: LANGUAGE: Semantic

tDCS to premotor cortex changes action verb understanding: Complementary effects of inhibitory and excitatory stimulation

Poster B83, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Tom Gijssels[1,2], Richard B. Ivry[3], Daniel Casasanto[1]; [1]University of Chicago, [2]Vrije Universiteit Brussel, Belgium, [3]University of California, Berkeley

Do neural systems for planning motor actions play a functional role in understanding action language? Across multiple neuroimaging studies, processing action verbs correlates with somatotopic activity in premotor cortex (PMC). Yet, only one neurostimulation study supports a functional role for PMC in action verb understanding: paradoxically, continuous theta-burst TMS over left PMC, a protocol assumed to disrupt processing, made people respond faster to action verbs. Here we investigated the effect of PMC excitation or inhibition on action verb understanding using transcranial Direct Current Stimulation (tDCS). Right-handers received bilateral stimulation to PMC hand areas, either exciting left PMC (anode placed over left PMC, cathode over right PMC) or inhibiting left PMC (electrode placement reversed). Then, participants made lexical decisions on unimanual action verbs and abstract verbs. tDCS polarity selectively affected response accuracy to unimanual action verbs. Inhibitory left PMC stimulation caused a relative improvement in performance for right-hand responses, consistent with our cTBS results, whereas excitatory left PMC stimulation caused a relative impairment. tDCS polarity did not differentially affect responses to abstract verbs. These complementary effects of exciting and inhibiting left PMC suggest that action language understanding does not depend on "all-or-nothing" activation of PMC, but rather relies on a complex balance of neural excitation and inhibition. Previous neurostimulation results showed that modulating PMC activity can influence how fast people respond to action verbs. The present results show that modulating PMC activity also affects how well people process action verbs, strengthening the evidence that motor simulations contribute to understanding action language.

Topic Area: LANGUAGE: Semantic

Value-Based Remembering and Executive Functioning in Aging

Poster B84, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Barbara J. Knowlton[1], Joseph P. Hennessee[1], Alan D. Castel[1]; [1]UCLA

For both younger and older adults, memory for items deemed valuable is better than memory for items considered less valuable. In the present study, we examined whether this value enhancement of memory was associated with executive function abilities as assessed by performance on the Wisconsin Card Sorting Test (WCST). Older (n=30) and younger (n=30) adult participants were cued to imagine being in different states of need ion each trial (e.g., hunger) and in different locations, then viewed objects that were congruent or incongruent with their state of need (e.g. hamburger or water bottle). Participants judged whether the presented object was congruent with the imagined state of need and also rated their own subjective value of the item. A surprise yes/no recognition test for items and locations was given after a 5 min delay. While recognition performance was significantly lower in older adults, both groups showed a significant benefit for items rated as congruent with imagined need and higher subjective value. While perseverative errors on the WCST were significantly correlated with overall recognition memory in older adults, there was no relationship between perseverative errors and the memory enhancing effects of either measure of value. These findings suggest that value may enhance memory in a relatively automatic fashion that is not dependent on executive abilities.

Topic Area: LONG-TERM MEMORY: Development & aging

Mental-orientation: A novel approach to Alzheimer's disease

Poster B85, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Gregory Peters-Founshtein[1,2], Michael Peer[1,2], Yanai Rein[1], Barak Yoresh[1,4], Shlomzion Kahana Merhavi[2], Zeev Meiner[3], Shahar Arzy[1,2]; [1]Neuropsychiatry Lab, Faculty of Medicine, Hadassah Hebrew University Medical School, Jerusalem, Israel, [2]Department of Neurology, Hadassah Hebrew University Medical Center, Jerusalem, Israel, [3]Departments of Physical Medicine and Rehabilitation, Hadassah University Medical Center, Jerusalem, Israel, [4]The Rachel and Selim Benin School of Computer Science and Engineering, Hebrew University, Jerusalem, Israel

Despite the high prevalence of Alzheimer's disease (AD), and its significant effects on individuals and society, its underlying mechanisms remain poorly understood. Clinical observations propose that a main pathology of AD is disorientation, which is defined as a disruption in the relation between the behaving self and the representations of events, places and people, leading us to hypothesize that disorientation may underlie several manifestations of AD. Recently, we introduced a novel approach to mental-orientation, which requires subjects to determine which of two familiar places, events or people is closer to themselves. Here we first tested this task in 60 patients, evenly distributed among AD, mild cognitively impaired (MCI) and healthy controls (HC). We then compared mental-orientation to standard neuropsychological tests in their diagnostic capacity, and used fMRI to differentiate between the brain regions active in mental-orientation and currently-used tests in young healthy participants. Our results show the mental-orientation task to clearly distinguish between AD, MCI and HCs, unlike currently-used tests. fMRI analysis revealed the mental-orientation task to activate the precuneus, middle temporal lobe and prefrontal cortex bilaterally, significantly overlapping the AD-implicated Default Network. The currently-used tests exhibited sparse activations, mostly at lateral occcipito-temporal cortices. Directly contrasting the two tasks revealed mental-orientation to preferentially activate regions aligned on a parietal-hippocampal axis, known to undergo early AD-related atrophy. Taken together, mental-orientation

task was found to surpass currently-used tests in classification of subjects along the AD-spectrum, and its predictions were supported by fMRI, linking it to preferential recruitment of specific AD-implicated brain regions.

Topic Area: LONG-TERM MEMORY: Development & aging

Roles of the posterior-anterior shift and of the parietal activation maintenance in age-related protective mechanisms involved in memory

Poster B86, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Emilie Alibran[1], Badiaa Bouazzaoui[1], Lucie Angel[1], Marie Gomot[1], Michel Isingrini[1]; [1]University of Tours

This study compared the brain maintenance (Nyberg et al., 2012) hypothesis and the reorganization-compensation posterior-anterior shift in aging hypothesis (Davis et al., 2007) to explain age-related possible protective mechanisms involved in episodic memory. Parietal and frontal old/new effect-event-related potentials were recorded while younger and older adults performed a word stem cued-recall task. In older adults, the brain maintenance was indexed as the individual parietal old/new activation level, whereas the reorganization-compensation posterior-anterior shift was indexed by computing an old/new frontal-parietal index for each individual reflecting the relationship between frontal and parietal activation. The results confirmed that the parietal old/new effect was of larger latency, of reduced magnitude and less lateralized in the older group than in the young group. They also showed a negative age-related effect on the frontal-parietal index supporting the posterior-anterior shift hypothesis. In agreement with the reorganization-compensation hypothesis, correlation analyses indicated that the older participants who presented a high level of memory were those showing the greater posterior-anterior shift. On the other hand, in disagreement with the brain maintenance hypothesis, the individual parietal activation level was not correlated with the memory performance in older adults. Overall, these findings support the view that age-related brain reorganization through a parietal-frontal shift in neural activation is better beneficial in old age than the maintenance of a high level of parietal activation.

Topic Area: LONG-TERM MEMORY: Development & aging

A Look at Age and Relational Memory: Explicit and Implicit Measures Show Differences in Relational Memory Performance Between Healthy Young and Older Adults

Poster B87, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

David Warren[1], Kelsey Spalding[2], Alice Olvera[2,3], Kevin Selden[2], Melissa Duff[4], Daniel Tranel[2]; [1]University of Nebraska Medical Center, [2]University of Iowa, [3]Loyola Marymount University, [4]Vanderbilt University

Relational memory processes bind together arbitrarily-related stimuli (e.g., faces and scenes) and are known to depend on the hippocampus. Meanwhile, the hippocampus is affected by healthy aging, and there is evidence that hippocampal-dependent relational memory degrades with age. However, studies of age and relational memory often use explicit measures (e.g., overt responses), but effects of relational memory are also evident in implicit measures (e.g., eye movements) even absent conscious awareness. Critically, implicit measures of relational memory in healthy aging are not currently available. This study tests the relationship between relational memory and age using explicit and implicit measures. Participants were recruited from two populations: younger adults (age 18-24; N=30); and older adults (50-84 y.o.; N=40). During the task, participants were asked to study face-scene pairs presented three times. Participants then completed a three-alternative forced-choice (3AFC) recognition task and a match-detection task. Relational memory performance was evaluated using both explicit measures (overt responses) and implicit measures (eye movements). Preliminary findings suggest that explicit memory performance during the 3AFC task was significantly impaired in older adults as compared to younger adults ($p<.05$). Analyses comparing eye-movements to selected matching faces (correct responses) versus selected non-matching faces (incorrect responses) revealed that for older adults a relational memory effect was attenuated ($p<.05$). Our findings illustrate a link between age and measures of explicit and implicit relational memory which could reflect underlying hippocampal volume loss. These effects could potentially be useful for early detection of age-related disease processes which affect the hippocampus such as Alzheimer's disease.

Topic Area: LONG-TERM MEMORY: Development & aging

Age differences in pre-stimulus subsequent memory effects: An event-related potential study

Poster B88, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Joshua Koen[1], Erin Horne[1], Nedra Hauck[1], Michael Rugg[1]; [1]University of Texas at Dallas

Pre-stimulus subsequent memory effects are thought to reflect proactive processes that benefit episodic memory encoding. The present study investigated age differences in pre-stimulus subsequent memory effects indexed by differences in ERP amplitude that occur just before the onset of successfully versus unsuccessfully encoded events. Healthy young and older adults incidentally encoded words for a subsequent memory test. Participants were given a task cue (X or O) before each word that cued which semantic judgment (shoebox or manmade) to perform on the word. Words were presented for either a short (300 ms) or long (1000 ms) duration

with the aim of placing differential demands on proactive processing initiated by the task cue. ERPs for subsequent successful and unsuccessful recollection were estimated time-locked to a task cue that onset 2000 ms before each study word. In young adults, a frontally distributed negative modulation of the pre-stimulus ERP predicted subsequent recollection success or failure in the short duration condition. A similar, but polarity reversed (successful > unsuccessful), pre-stimulus effect was observed for the long duration condition. These results suggest that proactive processes supporting encoding are sensitive to the perceptual demands made by the study item. By contrast, older adults showed no evidence of a pre-stimulus subsequent memory effect in the short duration condition and only a small negative going effect in the long duration condition. These results are broadly consistent with the proposal that older adults are less able to engage proactive processes that benefit memory encoding.

Topic Area: LONG-TERM MEMORY: Development & aging

Neural Responses Decrease While Performance Increases with Practice: A Neural Network Model

Poster B89, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Milena Rabovsky[1], Steven S. Hansen[2], James L. McClelland[2]; [1]Freie Universitaet Berlin, Germany, [2]Stanford University

The observation that neural responses decrease as behavior becomes faster and more accurate with practice is ubiquitous in neuroscience. Our work provides an account of this finding in terms of a shift in the relative roles of activation and strength of connections. We used a neural network model to simulate neural responses during language understanding, and examined the model's correlate of neural responses (specifically, the N400 component of the event-related brain potential), measured as the change in hidden layer activation induced by the current stimulus, at several time points during training of the network. We observed that the N400 magnitude first increased and then gradually decreased over the course of training while comprehension performance measured at the output layer showed a steady rise with additional practice. These results fit the empirical finding that N400 amplitudes first increase over the first few years of life and later decrease with age. Importantly, our results also speak to the issue of possible mechanisms underlying the reduction of neural activation with practice. In the model, the reduction in neural response is due to the continuous adaptation of connection weights over training. Specifically, as connection weights between the hidden and the output layer grow stronger, less activation at the hidden layer is necessary to efficiently modulate the output. This shift of labor from activation to connection weights might be an important mechanism contributing to the often observed reduction of neural activation with practice.

Topic Area: LONG-TERM MEMORY: Development & aging

The neural correlates of functional compensation in high performing older adults

Poster B90, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Abdelhalim Elshiekh[1], Sricharana Rajagopal[2], Stamatoula Pasvanis[2], Elizabeth Ankudowich[1], Natasha M Rajah[1,2]; [1]Department of Neuroscience, McGill University, [2]Douglas Mental Health University Institute and Department of Psychiatry, McGill University

Despite the common belief that cognitive decline is inevitable in older adulthood, recent evidence suggest that some older adults perform similarly to younger adults (YA) in a variety of cognitive tasks, including episodic memory tasks. Prior fMRI studies revealed that these "high"-performing older adults (HOA) exhibit increased PFC activity compared to lower-performing older adults (LOA), which may reflect functional compensation in the aging brain. However, this assumes that these groups only differ in brain activation patterns and performance, when in fact they may represent distinct subsamples in the population. In this fMRI study, we compared performance-related brain activity in YA, LOA and HOA during successful encoding and retrieval of spatial context memory tasks. The goal was to determine the patterns of functional compensation in HOA vs LOA compared to YA. We tested 24 LOA, and 20 HOA who were split based on performance on a separate temporal context memory task, and 45YA. Multivariate behaviour partial least square analysis (B-PLS) was used to identify patterns of whole-brain activity that correlate with performance across groups. Behaviourally, independent samples t-tests show that YA performed better than LOA but not HOA, while HOA scored higher than LOA. The B-PLS analysis indicated that compared to LOA, activity in medial PFC and ventral visual areas in HOA was predictive of successful encoding and retrieval. Interestingly, activity in those same areas was predictive of successful encoding and retrieval in HOA vs YA despite the comparable performance in both groups. Theoretical implications of these findings will be discussed.

Topic Area: LONG-TERM MEMORY: Development & aging

Empirical Validation of a Neuropsychological Battery to Assess Frontal Lobe and Medial Temporal Lobe Functioning in Young and Older Adults

Poster B91, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Anjali Thapar[1], Allen Osman[1]; [1]Bryn Mawr College

Neuropsychological tests sensitive to frontal lobe (FL) and medial temporal lobe (MTL) functioning are often used to characterize individual differences in FL and MTL functioning which, in turn, are used to explain age-related changes in cognition. Typically, high- and low- FL and MTL groups of older adults are compared on a cognitive

task to a control group of younger adults. Such comparisons, however, ignore individual differences in FL and MTL functioning that may occur independently of age. To address this problem, the current study evaluated both age-related changes and individual differences in FL and MTL functioning, as well as examined the association between each and memory performance. Three hundred participants (150 young and 150 older adults) completed a test battery that evaluated FL functioning (tasks measuring executive functioning, working memory, and mental control) and MTL functioning (tasks measuring immediate and delayed recall of verbal and visual memory). Participants also completed a yes/no item recognition memory task. Our results indicate that both young and older adult participants can be reliably differentiated into high- and low- FL and MTL groups and that individual differences in MTL functioning but not FL functioning is associated with reliable differences in performance in young and older adult participants on an item recognition test. Equally important, the results show that memory performance was completely explained by individual differences in MTL functioning. These results contribute to our growing understanding of the importance of investigating individual differences in MTL functioning when investigating age-related changes in episodic memory.

Topic Area: LONG-TERM MEMORY: Development & aging

Age-related dedifferentiation of anterior and posterior hippocampal structural whole-brain covariance

Poster B92, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Kristin Nordin[1], Jonas Persson[1], Eva Stening[1], Agneta Herlitz[2], Elna-Marie Larsson[1], Hedvig Söderlund[1]; [1]Uppsala University, Uppsala, Sweden, [2]Karolinska Institutet, Solna, Sweden

Structural whole-brain covariance, i.e. patterns of gray matter expressing associations among regions, potentially functionally significant, displays alterations in older age. Linked to memory impairments in both normal aging and Alzheimer's disease, decreases in covariance are interpreted as a sign of network decoupling, and increases as dedifferentiation of functional organization. Additionally, numerous studies report interrelated effects of age on regional hippocampal volume and memory performance, but even though the hippocampus interacts with distributed regions to support memory, little is known about age effects on hippocampal whole-brain structural covariance. Using voxel-based morphometry (VBM) and the multivariate approach partial least squares (PLS), we therefore assessed regional volume and structural covariance of the hippocampus in young, middle-aged and older adults (n=221), and measured spatial and episodic memory. Based on findings of a functional division along the hippocampal longitudinal axis, we specifically assessed age differences in relation to axis. Regional volume differences followed a posterior-to-anterior gradient across age groups, and performance on both memory tasks correlated negatively with age. There were two significant covariance patterns; a main pattern capturing common anterior and posterior whole-brain covariance, and a secondary pattern differentiating the two. While the first pattern was predominantly driven by the middle-aged and older groups, the second pattern was driven by younger and middle-aged women specifically. As this dedifferentiation of anterior and posterior structural covariance with increasing age was paralleled by inferior spatial and episodic memory, it is possible that memory organized along the hippocampal long-axis benefits from differentiation in structural covariance.

Topic Area: LONG-TERM MEMORY: Development & aging

Developmental Difference in Hippocampal Segmentation using FreeSurfer Compared with Manual Demarcation

Poster B93, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Qijing Yu[1], Roya Homayouni[1], Andrea Shafer[1], Naftali Raz[1], Noa Ofen[1]; [1]Wayne State University

There is growing interest in measuring the structural properties of the human hippocampus. In many investigations, researchers rely on automatic segmentation to calculate hippocampal volume. The validity of automatic hippocampal segmentation methods has recently been challenged, particularly when compared against manual demarcation in studies in older adults and young children. We assessed the agreement between hippocampal volumes estimated by manual morphometry and FreeSurfer—one of the most popular automatic segmentation software packages. For that purpose, we used intra-class correlation (ICC) in a sample of 5-25-year old participants (N=102). We found a modest agreement between manually measured volumes and the FreeSurfer output: ICC(3) left: 0.58-0.82, right: 0.44-0.84, total: 0.64-0.84. Consistent with prior findings, FreeSurfer overestimation was marginally more severe in younger compared to older participants: $F(1,99)=3.84$, $p=0.053$. In additional analyses, we truncated the range of the FreeSurfer segmentation to precisely match the range defined in the manual demarcation protocol, which is limited because of the poor visualization of the most anterior and posterior hippocampal boundaries. In this comparison, the ICC estimates were higher (ICC(3) left: 0.80-0.90, right: 0.78-0.91, total: 0.84-0.92), and FreeSurfer overestimation was no longer significant. However, the difference between hippocampal volumes estimated by the two methods became significantly age-dependent: $F(1,99)=5.33$, $p=0.02$. Thus, our findings provide additional evidence of the poor agreement between hippocampal volumes obtained by manual demarcation and FreeSurfer segmentation. Moreover, our results confirm the overestimation and age-related bias in FreeSurfer segmentation and call for caution in the interpretation of findings based on hippocampal FreeSurfer segmentation in developmental research.

Topic Area: LONG-TERM MEMORY: Development & aging

Vocabulary acquisition during sleep

Poster B94, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Marc Züst[1], Simon Ruch[1], Roland Wiest[2], Katharina Henke[1]; [1]University of Bern, Switzerland, [2]University Hospital of Bern, Switzerland

Recent evidence suggests verbal comprehension and simple nonverbal associative learning is possible during sleep. We investigated whether these findings can be combined to enable verbal associative learning, i.e. vocabulary acquisition, during sleep. We aurally presented novel vocabulary in the form of German-foreign word pairs during deep, slow-wave sleep and tested for sleep-learning after waking in an implicit test for semantic associations. Performance indicated that participants had established semantic word-word associations during slow-wave sleep even though they had no conscious awareness of sleep-learning. Electrophysiology indicated that sleep-learning can only occur if vocabulary is presented in-sync with slow wave peaks, which mark windows of opportunity for sleep-learning when neurons are excitable. Neuroimaging showed vocabulary retrieval was mediated by hippocampus and neocortical semantic storage sites in the temporal pole, as well as parietal- and frontal brain regions associated with vocabulary learning. These findings suggest that humans can encode new hippocampus-dependent semantic associations and commit them to long-term memory during a state of unconsciousness, like deep sleep.

Topic Area: LONG-TERM MEMORY: Episodic

Depth electrode recording of the amygdala-hippocampal network during mnemonic discrimination of emotional scenes

Poster B95, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Jie Zheng[1], Rebecca F. Stevenson[1], Logan D. Harriger[1], Stephanie L. Leal[2], Sumeet Vadera[1], Michael A. Yassa[1], Jack J. Lin[1]; [1]University of California, Irvine, [2]University of California, Berkeley

There is accumulating evidence that emotional arousal modulates mnemonic discrimination, the ability to discriminate between similar events or experiences. Results from a high-resolution fMRI study performed by our group suggest that this effect is mediated by interactions between the amygdala (AMY), a region critical for emotional processing, and the hippocampus (HC), which is thought to support mnemonic discrimination via pattern separation. However, higher temporal resolution is needed to characterize the dynamics of HC-AMY interactions. In the current study, we used AMY and HC depth electrode recordings in eight pre-surgical epilepsy patients to examine oscillatory activity during the discrimination of similar emotional and neutral scenes. Using a high-resolution MRI anatomical template coupled with post-implantation MRI scans, we were able to localize the depth electrodes within HC and AMY subregions. We analyzed theta (3-8 Hz) and gamma (70-150 Hz) power as well as theta coherence and found coordinated activity across HC and AMY that was modulated by memory and emotion. These results contribute to our growing understanding of the AMY-HC network and of how circuit-level interactions within this network influence the encoding and retrieval of episodic memory.

Topic Area: LONG-TERM MEMORY: Episodic

Older adults with one vs. no apolipoprotein E type 4 allele display different patterns of fMRI activity related to recognition, but not to spatial context

Poster B96, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

E. H. Yu[1,2], M-E Lafaille-Magnan[1,2], S. Pasvanis[2], S. Rajagopal[2], M.N. Rajah[1,2], PREVENT-AD Research Group[3]; [1]McGill University, [2]Douglas Mental Health University Institute, Montreal, Quebec, Canada, [3]https://preventad.loris.ca/team_2016_09_16.pdf

Episodic memory decline is characteristic of Alzheimer's disease. The apolipoprotein E type 4 allele (APOE4) increases risk for such dementia. We used fMRI technique to examine the relation of APOE4 status to brain responses in object recognition & spatial-context recall in healthy elderly with a family history of Alzheimer's. Some 25 APOE4-positive (mean age = 62 years) and 44 APOE4-negative (mean age = 64 years) older adults were recruited by the PREVENT-AD program (Montreal, Canada). Participants were instructed to memorize 48 coloured objects in their spatial context (left/right) during encoding. Following a 20-minute delay, participants were asked to recognize these old objects and to recall their spatial context among 48 new objects during retrieval. No group difference was found on test accuracy or reaction time. Multivariate Partial Least Square (PLS) analysis assessed group similarities and differences with this task on brain responses during encoding and retrieval. We observed a group*phase interaction for objects recognized without correct spatial context. Specifically, APOE4-positive adults activated the left medial temporal, inferior parietal, superior-middle temporal, posterior cingulate and fusiform cortices to a greater degree at encoding than at retrieval, whereas APOE4-negative adults activated these regions more at retrieval than at encoding. We conclude that APOE4 status affects recognition-related brain responses in older adults at high risk for Alzheimer's, even though such an effect is not apparent on behavioural levels.

Topic Area: LONG-TERM MEMORY: Episodic

Normal variation in relational memory and pattern separation can be predicted by white matter connectivity

Poster B97, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Chi Ngo[1], Kylie Alm[1], Athanasia Metoki[1], Nora Newcombe[1], Ingrid Olson[1]; [1]Temple University

To remember the last time you visited San Francisco, you need to discern between memories of similar conferences (pattern separation) as well as remember the relations between different aspects of the conference (relational memory), such as whom you saw and at which venue. Here we asked whether performance variation in pattern separation and relational memory depends on variation inherent in white matter. Healthy young adults learned 64 associations in an AB-AC structure (AB was shown in one context, and AC was shown in another context). Associations were tested by four-alternative-forced-choice. Half of the test trials taxed relational memory the other half taxed pattern separation. Probabilistic tractography on diffusion-weighted imaging data was used to examine structural connectivity between gray matter regions linked to the monkey and fMRI literatures to episodic memory. Consistent with past literature, fornix microstructure significantly predicted relational memory performance, whereas the left uncinate fasciculus microstructure significantly predicted pattern separation performance. Overall performance on both tasks significantly correlated with white matter microstructure connecting the left hippocampus and medial prefrontal cortex. Microstructure of control white matter tracts did not predict any memory measures. These findings indicate that even in healthy young adults, facility with specific aspects of episodic memory can be predicted by examining white matter in a fronto-temporal memory network.

Topic Area: LONG-TERM MEMORY: Episodic

Elucidating Neural Correlates of Olfactory Targeted Memory Reactivation in the Sleeping Human Brain

Poster B98, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Laura Shanahan[1], Eva Gjorgieva[1], Jay Gottfried[1,2]; [1]Northwestern University Feinberg School of Medicine, [2]Northwestern University Weinberg College of Arts and Sciences

Odors have been shown to be key agents in targeted memory reactivation (TMR), a technique used to manipulate sleep-based memory consolidation. During olfactory TMR, an odor is presented during learning, and then again during subsequent sleep (i.e., reactivation). TMR often results in enhanced performance for the associated memory task upon waking, but the neural mechanism underpinning these memory improvements is not well understood. Researchers speculate that reactivation cues bias memory replay toward associated memories. Here, we developed a novel olfactory TMR paradigm to test the hypothesis that odors evoke replay of associated memories in the sleeping human brain. First, subjects learn the locations of pictures belonging to specific categories during fMRI scanning. Next, subjects learn to associate each picture category with a unique odor. Then, half of the category-specific odors are presented in sleep during simultaneous EEG-fMRI recording. Our behavioral data suggests that reactivation improves memory performance for reactivated picture categories. Moreover, in an interference test following reactivation, reaction times for reactivated picture categories are increased, possibly reflecting a struggle to override the strengthened memory traces. Finally, we employ multivariate pattern classification of fMRI data to show that category-specific pictures elicit distinct ensemble patterns of neural activity during learning. In future analysis, we plan to directly test the hypothesis that odors promote replay of reactivated memory traces by searching for the re-emergence of category-specific fMRI activity during the reactivation phase.

Topic Area: LONG-TERM MEMORY: Episodic

Boosting the Brain: Frontal-midline Theta Neurofeedback Training and Its Transfer

Poster B99, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Kathrin C. J. Eschmann[1,2], Regine Bader[2], Axel Mecklinger[1,2]; [1]International Research Training Group "Adaptive Minds" (GRK 1457), [2]Saarland University, Saarbrücken, Germany

Enhancement of cognitive abilities is not only a challenge of a gradually aging society but also of a young achievement-oriented generation. Interestingly, cognitive control training studies demonstrate remarkable capacity for brain plasticity. One way of changing neural dynamics underlying successful cognitive performance is neurofeedback. Frontal-midline theta activity (4-8Hz) is proposed to reflect a cognitive control mechanism, which is needed for successful episodic memory retrieval, working memory performance or interference resolution. The present study aimed at investigating (1) whether frontal-midline theta activity can be enhanced by neurofeedback training and (2) whether this training transfers to cognitive and memory control abilities. Therefore, individual frontal-midline theta activity, derived from a pre-training session including an episodic memory task for concrete nouns and other cognitive control tasks, was trained over seven neurofeedback sessions. Preliminary results show that the theta training group exhibited a larger frontal-midline theta increase compared to an active control group who trained randomly chosen frequency bands. Moreover, performance from the pre-training session was compared to two post-training sessions that were conducted one day and thirteen days after the last neurofeedback session, respectively. In the second post-training session relative to the pre-training and the first post-training session the training group showed higher item memory performance compared to the control group, indicating less interference in the training group from material of the episodic memory task learned in previous sessions. The present study indicates a mechanism for cognitive enhancement in young adults with potential relevance for treatment of decline in cognitive control in old age.

Topic Area: LONG-TERM MEMORY: Episodic

The Lateral Parietal Cortex Processes both the Encoding and Retrieval of Spatial Long-Term Memories

Poster B100, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Oliver Gray[1], Daniella Ryding[1], Daniela Montaldi[1]; [1]University of Manchester

Our perception of the visual environment involves attending to information presented simultaneously in a variety of locations. Healthy individuals often show a subtle but significant bias to preferentially allocate attention to the left side of both visual and remembered space. These effects are known as perceptual and representational pseudoneglect, respectively. Surprisingly, the possibility that common mechanisms explain both biased perceptual attention allocation (perceptual pseudoneglect) and biased long-term memory retrieval (representational pseudoneglect) has never been explored. The lateral posterior parietal cortex has consistently shown activation during successful retrieval of episodic memories, using functional magnetic resonance imaging (fMRI). The investigation into this activation has yet to employ a method challenging attention allocation (and inducing a pseudoneglect bias) at encoding, and also requiring retrieval of episodic, long-term memory. We utilised fMRI whilst manipulating the location of images of objects at encoding (left versus right visual field) and employing a delayed forced-choice recognition task. We compared activity in areas of the brain associated with the allocation of attention with those associated with long-term memory retrieval. Critically, accuracy of delayed object recognition was greatest for items presented in the left visual field at encoding. Furthermore, we observed hemispheric lateralisation of cortical reactivation in the lateral parietal cortex during the retrieval of correctly identified, previously encountered images that reflected the side of visual space where the object was originally presented. This data provides a novel perspective on the lateral parietal cortex and provides an important complement to current theories of the neural bases of recognition memory.

Topic Area: LONG-TERM MEMORY: Episodic

Visual sampling predicts hippocampal activity

Poster B101, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Zhong-Xu Liu[1], Kelly Shen[1], Rosanna K. Olsen[1,2], Jennifer D. Ryan[1,2]; [1]Rotman Research Institute at Baycrest Health Sciences, Toronto, [2]University of Toronto

Eye movements serve to accumulate information from the visual world, contributing to the formation of coherent memory representations that support cognition and behaviour. The hippocampus and the oculomotor network are well connected anatomically through an extensive set of polysynaptic pathways. However, the extent to which visual sampling behaviour is related to functional responses in the hippocampus during encoding has not been directly studied in human neuroimaging. In the current study, participants engaged in a face processing task while brain responses were recorded with functional magnetic resonance imaging (fMRI) and eye movements were simultaneously monitored. The number of gaze fixations that a participant made on a given trial was significantly correlated with hippocampal activation, such that more fixations were associated with stronger hippocampal activation. Similar results were also found in the fusiform face area, a face-selective perceptual processing region. Notably, the number of fixations was associated with stronger hippocampal activation when the presented faces were novel, but not when the faces were repeated. Increases in fixations during viewing of novel faces also led to larger repetition-related suppression in the hippocampus, indicating that this fixation-hippocampal relationship may reflect the ongoing development of lasting representations. Taken together, these results provide novel empirical support for the idea that visual exploration and hippocampal binding processes are inherently linked.

Topic Area: LONG-TERM MEMORY: Episodic

Enhanced avoidance habits in people with a history of early-life stress

Poster B102, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Tara Patterson[1], Barbara Knowlton[1]; [1]University of California Los Angeles

Stress has been shown to increase appetitive habit behavior in both humans and nonhuman animals. It is possible that stressful experiences that occur during development may result in a long-lasting bias toward use of the habit learning system, due to the negative effects that stress has on brain regions involved in declarative memory and executive function. We were interested in testing whether people with a history of early-life stress would show a greater tendency toward habit behavior on an avoidance learning task. We conducted two experiments in which we measured self-reported early-life stress in adult participants who learned to make button press responses to avoid hearing aversive noises. After participants were trained on the responses, one of the responses was devalued, and we tested in extinction whether participants persisted in making the devalued response. We found that people who reported high levels of early-life stress were more likely to make the devalued response in extinction compared to people who reported low levels of early-life stress. These data provide support for the hypothesis that early-life stress alters the tendency toward habit responding, and demonstrate the utility of avoidance learning tasks in habit learning research.

Topic Area: LONG-TERM MEMORY: Other

Your favorite number is special (to you): ERP evidence for item-level differences in retrieval of information from numerals

Poster B103, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Danielle S. Dickson[1,2], Kara D. Federmeier[2]; [1]University of Texas at San Antonio, [2]University of Illinois at Urbana-Champaign

Arabic numerals have come to be used for many purposes beyond representing a particular quantity (e.g., as a label for an athlete on their jersey). However, in the numerical cognition literature, relatively little attention has been to paid to how this kind of meaning information is accessed and utilized by readers. Motivated by previous work showing that item-level ratings of personal familiarity can influence memory retrieval on the N400 (indexing initial semantic access) and on later positivities (indexing explicit memory retrieval), we recorded ERPs while participants read and rated Arabic numerals, presented in a list, for whether or not they were familiar/personally meaningful to them. The list was structured so that critical items (all double-digit numbers, 10-99) happened to repeat after a few intervening trials. The effect of repetition on the N400 was not impacted by subjective judgments of familiarity, suggesting that all numbers (personally meaningful or not) make initial contact with semantics, facilitating semantic access on second exposure. However, consistent with other similar studies of memory for visual patterns and letter strings, there was a late positivity (LPC) on second presentation, selective to numerals rated as familiar. This is the first evidence that readers can use Arabic numerals to guide explicit retrieval of non-numerical information.

Topic Area: LONG-TERM MEMORY: Other

Forgotten visual events from a naturalistic TV-viewing paradigm are associated with higher inter-trial coherence in the alpha band of the EEG

Poster B104, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Daniel A. Rogers[1], Phillip M. Alday[1], Andrew W. Corcoran[1], Jessica Gysin-Webster[1], Magdalena Nenycz-Thiel[2], Duane Varan[3], Matthias Schlesewsky[1], Ina Bornkessel-Schlesewsky[1]; [1]School of Psychology, Social Work and Social Policy, University of South Australia, [2]School of Marketing, University of South Australia, [3]MediaScience, Austin, Texas, USA

Oscillatory activity in the EEG alpha band (approximately 8–12 Hz) is known to be associated with memory performance (e.g. prestimulus power/phase differences at encoding predict working memory performance[1]). However, previous studies in this domain have used highly controlled experimental environments with explicit task demands. Here, we examined the relation between prestimulus alpha activity and success of memory encoding in a more naturalistic environment. Forty-two participants (28 female; mean age: 31 years; range 18–62) watched an hour of TV (two episodes of a popular comedy show) interspersed with 60 advertisements (36 from a previous study [2]; presented in 7 ad breaks), while their EEG was recorded. Video stills of 108 visual events within the ads were presented to participants as part of a surprise recall task following the TV viewing, interspersed with an equal number of unseen images. We examined alpha power and inter-trial coherence (ITC) at individual alpha frequency during the prestimulus interval for critical events, sorted by recall performance (hit/miss). Statistical analyses were performed using mixed-effects models. Results showed no relationship between prestimulus alpha power and recall, but significantly higher ITC for misses versus hits. These findings provide an initial indication that the systematic relationship between alpha phase and memory recall generalises to naturalistic settings without an explicit task. 1. Myers NE et al. (2014). J Neurosci, 34(23), 7735-7743. 2. Varan D et al. (2016). Advertising Research Foundation Re!Think 2016 Conference, New York.

Topic Area: LONG-TERM MEMORY: Other

Age-related changes to hippocampal and neocortical oscillations during relational binding and comparison.

Poster B105, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Renante Rondina[1,2], Rosanna Olsen[1], Morgan Barense[2], Jed Meltzer[1,2], Jennifer Ryan[1,2]; [1]Rotman Research Institute, [2]University of Toronto

Recent models of hippocampal function have emphasized its role in relational binding and comparison – the ability to form lasting representations regarding the relations among distinct elements, and the ability to evaluate current perceptual input to previously formed representations, respectively. The present study used magnetoencephalography to examine the extent to which aging is associated with changes in the recruitment of oscillatory activity within hippocampal and neocortical regions to support relational binding, maintenance, and comparison processes during a short delay visuospatial memory task. Participants were required to bind the relative visuospatial positions of objects that were presented singly across time. After a 2 second delay, the objects were re-presented simultaneously, and participants were required to indicate whether the relative spatial positions among the objects had been maintained. Younger and older adults performed with similar accuracy. Over the encoding period, younger adults uniquely showed a change in theta power (~5 Hz), whereas older adults uniquely showed a change in alpha (~10 Hz) power. Over the maintenance period, younger and older adults showed similar theta, alpha, and beta (~20 Hz) activity. Over the retrieval period, older adults showed a stronger theta, alpha, and beta response than younger adults. These findings provide novel evidence for the role of the hippocampus and functionally connected regions in relational binding and comparison that is affected by aging. The present findings are discussed in the context of current models regarding the cognitive neuroscience of aging.

Topic Area: LONG-TERM MEMORY: Other

Influence of sex on genetic contributions to default mode network associations: a structural MRI study of monozygotic and dizygotic twin pairs

Poster B106, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Matthew Jerram[1], Elena Molokotos[1], Amy Janes[1,2]; [1]Suffolk University, [2]McLean Imaging Center

Neuroimaging has demonstrated sex-based differences in brain structure and function, including the default mode network (DMN). The DMN is also highly heritable, both functionally and structurally. To date, no research has yet examined how this heritability is impacted by sex. In this study, we used structural MRI (sMRI) to investigate sex differences in cortical surface area (SA) measures in the DMN in a group of monozygotic (MZ) and dizygotic (DZ) twins. We hypothesized that SA would be differentially correlated between the MZ and DZ pairs and that the pattern of correlation would differ between male and female pairs. Data from the Human Connectome Project were used for this study, which included 3T sMRI data for MZ (n = 72, 52 female) and DZ (n = 60, 35 female) twin pairs, aged 21-35 years. Analysis used a standard pipeline in freesurfer and SA was extracted from regions known to be part of the DMN, including the precuneus, posterior cingulate, rostral anterior cingulate and medial orbitofrontal cortex. Total DMN (sum of regional SAs) and individual regions were analyzed. Pearson correlation was calculated for SA within MZ and DZ twin sets. To provide a measure of genetic influence, Fisher's z transformation examined the MZ-DZ difference in correlation within sex. Results showed that MZ-DZ differences in correlation were significantly larger for women than for men, indicating a stronger genetic influence in DMN structure in women. These results illustrate the importance of considering sex differences when examining the heritability of brain endophenotypes.

Topic Area: NEUROANATOMY

Probing plasticity of auditory cortex in adulthood: Structural brain changes following pitch discrimination training

Poster B107, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Elisabeth Wenger[1], André Werner[1], Simone Kühn[1,2], Ulman Lindenberger[1]; [1]Max Planck Institute for Human Development, Berlin, Germany, [2]University Clinic Hamburg-Eppendorf, Hamburg, Germany

Musicians are a particularly suitable model for investigating structural plasticity of sensory processing in humans. In this study, we targeted the domain of auditory processing and investigated experience-induced changes in pitch processing. We recruited young adults between 18 and 33 years who had signed up for a course that prepares candidate students for their conservatory entrance examination. An important component of this training course is relative pitch discrimination, that is, the ability to identify tones and intervals in relation to a reference tone. Participants of the experimental group were training for different university curricula: instrumentalist (various instruments), Tonmeister, conductor, or composer (n=21). As a control group, we recruited 15 younger adults who had also received musical training in their youth and also actively performed music in their daily lives but who did not participate in a preparatory course. All participants were assessed behaviorally and with functional and structural magnetic resonance imaging (MRI) 4 to 5 times over 10-12 months. Using voxel-based morphometry (VBM) to automatically segment gray matter volume, we detected a gray matter decrease in left superior temporal gyrus in aspiring professionals compared to amateurs over time. Our results are consistent with the recently proposed expansion–renormalization model of plastic changes (Lövdén et al., 2013, NBR), and suggest that the auditory cortex of aspiring professionals who were perfecting their pitch discrimination skills was undergoing renormalization. Further analyses will focus on characterizing the shape and size of Heschl's gyrus to asses individual variation and group differences therein.

Topic Area: NEUROANATOMY

White matter integrity predicts cognitive training-induced improvements in attention and executive functioning in schizophrenia

Poster B108, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Karuna Subramaniam[1], Jeevit Gill[1], Melissa Fisher[2], Pratik Mukherjee[1], Srikantan Nagarajan[1], Sophia Vinogradov[2]; [1]University of California San Francisco, [2]University of Minnesota

Schizophrenia (SZ) is considered a disorder of connectivity particularly in terms of the white matter architecture connecting grey matter regions, and is associated with deficits in attention/vigilance, learning/memory, and executive functioning. However, the functional significance and treatment implications of this reduced white matter integrity are unknown. Here, we examined patterns of white matter connectivity in SZ, and examined whether microstructural white matter integrity in SZ predicted cognitive gains induced by intensive cognitive training. We performed diffusion tensor imaging (DTI) in 48 SZ patients and 28 healthy control (HC) participants at baseline, and then assigned patients to 70 hours of cognitive training. Compared with HC participants, SZ patients showed reduced white matter integrity, indexed by fractional anisotropy (FA) metrics, in several regions including anterior and posterior corona radiata, retrolenticular internal capsules, posterior thalamic radiations, superior longitudinal fasciculus, sagittal stratum, and the corpus callosum. After 70 hours of training, SZ patients showed significant improvements in attention/vigilance ($p=.01$) and executive functioning ($p=.003$). Interestingly, training-induced improvements in attention and executive functioning in SZ patients were associated with better FA white matter integrity in areas where no significant FA reductions were seen at baseline when compared to HC subjects. Specifically, white matter integrity in right fronto-occipital fasciculus predicted training-induced improvements in attention/vigilance, while white matter integrity in right corticospinal tract and bilateral medial lemnisci predicted training-induced improvements in executive functioning. These results suggest that preserved integrity of white matter tracts may indicate which patients will show a positive response to intensive cognitive training in SZ.

Topic Area: NEUROANATOMY

Using Patterns of Functional Brain Connectivity to Predict Autism Spectrum Disorder

Poster B109, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Hakeem Brooks[1], Jin Cheong[2], Jeremy Cohen[1], Luke Chang[2]; [1]Xavier University of Louisiana, New Orleans, LA, [2]Dartmouth College, Hanover, NH

Autism Spectrum Disorder (ASD) is a neurodevelopmental disorder characterized by social and communication deficits and repetitive behaviors. Considerable work has focused on characterizing the neurobiological sequelae of this disorder, but no reliable pathognomonic biological marker of this disease has yet emerged. One potential reason is that most studies use relatively modest sample sizes and are focused with identifying correlates of the disorder rather than predictive markers. To address these limitations, we combined multivariate statistical learning techniques with a large open access resting state functional magnetic resonance imaging dataset (Autism Brain Imaging Data Exchange II; ABIDE II) to develop predictive brain markers of ASD. We used functional connectivity metrics to measure how well different regions of the brain communicate with each other as features in our predictive model. Our classifier was able to consistently distinguish between ASD and neurotypical populations groups and revealed which specific brain connections most reliably contribute to discriminating between the two groups. Our results demonstrated that functional neuroimaging, and functional connectivity specifically, could provide a viable approach to quantifying aspects of ASD etiology.

Topic Area: NEUROANATOMY

Gray matter volume differences in children with discrepant reading ability or poor reading ability

Poster B110, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Audreyana Jagger[1], Michelle Kibby[1]; [1]Southern Illinois University

The neurobiological literature on reading disability is often discrepant, which may be related to how a reading disorder is defined (Leonard, 2001). Developmental dyslexia (DD) is often defined as a discrepancy between basic reading ability and IQ, whereas poor readers (PR) are typically defined as scoring below average on measures of basic reading. This study included 106 children, 8-12 years of age (53 male). T1 weighted images were collected on all participants and were analyzed using Voxel Based Morphemetry (VBM). Two, one-way ANCOVAs, with age and gender as covariates, were conducted using the SPM and VBM8 toolboxes. Total brain volume was handled as a nuisance variable. The first ANCOVA compared gray matter volumes between children who met criteria for developmental dyslexia (n = 26) or did not (n = 79). Children with DD showed decreased brain volume in the left fusiform and lingual gyri and occipital lobe. Children with DD showed increased gray matter volume in the left middle and superior temporal gyri. The second ANCOVA compared gray matter volumes between children who met criteria to be a poor reader (n = 27) or did not (n = 78). The children who were PR showed decreased gray matter volume in the left calcarine, cuneus, precentral, postcentral, inferior frontal, and middle frontal gyri. The children with PR showed increased gray matter volume in the right middle frontal gyrus. Thus, whereas both definitions had left occipital stream reductions in volume, the PR group showed additional reductions in other cortical areas.

Topic Area: NEUROANATOMY

Subclinical Eating Disorder Traits are Correlated with Cortical Structure in Regions Associated with Food Perception and Food Reward

Poster B111, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Emily Richard[1], Cynthia Peng[1], Esha Mehta[1], Caylynn Yao[1], Annchen Knodt[2], Ahmad Hariri[2], Gregory Wallace[1]; [1]The George Washington University, [2]Duke University

Although many studies have found atypical brain structure in clinically-diagnosed eating disorders, no studies to date have explored individual differences in brain structure as a function of subclinical eating disorder traits. Therefore, we seek to identify neural endophenotypes in large and relatively unconfounded subclinical samples. In the current study we correlate variation in cortical thickness with scores on two Eating Disorder Inventory-3 (EDI-3) subtests: Bulimia and Drive for Thinness. 456 young adults (313 female:143 male) self-reported drive for thinness traits, and 247 young adults (169 female:78 male) self-reported bulimia traits and provided one anatomic MRI scan. The CIVET brain-imaging pipeline (v2.0) and SurfStat were used to derive vertex-level cortical thickness values and complete analyses. There were significant negative correlations between drive for thinness traits and cortical thickness in the right insula, and between bulimia traits and cortical thickness in the bilateral insula, left posterior parietal, left somatosensory, and right orbitofrontal cortices (FWE-corrected ps<.05). Furthermore, in subjects showing higher EDI-3 traits, there was diminished correlation between these key regions and the rest of cortex (FWE-corrected ps<.05) compared to those with lower EDI-3 traits. Strikingly, self-ratings of EDI-3 traits were correlated with thickness in distinct cortical regions (e.g., insula and orbitofrontal cortex) that are crucial to food perception and food reward. Furthermore, higher levels of these traits negatively modulated anatomical coupling between these regions and other portions of cortex. These findings complement the clinical literature, and provide additional evidence that these neural signatures can serve as informative endophenotypes for future genetic studies.

Topic Area: NEUROANATOMY

Tactile Enumeration and Brain Plasticity in Acalculia

Poster B112, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Zahira Ziva Cohen[1], Isabel Arend[1], Kenneth Yuen[2], Ronel Veksler[1], Sharon Naparstek[1], Yarden Gliksman[1], Avishai Henik[1]; [1]Ben-Gurion University of the Negev, Beer Sheva, Israel, [2]Johannes Gutenberg University Medical Center, Mainz, Germany

The ability to enumerate is one of the building blocks of arithmetic and fingers are used in the early steps of this process. We explored tactile enumeration (TE) with fingers as the input surface, and voxel-based morphometry (VBM) to study gray matter changes of an acalculic participant—NO, a 22-year-old female with acalculia following a stroke to the left intraparietal sulcus. NO and a group of neurologically healthy controls reported how many fingers were stimulated. NO was tested at four time points: one month after the infarct (acute phase), one month later, half a year later, and a year and a half later. For the sensory intact hand, only in the acute phase was NO less accurate than controls. The RT slope of enumerating up to four stimuli was significantly steeper than that of controls in the acute phase but not in the subsequent time points. VBM analysis applied to acute phase and half a year later showed an increase in gray matter for NO relative to controls in the inferior occipital cortex during both phases. Her performance and neuro-anatomical changes serve as a first glance of tactile enumeration associated with arithmetic deficiencies.

Topic Area: NEUROANATOMY

Differences in brain structures in healthy young smokers: an MRI volumetric study

Poster B113, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Gergely Darnai[1,2], Beatrix Lábadi[1], András Zsidó[1], Orsolya Inhóf[1], Eszter Simon[1], Eszter Kohn[1], Gábor Perlaki[3,4], Gergely Orsi[3,4], Norbert Kovács[2], József Janszky[2,4], Tamás Bereczkei[1]; [1]University of Pécs, Department of Psychology, Hungary, [2]University of Pécs, Department of Neurology, Hungary, [3]Pécs Diagnostic Centre, Pécs, Hungary, [4]MTA-PTE Clinical Neuroscience MR Research Group, Pécs, Hungary

Growing evidence from animal and human neuroimaging studies indicates functional and structural brain-altering effects of smoking. Investigations in humans found wide range of effects but studies focusing on young healthy population are sparse. We used structural magnetic resonance imaging technique for assessing volumetric differences between 18 smokers (9 males) and 18 age- and gender-matched controls. Significantly smaller grey matter volumes ($p = 0.05$, corrected for intracranial volume) were found in anterior and posterior cingulate, and parahippocampal cortex in smokers, although greater insular and orbitofrontal volumes were found also in people with nicotine addiction. Group differences were found in corpus callosum, bilateral pallidum, bilateral cerebellum and right accumbens - non-smokers showed greater volumes in every subcortical region. These findings provide evidence for cognitive dysfunctions and alterations in cognitive control function in earlier stages of life.

Topic Area: NEUROANATOMY

Age predicts Changes in Functional Networks in Early Childhood: Integration of Sensory and Cognitive Networks

Poster B114, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Christiane Rohr[1], Anish Arora[1], Ivy Cho[1], Kari Parsons[1], Prayash Katlariwala[1], Dennis Dimond[1], Deborah Dewey[1], Signe Bray[1]; [1]The University of Calgary, Canada

Early childhood is a period of profound neural development and remodeling during which cognitive skills undergo rapid maturation. Over the past decade, functional magnetic resonance imaging (fMRI) has enabled the examination of functional brain networks in children as they mature. Yet, due to the challenges associated with scanning young children, studies in early childhood are sparse. Here, we examined the relationship between age and functional connectivity in five common networks in 41 female children between 4-7y (mean=5.31; SD=0.76). Following training in an MRI simulator, children freely watched clips from 'Elmo's World' in a 3T GE750w scanner. 35 components were extracted from their fMRI data using FSL's MELODIC. Among these, the default mode (DMN), salience, visual, sensorimotor and dorsal attention networks were identified as explaining the most variance, and used for further analysis. A dual regression (as outlined by Jolles et al.; Cereb.Cortex 2011) resulted in a set of participant-specific spatial maps for each network. We then tested for linear age effects in these networks, thresholded at $p<0.01$ family-wise error corrected. All five networks showed increasing connectivity with age, particularly in the core regions of each network. For instance, the anterior cingulate and the precuneus showed increased connectivity within the DMN. These results extend earlier work by Jolles et al (2011), who found that children had greater connectivity only in cognitive networks as compared to adults. Our findings highlight the profound network integration that occurs across this age range, and add to our understanding of early childhood development of brain networks.

Topic Area: NEUROANATOMY

Elevated inflammation associated with reduced brain volume and white matter integrity in the Coronary Artery Risk Development in Young Adults Study

Poster B115, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Aoife O'Donovan[1,2], Allison Kaup[1,2], Lenore Launer[3], Stephen Sidney[4], Kristine Yaffe[1,2]; [1]University of California, San Francisco, [2]San Francisco VA Medical Center, [3]National Institute on Aging, [4]Kaiser Permanente Northern California

Elevated inflammation is associated with mild cognitive impairment and dementia, but the neural underpinnings of these associations are poorly understood. In older adults, higher inflammation has been associated with reduced brain volume and white matter integrity. Here, we examined if inflammation is associated with brain structure in midlife. Participants were 719 adults from the Coronary Artery Risk Development in Young Adults (CARDIA) study who underwent brain MRI at the Year 25 Exam (M age = 50.3±3.5; range 42-56; 48% male; 40.5% Black and 59.5% White). Inflammation was indexed by log-transformed C-reactive protein (CRP) measured concurrent with, and 5, 10 and 18 years before, MRI. Hierarchical linear regression was used to examine cross-sectional and prospective associations of CRP with brain volume and white matter integrity measures. All models were adjusted for age, sex and race, and brain volume models were additionally adjusted for intracranial volume. CRP was cross-sectionally associated with reduced total brain volume (β = -.03, p = .004), reduced gray matter volume (β = -.03, p = .03), higher white matter mean diffusivity (β = .10, p = .01) and lower white matter fractional anisotropy (β = -.09, p = .02), but not with white matter volume or white matter hyperintensities. CRP was not prospectively associated with MRI measures. Findings remained the same when excluding participants with CRP > 10mg/L. Links between inflammation and reduced brain volume and white matter integrity are evident in midlife. A better understanding of these links may inform new interventions.

Topic Area: NEUROANATOMY

Differences in association for surface area and thickness within functional brain networks between monozygotic and dizygotic twin pairs

Poster B116, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Elena Molokotos[1], Amy Janes[2], Matthew Jerram[1]; [1]Suffolk University, [2]McLean Imaging Center

Heritability rates of cortical surface area (SA) and thickness differ regionally. Whether these patterns correspond with functional brain networks is unclear. Such a link is plausible as network activation is heritable and brain function and structure are coupled. To determine the heritability of primary resting state networks (RSNs), we evaluated the SA and thickness of the default mode network (DMN), central executive network (CEN) and salience network (SN). The Human Connectome Project collected magnetic resonance imaging data for monozygotic (MZ, n = 72) and dizygotic (DZ, n = 60) twin pairs. Following a standard freesurfer pipeline, total network SA and thickness were calculated by summing the values of individual regions known to comprise these RSNs. Pearson correlation coefficients were calculated for thickness and area of RSNs in MZ and DZ twin sets. To demonstrate a genetic influence, correlation coefficients were z-transformed and compared between MZ and DZ sets. Relative to DZ twins, MZ twins showed stronger correlations for SA of the SN (p = .002), CEN (p = .001), and DMN (p = .001) and thickness for the CEN (p = .001) but not the other networks. The heritability of network anatomy is congruent with prior work showing strong heritability of global brain structure. These findings suggest that, while SA is heritable across networks, thickness is only heritable within the CEN. It is hypothesized that SA and thickness are mediated via different genetic mechanisms and the results suggest that the CEN structure is more broadly genetically determined than other RSNs.

Topic Area: NEUROANATOMY

Sensorimotor Synchronization at 3 Tempi

Poster B117, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

GEORGIOS MICHALAREAS[1,3], Francesco Di Pompeo[2], Pascal Fries[3], David Poeppel[1,4]; [1]Department of Neuroscience, Max Planck Institute for Empirical Aesthetics, [2]Institute for Advanced Biomedical Technologies, University G. D'Annunzio, [3]Ernst Strüngmann Institute for Neuroscience in Cooperation with Max Planck Society, [4]Department of Psychology, New York University

We present evidence for the concurrence of three Sensorimotor Synchronization (SMS) models in the human brain, each with distinct temporal dynamics. Participants were presented with blocks of 10 flashes, with a fixed inter-flash interval (IFI = 1.2 sec), and were instructed to flex one of four extremities (either hand or foot) in synchrony with the flashes. In all trials within any given block, the same extremity was used and blocks were presented in a pseudo-random sequence. (Data from the Human Connectome Project.) The main behavioral metric is the time asynchrony between the muscle movement (EMG) onset and the corresponding instructing visual stimulus, termed here "VMA (Visuo-Motor Asynchrony)". The analyses reveal three main phenomena: 1) Movement onset for feet was on average ~50 msec earlier than hands, consistently across the experiment. 2) Within each block, VMA followed a U-shaped pattern. Additionally, the within-block VMA variance, contrary to expectation, increased in the first third of the experiment and then stabilized. 3) The mean VMA across blocks follows a slow but consistent negative drift from positive values (movement onset after flash) towards negative values (movement onset before flash). The slope of the drift appears to be similar in each extremity and most importantly is extremity specific, hinting at the existence of sensorimotor memory specific to each extremity. These three findings suggest three largely independent models in the human brain regarding sensorimotor synchronization. We probe the relevant brain networks with magnetoencephalography data.

Topic Area: PERCEPTION & ACTION: Motor control

Grasping Movement (Re-)planning Interferes with Working Memory during the Maintenance Process: An ERP Study

Poster B118, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Rumeysa Gunduz Can[1,2], Thomas Schack[1,2,3], Dirk Koester[1,2]; [1]Faculty of Psychology and Sport Science, Bielefeld University, Germany, [2]Cognitive Interaction Technology - Center of Excellence, Bielefeld University, Germany, [3]Research Institute for Cognition and Robotics, Bielefeld University, Germany

The present study focuses on the neurophysiological interactions of cognition, specifically working memory, and grasping movements. In particular, we investigated neuro-cognitive costs of implementing a new grasp plan for separate working memory (WM) domains (verbal, visuospatial) and processes (encoding, maintenance, retrieval). In a dual-task paradigm, 35 participants concurrently performed a WM task and grasp-to-place task (grasp a sphere and place it onto either the left or right motor target according to an arrow cue). For 30% of trials, grasping movement had to be re-planned online. This study employed a 2 (WM Task: Verbal vs. visuospatial) x 2 (Grasp Planning: Prepared vs. re-planned) within subject design. Event-related potentials (ERPs) were analyzed separately for encoding, maintenance, retrieval processes. Behavioral analyses showed that the memory performance decreased for both WM tasks when grasp re-planning was required. That is, grasp re-planning interferes with WM in domain-general pattern. ERP analyses showed for maintenance process that prepared trials elicited larger negative slow waves compared to re-planned trials regardless of WM task. That is, maintenance-related ERPs of verbal and visuospatial tasks were equally affected. There was no effect for encoding and retrieval processes. Therefore, ERP findings support the domain-general re-planning interference with WM. More importantly, for the first time, ERP findings show the process-specific (maintenance) re-planning interference at the neurophysiological level. The present study provides a better understanding of neuro-cognitive mechanisms of manual action flexibility, particularly focusing on ERPs during overt movement execution.

Topic Area: PERCEPTION & ACTION: Motor control

Feedforward Motor Enhancement of Auditory Sensory Thresholds

Poster B119, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

John Myers[1], Jeffrey Mock[1], Edward Golob[1]; [1]University of Texas at San Antonio

When we move feedforward motor and feedback sensory systems exchange information to monitor our actions and their sensory consequences. Previous studies demonstrated that movement can influence perceptual judgments of loudness when comparing two stimuli. This study first asked whether feedforward motor systems influence auditory thresholds, a more basic measure of perception. Second, if thresholds are affected how specific is the perceptual bias relative to the expected sensory consequence of the movement? We tested subjects (n = 16) in two-phase motor conditions and a non-motor control. In the first motor phase subjects learned the association between pressing a button and a target tone (either 0.6 or 1.0 kHz) presented simultaneous to the press. In the second phase visual cues indicated when to press the button, and thresholds were tested for the target tone and two infrequent (p = 25%) non-target tones that were 20% higher/lower in frequency. The non-motor condition was the same except that visual cues did not elicit motor responses and only required that participants listen for tones. An incremental staircase procedure was applied to the tones to define thresholds. Results showed a trend for lower thresholds in the motor condition. There was also a main effect of frequency, indicating greatest sensitivity to targets and higher frequencies ($p < 0.01$). We conclude that feedforward motor commands may not only enhance auditory perception, but the enhancement may in part depend upon the expected sensory feedback.

Topic Area: PERCEPTION & ACTION: Motor control

Neural Correlates of a Prospective Sense of Agency

Poster B120, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Nura Sidarus[1,2], Matti Vuorre[3], Patrick Haggard[1]; [1]University College London, [2]Ecole Normale Supérieure - PSL Research University, [3]Columbia University

Sense of agency (SoA) refers to the feeling that we are in control of our own actions and, through them, of events in the outside world. One influential view claims that the SoA depends on a retrospective matching between the expected and actual outcome of an action. However, recent studies have revealed an additional, prospective component to the SoA, related to action selection. The present study aimed to clarify the neural mechanisms of this prospective mechanism by means of event-related potentials (ERPs). Participants responded to imperative left/right arrow stimuli that were preceded by either a compatible or an incompatible subliminal prime. After a variable delay, action outcomes were displayed, and subjective agency ratings were collected. Results show that incompatible priming disrupted action selection, and led to a reduction in SoA over action outcomes, relative to compatible priming. ERPs revealed that signals associated with SoA emerged already at the time of the action. This indexed an action monitoring process that signalled disruptions in action selection, and was linked to a reduction in SoA. Later, outcome monitoring was also associated with SoA. Thus, replicating previous studies, we found that an unconscious influence on action selection processes can affect the conscious experience of agency. Moreover, taking advantage of the temporal resolution of ERPs, we show that action monitoring signals influence SoA prospectively, as they emerge long before the outcome is known. Furthermore, the influence of this prospective, fluency-based, component on SoA is independent from retrospective outcome monitoring.

Topic Area: PERCEPTION & ACTION: Motor control

Dissecting stimulus-dependent and stimulus-independent factors in an implicit learning task reveals a mixture of performance enhancing and performance eroding processes on different time scales

Poster B121, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Balázs Török[1,3], Karolina Janacsek[2,3], Dávid G. Nagy[2,3], Gergő Orbán[3], Dezso Nemeth[2,3]; [1]Budapest University of Technology and Economics, [2]Eötvös Loránd University, [3]Hungarian Academy of Sciences

Performance deterioration during a continuous period of training (termed reactive inhibition) can confound measures of learning in experiments. This may lead to incorrect conclusions for sleep-related consolidation (Rickard et al., 2008). In our study we present a parametric model producing subject-by-subject and trial-by-trial predictions for performance, aimed to dissociate learning from non stimulus-dependent reaction time changes. One hundred and eighty subjects participated in our experiment. The Alternating Serial Reaction Time (ASRT) task was used to measure perceptual-motor learning. We administered one minute long continuous training blocks separated by 15-20 seconds of breaks. Three sessions of 15 blocks were recorded with a 3-5 minute break between sessions. Performance improvement over the 5 minute break is often associated with an early boost (Brawn et al. 2010), however our model can explain such illusory improvements by a quadratic formulation of reactive inhibition. This form suggests a linear increase in reaction times during a block of continuous training with an increase of this slope between blocks. Our results show that including reactive inhibition in our model significantly improves predictive power for 90% of participants. Moreover, reactive inhibition can explain a larger share of variance seen in individuals' reaction time data. We also exhibit evidence for independence of statistical learning measure used in the ASRT task from reactive inhibition. We discuss methodological implications for learning experiments.

Topic Area: PERCEPTION & ACTION: Motor control

Reliability of fMRI data during speech production tasks across scanning sessions

Poster B122, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Saul Frankford[1], Alfonso Nieto-Castañón[1], Frank H. Guenther[1]; [1]Boston University

Functional neuroimaging techniques are well equipped to characterize the average neural activity for a specific speaking task compared to baseline, across healthy subjects. Average neural activity is also useful for understanding neurological diseases that are relatively homogeneous across the population. However, speech disorders that are the result of a stroke or traumatic brain injury often have characteristics unique to an individual. To map the speech production network in individuals, a crucial first step is to quantify within-subject reliability. In this study, we looked at measures of reliability in neural activation for 14 healthy subjects who participated in two similar speech production experiments between 6 and 52 days apart. We employed a classification algorithm based on principal component features to identify whether a subject's activation pattern from one experiment most resembles the same subject in the second experiment or one of the other subjects. Using 25 principal components, the classifier maintained a 100% success rate, even when 62 additional subjects from other speech studies were included in the identification task. We also found that, on average, individual subjects had a between-session Dice coefficient of 0.73 and an intra-class correlation of 0.88. These results suggest that healthy speakers have reliable speech activation patterns from session to session and may indeed have a unique neural "fingerprint" that can be observed during speech production.

Topic Area: PERCEPTION & ACTION: Motor control

Lateralization of hand-related movement imagery: An EEG study

Poster B123, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Chris Donoff[1], Chris Madan[1,2], Sarah Elke[1], Anthony Singhal[1]; [1]University of Alberta, [2]Boston College

It is well known that overt movements arise from the activation of the primary motor cortex (M1) and supplementary motor areas in the precentral region of the brain. Prior EEG studies have reported lateralized desynchronization in mu (8–13 Hz) and beta (14–25 Hz) rhythms over M1, reflecting an active neural state for movement preparation and execution, followed by a synchronization of beta rhythms indicative of movement termination. These event-related desynchronizations and synchronizations have also been shown to occur during imagined movements. The majority of these studies have utilized subjective measures of movement imagery ability, introducing potential biases of confidence and social desirability that may confound performance measures. Here, we used an objective test of movement imagery to extend previous findings of contralateral dominance of mu and beta desynchronizations and ipsilateral dominance of mu synchronizations, with the added goal of relating oscillatory power with individual movement imagery ability. EEG data was recorded using a 256-channel array, while participants complete two objective movement imagery questionnaires, the Test of Ability in Movement Imagery (TAMI) for whole body movements, a novel hand-specific test inspired by the TAMI, and the Edinburgh Handedness Inventory. The results show consistent lateralization of ERD using the Better OSCillation (BOSC) detection method. The novelty of the present study arises from our ability to analyze EEG power as a function of imagery performance as well as handedness. We suggest that an objective test of imagined hand movements can provide a skill-based measurement of handedness.

Topic Area: PERCEPTION & ACTION: Motor control

Implicit Sequence Learning in Children with and Without ASD

Poster B124, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Morgan Wright[1], Rebecca Campbell[1], Kaitlyn Tracy[1], Amber Schmitt[1], Jin Bo[1]; [1]Eastern Michigan University

Studies reveal impaired implicit learning in children with Autism Spectrum Disorders (ASD). However, the findings in the motor learning literature have been controversial. The current study focused on implicit sequence learning in children with ASD. Four children diagnosed with ASD and 13 typically developing (TD) children (7-11 years of age) performed a serial reaction time task that contained 12-element second-order conditional sequences. There were 6 blocks of a learning sequence and 4 blocks of an alternative sequence with a different structure than the learning sequence. Blocks 3 through 7 and 9 contained the learning sequence and Blocks 1, 2, 8 & 10 contained the alternative sequence. Learning was measured as the response time (RT) differences between Block 7 and 8, Block 8 and 9, and Block 9 and 10. Explicit awareness during sequence learning was assessed using a generation task, recognition task, and open-ended questionnaire. Preliminary analyses revealed positive learning in TD children because of a significant difference between block 7 and 8, block 8 and 9 (both ps < 0.05). Marginal significant RT differences between block 7 and 8 were found in children with ASD ($p < 0.05$). Comparison between the two groups did not show learning differences. The lack of significant differences might be due to the small sample size of the pilot. The awareness tasks revealed that none of the participants developed explicit awareness of the learning sequence. Possible implicit motor learning difficulties in children ASD may be suggested.

Topic Area: PERCEPTION & ACTION: Motor control

Neural correlates of guided and unguided motor timing in Parkinson's disease

Poster B125, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Klara Hagelweide[1,2], Ellen Binder[2], Katja Kornysheva[3], Esther A. Pelzer[2,4], Marc Tittgemeyer[4], Gereon R. Fink[2,5], Ricarda I. Schubotz[1,2]; [1]University of Muenster, Germany, [2]University Hospital Cologne, Germany, [3]University College London, Great Britain, [4]Max Planck Institute for Metabolism Research, Cologne, Germany, [5]Research Centre Jülich, Germany

The cortico-basal ganglia-thalamo-cortical loop connecting the putamen to the supplementary motor area plays an important role in motor timing. As dopaminergic depletion disrupts this motor loop, patients suffering from Parkinson's disease (PD) show behavioral deficits and motor loop hypoactivity when tapping in synchronization to a pacing signal. This impairment is increased when tapping is continued without pacing signal and accompanied by compensatory hyperactivity in cerebellum, lateral premotor cortex and prefrontal areas. To disentangle the influence of lacking external guidance from memory-driven time interval production, we extended the classical synchronization – continuation paradigm with a free tapping condition which required tapping at a self-chosen interval. Using this paradigm we measured fourteen PD patients (8 male) 'on' and 'off' medication and fourteen healthy control participants matched for gender and age in an fMRI study. As hypothesized, patients showed poorer tapping performance compared to healthy controls and 'off' compared to 'on' medication accompanied by less activity in the motor loop. Interestingly, the expected hyperactivity in cerebellum and lateral premotor cortex in patients was only observed during continued tapping. As tapping deficits were not more pronounced during continuation or free tapping than in synchronization trials, the observed hyperactivity probably reflects a compensatory mechanism not used during free tapping. Instead, in free trials there was a tendency to more negative asynchrony 'off' compared to 'on' medication, possibly showing that the production of an externally given time interval implies more compensational resources than the production of a self-chosen interval.

Topic Area: PERCEPTION & ACTION: Motor control

Cerebellar-Motor Connectivity in Patients with Schizophrenia: Insight Into Negative Symptom Severity

Poster B126, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Jessica Bernard[1]; [1]Texas A&M University

A role for the cerebellum in schizophrenia was initially suggested as part of the cognitive dysmetria framework. Increasing evidence suggests that cerebellar dysfunction is present in patients with schizophrenia as seen in abnormal eye-blink conditioning and postural control. Prior work in adolescents at ultra-high risk for psychosis has demonstrated that cerebellar-motor dysfunction is present prior to disease onset. Importantly, cerebellar-motor hyperconnectivity is also predictive of positive symptom progression over time in this important at-risk group. This work suggests that cerebellar-motor hyperconnectivity may also be present in patients with schizophrenia. Here, we investigated this idea taking advantage of data from schizconnect.org. The analysis included 82 patients with schizophrenia (38.36 +/-13.78 years, 15 female) and 88 controls (38.78 +/-11.76 years, 25 female) with resting state and structural brain images. Data were analyzed using the CONN toolbox. All data were thresholded using non-parametric analysis (5,000 permutations) with an initial threshold of $p<.001$ and cluster-threshold of $p<.05$, FDR corrected. Consistent with the idea that cerebellar-motor hyperconnectivity is consistent with disease progression, results indicate that in patients with schizophrenia cerebellar Crus I connectivity with motor and premotor cortical regions is increased relative to controls. Further, motor networks provide interesting insight into symptoms. Greater connectivity between the motor cortex and putamen was associated with more severe negative symptoms. Together, this work further supports a putative cerebellar-motor marker of the progression of schizophrenia, but also suggests that another key subcortical region related to motor function, the putamen, may be especially important for our understanding of negative symptoms.

Topic Area: PERCEPTION & ACTION: Motor control

Motor cortex excitability during perception of dynamic handwritten and typed text

Poster B127, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Chelsea Gordon[1], Ramesh Balasubramaniam[1]; [1]University of California, Merced

The motor system is active during the observation of actions performed by others and during the processing of action-related language. This suggests a role for the motor system in perception and language cognition (Rizzolatti et al., 1996; Pulvermüller et al., 2005). Recently it has been proposed that the motor system might also have a direct role in sensory prediction, even in the case of inanimate events (Schubotz, 2007). As contexts that recruit the motor system turn out to be broader than previously assumed, it could be that the role of the motor system in the perception-action-cognition loop is modulated by context. In this study, we look at corticospinal excitability using single-pulse transcranial magnetic stimulation (TMS) during the perception of written language to examine the extent of motor involvement. We found that while viewing videos of handwritten words and nonwords, there is consistent facilitation in motor-evoked potentials (MEPs) recorded from the first dorsal interosseous (FDI) muscle with each presentation of the stimulus, implicating a mechanism akin to the simulation of the inferred agent writing the stimuli. When subjects viewed videos of typed words and non-words, we observed a less pronounced facilitatory effect which is further reduced for each reoccurence of a stimulus. The data suggest that the role of the motor system in the processing of written language is a dynamic one that changes with situational context, allowing for simulation or prediction depending on its context.

Topic Area: PERCEPTION & ACTION: Motor control

Electrophysiological Correlates of an Excitatory:Inhibitory Imbalance in Children with Autism Spectrum Disorder

Poster B128, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Lauren C. Shuffrey[1,2,3,4], Lisa Levinson[1], Heather L. Green[1], Dayna Moya Sepulveda[1], Grace Pak[1], Alexis Becerra[1], Karen Froud[1]; [1]Teachers College, Columbia University, [2]Columbia University Medical Center, [3]New York State Psychiatric Institute, [4]Center for Autism and the Developing Brain

Emergent evidence suggests that sensory processing abnormalities in Autism Spectrum Disorder (ASD) may be due to a neurochemical imbalance between excitatory glutamate (Glu) and inhibitory γ-aminobutyric acid (GABA) neurotransmission, also known as the excitatory:inhibitory (E:I) theory of ASD. Behavioral studies have demonstrated that healthy adults have a directional impairment of discrimination in conditions of large/high-contrast visual stimuli, thought to reflect surround suppression of motion selective neurons and to be driven by GABA (Tadin et al. 2003; Aaen-Stockdale et al. 2009). To explore possible consequences of imbalanced GABA:Glu neurotransmission on the visual system, we investigated surround suppression in ASD using a visual motion processing task during electroencephalography recording to derive the N1 event related potential (ERP). Five high-functioning medication-free children with ASD based on DSM-5 criteria and four typically developing (TD) children aged 7 – 12 years were recruited. Stimuli consisted of 1 cycle/degree vertical sine wave gratings surrounded by two-dimensional Gaussian envelopes drifting either right or left at a consistent speed. Stimulus size was either 5.0° or 0.7° and stimulus contrast was either 92% or 2.8%. In the high-contrast experiment, children with ASD showed significantly enhanced processing of large stimuli compared to small stimuli, thought to reflect weakened surround suppression ($p=.007$) as indexed by N1 ERP latency. Children with ASD had significantly shorter N1 ERP latencies to large/high contrast-stimuli than TD children ($p=.006$). This paradigm may have potential for use as a clinical outcome measure in research trials to evaluate the effectiveness of investigational pharmaceuticals that act on GABAergic neurotransmission.

Topic Area: PERCEPTION & ACTION: Vision

Cultural specialization of visual cortex

Poster B129, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

John C. Ksander[1], Laura E. Paige[1], Hunter A. Johndro[1,2], Angela H. Gutchess[1]; [1]Brandeis University, [2]Tufts University

Although much of the cross-cultural research concerns social processes, a growing body of evidence suggests culture influences how individuals perceive and remember the world around them. This research spans a number of cognitive domains, but the perceptual experiments in particular have yielded mixed findings, with some studies identifying cultural differences and some not (e.g., eye fixation patterns to objects vs. contexts). The current study investigates whether perception is distinguishable across cultures during a simple object viewing task using multi-voxel pattern analysis. During functional magnetic resonance imaging, 20 East Asian and 20 American participants viewed photos of everyday items, which were equated for familiarity and conceptual agreement between cultures. Whole brain searchlight mapping with permutation-testing statistical evaluation assessed whether these stimuli evoked multi-voxel patterns that were distinct between cultural groups. In this analysis, participants' cultural identities were successfully decoded from stimuli representations in left lateralized Brodmann areas 17 and 18. This study is the first to show culturally distinct multi-voxel representations of stimuli that do not vary considerably in commonness, functionality, or meaning between cultures. These objects were familiar to all participants, and did not exhibit features or qualities unique to either culture. Yet, these stimuli were still represented differently by American and East Asian participants in visual cortex. This result suggests that one's cultural background specializes the cortex involved with object recognition, a fundamental perceptual task ubiquitous to everyday life.

Topic Area: PERCEPTION & ACTION: Vision

It's the Right Cue: Hemispheric Differences in Predictive Processing of Natural Scenes.

Poster B130, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Manoj Kumar[1], Yanqi Zhang[1], Diane M. Beck[1], Kara D. Federmeier[1]; [1]University of Illinois at Urbana-Champaign

Imaging studies have revealed hemispheric asymmetries in the processing of natural scenes, with the left hemisphere (LH) showing sensitivity to scene category but not identity and the right (RH) showing sensitivity to both identity and category (Stevens et al., 2012). However, little is known about the processing dynamics underlying such asymmetries, including each hemisphere's sensitivity to perceptual regularities and to contextual information that may be predictive of scene category. To address this, we manipulated both scene representativeness (good/bad exemplars) and expectancy (match/mismatch to a prior verbal category cue) and measured event-related potentials (ERPs) while participants viewed presentations, to the left visual field (LVF) and right visual field (RVF), of scenes from six categories: beaches, city streets, forests, highways, mountains and offices. Both hemispheres showed similar sensitivity to scene representativeness, with larger N300 responses (an ERP component linked to high-level perceptual processing) for bad than good exemplars. However, there were notable asymmetries in the time-course of sensitivity to cuing. With LVF (RH) presentation, cuing effects emerged early (150-200 ms), in the form of an enhanced P2 response to good scenes that mismatched (versus matched) the cues. In contrast, cuing effects for RVF (LH) presentation did not emerge until 300-350 ms, in the form of modulations of the N300 (smaller for good matches). The results suggest a RH superiority for using context to prepare perceptual templates in anticipation of upcoming scene information and rapidly matching those templates with incoming perceptual information.

Topic Area: PERCEPTION & ACTION: Vision

Category Learning Generates Categorical Perception: Behavioral, Neural and Computational Aspects

Poster B131, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Fernanda Perez Gay Juarez[1,2,3], Christian Thériault[2,3], Madeline Gregory[1,3], Daniel Rivas[2,3], Hisham Sabri[2,3], Stevan Harnad[1,2]; [1]McGill University, [2]Université du Québec à Montréal, [3]Center for Research in Brain, Language and Music

It is known that categorical perception (CP) — between-category separation and within-category compression — occurs innately in both perceived similarity and discriminability for colors, phonemes and facial expressions. It is now emerging that categorical perception can also be induced by category learning. We trained human subjects through trial and error with corrective feedback to sort samples of multidimensional visual stimuli into two categories based on features that covaried with category membership. Event-related potentials (ERP) were measured during the training. We tested two kinds of stimuli: black and white textures made up of distributed microfeatures and fish images with local features. For both types of stimuli pairwise similarity judgments before and after learning revealed between-category separation and within-category compression. These effects were absent in subjects who failed to learn. We also found ERP changes in an early, occipital N1 component (150-220 ms) that correlated with the degree of perceived separation. Learning also had an effect on frontal and parietal late positive components that correlated with learning performance rather than CP effects. To model the observed CP effects, we trained "deep learning" nets to categorize our textures through auto-association followed by supervised reinforcement learning with corrective feedback. Comparing the average within- and between-category distances in hidden-unit activation space before and after category-learning revealed between-category separation and within-category compression, as in the experimental subjects. We hypothesize that CP occurs through dimensional reduction: a learned filter selects for the covarying features and ignores the non-covariant ones, thereby changing the encoded distances between the inputs.

Topic Area: PERCEPTION & ACTION: Vision

Which way: Neural decoding of spatial directions in images, schemas, and words

Poster B132, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Steven Weisberg[1], Steven Marchette[1], Anjan Chatterjee[1]; [1]University of Pennsylvania

Often, when we navigate we interpret spatial directions in different formats; for example by reading a map or a list of directions. How do neural representations bridge across these formats to reach a common understanding? Our ability to seamlessly transition between these formats suggests that some brain regions may have a common code for directions across different formats. Research on prepositions and actions has revealed distinct regions involved in processing words, schemas, and images (Amorapanth et al, 2012; Watson et al, 2014). Here, we used multivoxel pattern analysis in an fMRI experiment to test the hypothesis that distinct regions of the brain decode spatial direction in these formats. In a continuous carryover sequence (Aguirre, 2007), we presented spatial directions one at a time. Subjects (n = 20) determined the spatial direction, but only responded to catch trials, which were discarded. Searchlight analyses revealed separate decoding of images and schemas, but not words, in parahippocampal and occipital place areas (PPA, OPA) – scene-specific regions of cortex (Epstein, 2014). To further determine the coding properties of spatial directions, we tested a visual angle model (angular distance between directions) and an egocentric model (angular distance between directions calculated across the front: sharp left and sharp right most dissimilar). Both models fit the pattern of activity in bilateral OPA, but the egocentric model fit better than the visual angle model. Our results suggest that OPA decodes visuospatial, but not verbal, representations of spatial directions, which allows us to interpret maps and signs.

Topic Area: PERCEPTION & ACTION: Vision

Embodiment and expertise effects on aesthetics judgments

Poster B133, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Beatriz Calvo-Merino[1], Alexander Jones[2], Patrick Haggard[3], Bettina Forster[1]; [1]City, University of London, [2]Middlesex University, [3]University College London

The growing field of Neuroaesthetics addresses the cognitive and neural mechanisms underpinning aesthetic experiences, especially when related to movement perception (performing arts/dance), and how these are shaped by the observer's experience. In this context, the recent explosion of research investigating the neurocognitive processes for observing bodies and actions of others, and which contribute to empathy, provides an ideal platform for developing a neuroaesthetic account of dance. Recent studies have provided a sensorimotor aesthetic framework that integrates multidimensional layers from neural, behavioral and physiological responses. Here we present data from two related experiments investigating independently the specific neural determinants of aesthetic judgments. Compared to a control visual judgment task, subjects judged biological motion (of dance movements) and body postures (dance postures) during fMRI and EEG, respectively. Our results showed a stronger engagement of somatosensory cortex (SCx), as reflected in the fMRI activations and somatosensory evoked potentials (SEPs, EEG) for the aesthetic judgment of biological motion and body postures, suggesting an important mechanism involving SCx and embodiment in relation to aesthetic evaluation of human movement. Importantly, this response had different temporal dynamics (as suggested by the EEG data) in the expert population (professional dancers) as compared to non-experts, suggesting that visual and motor memories shaped by experience influence this highly complex and uniquely human ability for aesthetic experience. Importantly, these results suggest that the effect of expertise goes beyond mere perceptual processing differences but that the aesthetic response is manifested in brain regions linked to embodiment.

Topic Area: PERCEPTION & ACTION: Vision

Deconstructing a Superadditivite Effect of the Sander Parallelogram Illusion

Poster B134, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Robert L. Whitwell[1], Sean Olsen[1], James T. Enns[1]; [1]The University of British Columbia

One contested issue in the debate on whether or not action resists pictorial illusions is centred on how attention operates in perception and action tasks. The posterchild for this issue is the well-known Ebbinghaus illusion, which is most famously viewed with the two sets of surrounding inducers and their respective target inner circles (the 'dual' configuration). Critics have claimed that the perception-action dissociation depends on spatial attention being deployed to two locations simultaneously or in rapid succession: the dual configuration yields an effect that is greater than the sum of its components (superaddivity) when the sizes of the inner disks are adjusted simultaneously but not when the adjustable stimulus (e.g., the participant's grasping hand or a third disk) is isolated. Here, we test the Sander Parallelogram illusion for superadditivity. In experiment 1, we quantified the effect of the Sander illusion across three different methods of adjustment in which the comparator is isolated: line-length matching, gap-length matching, and line-length to thumb and finger aperture size (manual) matching. We found a reliable and powerful effect of the illusion (16.5%) across all three methods. In experiment 2, we tested for superadditivity by contrasting the composite Sander display against the sum of its two component parts. We found a clear superadditive (5%) boost for the composite with no differences across measures. Thus, despite the isolation of the adjustable comparator which rendered simultaneous comparison moot, the composite Sander Parallelogram illusion induces superadditivity. Taken together, our results highlight the scene-based nature of spatial attention and vision-for-perception.

Topic Area: PERCEPTION & ACTION: Vision

Comparing computational, object and functional models of scene representation in the human brain

Poster B135, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Iris I A Groen[1], Michelle R Greene[2], Christopher Baldassano[3], Li Fei-Fei[2], Diane M Beck[4], Chris I Baker[1]; [1]National Institutes of Mental Health, [2]Stanford University, [3]Princeton University, [4]University of Illinois

Complex scene perception is characterized by the activation of multiple regions in posterior cortex. So far, these regions have been mostly interpreted as representing visual characteristics of scenes, such as the depicted environment ("a kitchen"), constituent objects ("an oven"), or spatial layout ("a closed space"). Recent behavioral evidence, however, suggests that the functions afforded by a scene (e.g. "could I prepare food here?") play a central role in how scenes are understood (Greene et al., 2016, JEP:General). Here, we studied whether the brain represents scene functions using a model-based approach. Healthy volunteers (n=20) viewed images from 30 scene categories in an ultra-high-field 7T MRI scanner. Stimuli were carefully selected from a larger set of scenes characterized in terms of their visual properties (derived computationally using a deep neural network), object occurrence, and scene function (derived using separate behavioral experiments), such that each model predicted a maximally different pattern of brain responses. We found that the visual model best predicted fMRI responses in scene-selective regions, with additional but limited contribution from the functional and object models. A whole brain analysis confirmed a strong contribution of the visual model throughout high-level visual cortex. The greatest correspondence with the functional model was observed in parts of anterior ventral and parietal cortex, potentially overlapping with a network involved in memory retrieval. Overall, these results show that while visual properties clearly drive brain responses to complex scenes most strongly, understanding complex scenes may also engage larger-scale networks beyond those revealed by simple visual activation experiments.

Topic Area: PERCEPTION & ACTION: Vision

Model-free population receptive field profile estimates reveal information about orientation and ellipticity in early visual areas.

Poster B136, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Christian Merkel[1], Jens-Max Hopf[1,2], Mircea Ariel Schoenfeld[1,2]; [1]Otto-von-Guericke University, Magdeburg, [2]Leibniz Institute for Neurobiology, Magdeburg

Estimates of visual field topographies in human visual cortex obtained through fMRI travelling wave techniques usually provide the parameters of population receptive field (pRF) location (polar angle, eccentricity) as well as receptive field size. These parameters are obtained by fitting the recorded data to a standard model population receptive field. In the current work pRF profiles are measured directly by back-projecting preprocessed fMRI time series to sweeps of a bar across the visual field in different angles. These model-free pRF profiles not only contain information about receptive field location and size but also about the pRF shape characteristics. The current data suggests that the elongation (ellipticity) of pRFs decreases across the early visual hierarchy to a different degree for the ventral and the dorsal stream. This suggests that the information on parvo- and magnocellular pathway properties is preserved at a population-level. Furthermore, ellipticity changes as a function of eccentricity. pRF orientation shows a high degree of collinearity with its angular position, which could be observed in particular within area V2. Using model-free pRF measurements, the traveling wave technique provides additional characteristics of pRF topographies that are not restricted to size.

Topic Area: PERCEPTION & ACTION: Vision

Is the N170 lateralization for word and face processing affected by sign language experience and/or deafness?

Poster B137, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Zed Sevcikova Sehyr[1], Karen Emmorey[1], Katherine J. Midgley[1], Phillip J. Holcomb[1]; [1]San Diego State University

We examined whether lateralization of N170 to words and faces in deaf signers and hearing speakers differs as a result of distinct perceptual experiences. Left-lateralization of N170 for words is well-established in skilled hearing right-handed readers. The N170 for faces is typically right-lateralized although this finding is less consistent. Early neurophysiological studies suggested greater right hemisphere involvement in word reading for deaf individuals and some fMRI evidence points to leftward asymmetries in language regions for deaf signers viewing linguistic and emotional faces. Twenty-four deaf signers (12 female) and 32 hearing non-signers (17 female) made same-different judgments to pairs of words or faces (192 trials each), where the first stimulus was presented centrally and the second was presented to either the left or right hemisphere. EEG from 29 electrode sites was recorded to the central stimulus and average-referenced. Both groups showed a left-lateralized N170 for words at occipital sites, but only hearing participants also showed a larger N170 at left than right temporal sites. Further, N170 lateralization for words reliably indexed word discrimination accuracy in the hearing but not the deaf group. For faces, both groups showed bilateral N170 at occipitotemporal regions, with only the hearing males trending towards right-lateralized N170. No gender differences in N170 asymmetry were observed in the deaf group. The study offers evidence for unique organization of visual pathways in the occipitotemporal cortex for deaf signers. The asymmetry of N170 to faces may be sensitive to a host of individual factors and requires further scrutiny.

Topic Area: PERCEPTION & ACTION: Vision

Teaching cognitive neuroscience: Transformation from large lecture class to small active learning groups

Poster B138, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Brenda Rapp[1], Soojin Park[1], Jeremy Purcell[1], Michael Reese[1]; [1]Johns Hopkins University

Many cognitive neuroscientists face the challenges of teaching large groups of undergraduate students the complex, rich and often difficult concepts of cognitive neuroscience. Another challenge is teaching undergraduates who enter college with extensive experience learning with digital resources and already familiar with a myriad of internet learning resources. We addressed these challenges by transforming a large (200-250 student) introductory cognitive neuroscience, lecture-style course into a hybrid format modeled on the framework developed by Steven Luck (http://psc100y.faculty.ucdavis.edu/). Course design was based on well-established learning principles such as active learning, repeated testing and distributed study. The previously twice weekly, 75-minute lectures were converted to on-line lectures that allowed for individualized viewing. Each on-line lecture was accompanied by an on-line quiz that was time-limited and deadlined. Class meetings consisted of once/week review sessions and once/week active-learning sessions; these were led by five different instructors who taught simultaneously in separate classrooms. Active Learning Sessions were the key added value of the hybrid approach allowing for experiential learning and meaningful interaction with professors. Students worked in teams on activities such as: brain navigation, lesion tracing in the language system, debating the use of CNS methods in the courtroom, building artificial neural networks and making a pitch to NIH. Course evaluation included on-line questionnaires, focus groups, classroom observations, and a comparative analysis of student responses on exam questions used in previous years. All evaluation modalities revealed significant improvement in performance and student satisfaction.

Topic Area: OTHER

Intergenerational early adversity: executive function and stress physiology in parents and children from lower socioeconomic status backgrounds

Poster B139, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Eric Pakulak[1], Theodore Bell[1], Ryan Giuliano[1], Christina Karns[1], Helen Neville[1]; [1]University of Oregon

Two aspects of brain function that underlie disparities in outcomes related to early adversity are stress physiology and self-regulation (e.g. executive function; EF, Blair & Raver, 2012). Two-generation programs targeting these systems in parents and their children have been shown to be effective (e.g., Neville et al., 2013). Here we report preliminary results from a project in which we are acquiring measures of EF and autonomic nervous system function in preschool-aged children (n = 66) and their parents (n = 57) from lower socioeconomic status backgrounds. Child EF measures included inhibitory control (IC) (Konchaska, et al., 1996) and working memory (WM). Adult EF measures also included IC (Berkman et al., 2014) and applied EF (Cella et al., 2012). As proxies of the parasympathetic nervous system (PNS) and sympathetic nervous system (SNS) functions, we assessed respiratory sinus arrhythmia and pre-ejection period. Controlling for child age, baseline PNS function in adults predicted baseline PNS function in their children ($r = .363$, $p < .02$). No similar relationship was found for SNS function. Adult IC predicted child IC ($r = .357$, $p < .02$), and there was a non-significant trend for a similar relationship between adult applied EF and child IC ($r = -.260$, $p = .10$). No similar relationships were found for WM measures. These preliminary results suggest a degree of specificity in the relationship between foundational systems in children and parents, as intergenerational relationships were stronger for measures of PNS function and inhibitory control.

Topic Area: EXECUTIVE PROCESSES: Other

Measures of Functional Networks Correlate with Chronic Symptom Status in Patients with Traumatic Brain Injury

Poster B140, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Keith Main[1,2,3], Anna-Clare Milazzo[2,3], Bernard Ng[3], Salil Soman[2,3,4], Jordan Nechvatal[2,3], Jennifer Kong[2], Stephanie Kolakowsky-Hayner[5], Ansgar Furst[2,3], J. Wesson Ashford[2,3], Michael Greicius[3], Maheen Adamson[1,2,3]; [1]Defense and Veterans Brain Injury Center, [2]War Related Illness and Injury Study Center, [3]Stanford University School of Medicine, [4]Harvard University Medical School, [5]Santa Clara Valley Medical Center

The presentation of chronic, cognitive symptoms in patients with traumatic brain injury (TBI) may be due to alterations in neural network connectivity. Using resting-state fMRI and diffusion tensor imaging (DTI), we examined functional and structural connectivity in 23 TBI patients with self-reported, chronic symptoms and 34 diverse controls (5 with moderate-to-severe TBI, 13 with a history of minor head injury, 16 with no history of head injury) without symptoms. Chronic symptoms included deficits in memory, attention, language, and visual perception. We hypothesized that chronic symptom status would correlate with altered functional connectivity in predefined regions of the dorsolateral prefrontal and lateral parietal cortices (executive control network). Regression analyses demonstrated that chronic symptoms significantly predicted decreased connectivity in the left executive control network. The same analysis including the 5 moderate-to-severe TBI patients in the chronic symptom group resulted in non-significance. This suggests that chronic symptoms are operative, not TBI status. Additional between-group tests showed decreased connectivity for the left dorsolateral prefrontal cortex in the chronic symptom group. Further tests on 14 large-scale, resting-state networks revealed a decrease in connectivity in the chronic symptom group between the following networks: left executive control, retrosplenial/medial temporal, and precuneus/posterior cingulate. Structural connectivity, measured by fractional anisotropy, correlated with initial injury severity but not chronic symptom status. Our results suggest that a decrease in functional connectivity in the left executive control network, particularly connections with the left dorsolateral prefrontal cortex, aligns more closely with chronic symptom status than injury severity.

Topic Area: EXECUTIVE PROCESSES: Other

Cognitive Control for Speech Production: Evidence for a rostro-caudal activation gradient in the frontal lobes

Poster B141, Sunday, March 26, 8:00 – 10:00 am, Pacific Concourse

Nicolas Bourguignon[1], Don Nguyen[2], Vincent Gracco[2,3]; [1]Ghent University, [2]Centre for Research on Brain, Language & Music, McGill University, [3]Haskins Laboratories

Speech production requires lateral prefrontal cortices (LPFC) for cognitive control (CC) – the goal-directed selection of actions from competing alternatives. Yet, the extent to which these systems entail neural-computational principles of CC similar to those in other adaptive-creative behaviors remains elusive. Addressing this issue we examined the extent to which speech production recruits separate modules along the antero-posterior axis of LPFC tasked with the selection of spoken words from conflicting alternatives at distinct levels of representation: We reasoned that low-level selection of names for contextually specified objects – i.e., the nominative level of speech – should engage posterior LPFC (pLPFC), while higher-level selection of verbs semantically associated with contextual objects – the predicative level – should engage anterior LPFC (aLPFC). Using information-theoretic measures of uncertainty (entropy) as predictors of LPFC activity and speech onset latencies (SOLs), we hypothesized that the degree of involvement of pLPFC and aLPFC should reflect variations in selection uncertainty during confrontation naming (CN) and verb generation (VG) tasks, respectively. We tested these hypotheses in an fMRI study of speech production using participants' cue-specific SOLs and information-theoretic indices of response entropy as regressors of interest. SOL in both tasks were reliably predicted by cue-specific entropy variations, and fMRI results revealed that selection uncertainty during CN engaged pLPFC while predicative uncertainty during VG activated aLPFC, providing evidence for the hierarchical organization of LPFC areas in uncertainty resolution at the nominative and predicative levels of speech production suggesting deep homologies between the neural-computational systems of speech and action control.

Topic Area: EXECUTIVE PROCESSES: Other

The brain pulsatility: an index of neurocognitive aging

Poster C1, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Badiaa Bouazzaoui[1], Lucie Angel[1], Michel Isingrini[1], Severine Fay[1], Laurence Taconnat[1], Sandrine Vanneste[1], Moise Ledoux[1], Frédéric Patat[2,3], Vincent Camus[2], Laurent Barantin[2], Frédéric Andersson[2], Jean-Pierre Remenieras[2]; [1]Université de Tours, UMR CNRS 7295 Centre de Recherches sur la Cognition et l'Apprentissage, [2]Université de Tours, UMR INSERM U930 Imagerie & Cerveau, [3]CIC IT 1415 Ultrasons et radiopharmaceutiques

Aging is characterized by a cognitive decline in particular of executive functioning, fluid intelligence, episodic memory, and attentional abilities and is also associated with electrophysiological changes (e.g. reduced amplitudes and increased latencies of the P3b EEG component). The vascular hypothesis proposes that brain is sensitive to vascular dysfunction which may accelerate age-related brain modifications and thus explain neurocognitive declines during aging. In order to test this vascular hypothesis, 40 participants from 20 to 80 years were administrated cognitive measures (executive functions (flexibility and inhibition), fluid intelligence, episodic memory and attention). EEG was recorded during an oddball paradigm to measure the neural correlates of attentional processes (P3b component). To assess vascular health, we used an innovative local measure: the pulsatility of deep brain tissue that is due to variations in cerebral blood flow over the cardiac cycle. Results showed (1) a classical effect of age on neurocognitive measures, (2) that brain pulsatility decreases with advancing age, (3) that brain pulsatility is positively correlated with inhibition, fluid intelligence and the amplitude of the P3b and (4) that brain pulsatility strongly mediated the age-related variance in both cognitive performance and the magnitude of the P3b component. The mediating role of the brain pulsatility in age-related effect on neurocognitive measures pleads in favor of the vascular hypothesis of cognitive aging.

Topic Area: ATTENTION: Development & aging

Increased neural response to wins over losses with older adults: Examining the positivity bias in aging

Poster C2, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Anna McCarrey[1,2], Joshua Goh[2,3], Vijay Venkatraman[4], Claudia Wolf[2], Gabriela Gomez[2], Susan Resnick[2]; [1]Idaho State University, [2]National Institute on Aging, [3]National Taiwan University College of Medicine, [4]University of Melbourne

The goal of this study was to investigate neural response to positive and negative events in a large sample of 309 healthy older adults (47.2% male; mean age: 70.3±12.2 years) from the Baltimore Longitudinal Study of Aging. Participants experienced win (positive) and loss (negative) events whilst playing a risk-taking task. For each trial, participants chose to accept or decline point offers, with a stipulated probability of winning. The instructions were to win as many points as possible. The magnitude of points offered and probability of winning varied across 72 trials. Feedback was given after each risky decision was made. Accepting an offer resulted in either a win or a loss; declining an offer resulted in neither. Two functional EPI scans were acquired per participant with 180 volumes per scan (2s TR, 37 axial slices, and 1.87*1.87*3.93 mm3 voxels). Whole brain analyses were performed using SPM8 and voxels were considered significantly activated at $p < .05$ corrected for the familywise error rate. Results showed significantly increased activation during feedback for wins relative to losses in several brain regions, including the visual cortex, cerebellum and posterior cingulate cortex. There were no regions that showed increased activation for losses relative to wins. Heightened neural sensitivity to wins over losses in this older sample could not be explained by age, sex or risk profile. Taken together, these findings lend support for Socioemotional Selectivity Theory and suggest a neural pathway by which older adults experience increased sensitivity for positive over negative events.

Topic Area: ATTENTION: Development & aging

The Effects of 1 Hour Sleep Loss in School-Aged Children: An Event-Related Potentials Study

Poster C3, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Sarah Leonhardt[1], Josh A. Miller[2], Dennis L. Molfese[3]; [1]Carroll College-Helena, MT, [2]Colgate University, [3]University of Nebraska-Lincoln

Small amounts of sleep loss may have profound academic consequences to school-aged children. Unfortunately, there is limited brain research investigating the impact of sleep loss on cognitive areas such as attention. In an effort to address this gap, event-related potentials (ERPs) were recorded during an auditory "oddball" task. Baseline sleep measures were obtained for 78 children, 5-8 years of age, for the first week. In week two, children were randomly assigned to continue normal sleep patterns (control) or restrict sleep for 1 hour each night (restricted). Sleep restriction ERPs for left temporal electrode sites significantly increased in latency and amplitude for the P3 waveform. Increased P3 may indicate modest sleep loss alters brain activity in school-aged children and negatively impacts academic performance.

Topic Area: ATTENTION: Development & aging

Contributions of medial prefrontal cortex to internally directed attention

Poster C4, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Julia W. Y. Kam[1], Jack L. Lin[2], Tor Endstead[3], Anne-Kristin Solbakk[3], Pal G. Larsson[4], Sandon Griffin[1], Robert T. Knight[1]; [1]University of California, Berkeley, [2]University of California, Irvine, [3]University of Oslo, [4]Oslo University Hospital

Humans spend up to half of their awake time engaging in thoughts unrelated to their current tasks that are strongly associated with personal concerns and goals in everyday life. While neuroimaging evidence implicates the default mode network in these pervasive thoughts, the underlying mechanism of such internally directed attention is still largely unknown. Cross-frequency coupling is a potential neural mechanism underlying internally directed attention given its purported functional role in the integration of spatiotemporal dynamics within and across large-scale brain networks. To address this issue, we recorded intracranial EEG activity in patients undergoing presurgical monitoring for intractable epilepsy who were implanted with subdural and/or depth electrodes. Patients performed an attention task wherein half the time, they had to detect a rare target tone (i.e. externally directed condition); the other half of the time, they were told to ignore all the tones and to allow their minds to wander (i.e. internally directed condition). Cross-frequency coupling was computed between the alpha (8-12Hz) and high frequency range (70-150Hz) for each electrode, which was then examined as a function of condition across patients. We found increased coupling in the medial prefrontal cortex (PFC) during the internally directed relative to externally directed conditions, suggesting that the enhanced spatiotemporal integration of information within the medial PFC as part of the default mode network is one potential mechanism in facilitating internally directed attention.

Topic Area: ATTENTION: Other

Engaging narratives evoke similar brainwaves and lead to similar perception of time

Poster C5, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

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

Films are often characterized as “engaging”, reflecting their ability to attract an audience. But what precisely does it mean for an audience to be engaged? Here we provide an objective behavioral definition: An audience is engaged to the extent that it is willing to commit scarce resources, such as time. To quantify this, 1000 subjects were recruited online within one hour to watch short videos under time pressure, thus revealing preferential time commitment. This experimentally measured engagement reproduced the natural behavior of millions of YouTube viewers, and was predicted by the brainwaves of 20 individuals recorded in the laboratory during video presentation. The neural predictive metric, inter-subject correlation of evoked responses, was also representative of subjective time perception. More correlated brains perceived time durations more uniformly. These findings suggest that the similarity of neural processing reflects behavioral engagement, and leads to a similar perception of time.

Topic Area: ATTENTION: Other

Individual difference effects on attentional capture by perceptually salient distractors

Poster C6, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Tessa Abagis[1], John Jonides[1]; [1]University of Michigan

Perceptual load is an important determinant of distraction. According to the Perceptual Load theory of attention, high, as opposed to low, perceptual load leaves fewer resources for processing extraneous information and results in less distractor interference. We conducted a replication of of Forster and Lavie (2008), in which participants completed a visual search task with perceptually salient distractors presented infrequently (10% of trials) in the periphery. Perceptual load was manipulated in blocks and was low (other items in the visual search circle were small circles dissimilar from the target) or high (other items in the circle were letters similar to the target). We replicated the finding that distractors cause distractor interference in low, but not high, perceptual load. Furthermore, we examined how inattention (measured by the CAARS) and working memory span (as tested with operation span and visual array tasks) affect perceptual load-induced distractor interference. High, as opposed to low, working memory load during a perceptual load task is associated with increased distractor interference (Lavie et al., 2004). High inattention is associated with high distractor interference in low, but not high, perceptual load (Forster and Lavie, 2007). We therefore predict decreased overall distractor interference as working memory span increases and inattention decreases. We conclude that inattention and working memory span both influence susceptibility to distractor interference and high perceptual load makes performance more nearly equal across all participants, save those with very low working memory spans.

Topic Area: ATTENTION: Other

Reappraisal of stress improves selective attention

Poster C7, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Ritsuko Nishimura[1]; [1]Aichi Shukutoku University

Stress in daily life is a negative experience and impairs cognitive performance. Negative emotion negatively affects cognitive function. Negative emotions (e.g., fear and anxiety) importantly affect the avoidance system; this leads processes related to managing negative emotion to compete with executive function processes. Therefore, reducing negative emotion may improve cognitive function under stress. The present study tested if stress reappraisal improves selective attention. The following conditions were used. In the Reappraisal condition, participants received an instruction that stress is not harmful and increased arousal actually aids performance in stressful situations. In the Ignore condition, participants received an instruction that ignoring stress optimally reduces nervousness and improves outcomes. In the Control condition, participants received no instruction. All the participants were instructed that they would be completing a stressful task (speaking before an audience and video camera), received the instruction corresponding to their condition, and then completed a flanker task. The distractors' interference effect on the targets was measured. I hypothesized that stress reappraisal would reduce negative emotion under stress and help participants in the reappraisal condition to more effectively ignore the distractors by preventing negative emotion management processes interfering with executive function. The results supported this hypothesis: the interference effect was reduced only in the reappraisal condition. This result suggests that stress reappraisal improves executive function while under stress.

Topic Area: ATTENTION: Other

Differential neural outcome processing of monetary and non-monetary feedback: a comparison of college drinkers and non-drinkers

Poster C8, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Heather E. Soder[1], Geoffrey F. Potts[1]; [1]University of South Florida

Risk-takers tend to ignore potential punishments when making decisions and experience a reduced Feedback-Related Negativity (FRN), an event-related potential component thought to index a reward prediction error in the anterior cingulate cortex. However, it is unclear if risk-takers exhibit an attenuated FRN to punishments other than monetary loss. Fifty participants completed counterbalanced passive reward and punishment prediction tasks. The reward task presented participants with a reward ($1) or a withheld reward ($0) that was fully predicted or unpredicted, while the punishment task similarly delivered punishment (an aversive noise burst) or a withheld punishment (silence). ERPs in response to task feedback were compared across drinkers and non-drinkers (past month). On the reward task, the drinking group displayed an enhanced positivity to unexpected rewards and a reduced negativity to withheld rewards, while non-drinkers exhibited a comparably reduced positivity to rewards and enhanced negativity to non-rewards. On the punishment task, a similar positivity to unexpected punishments was observed for both groups, but drinkers had a comparably reduced negativity to withheld punishments (silence). These results suggest that while drinkers may be hypersensitive to monetary rewards and hyposensitive to monetary punishments, this finding may not generalize to non-monetary outcomes. These findings may reflect anterior cingulate cortex input from two separate motivational systems – an appetitive system and an aversive system – with independent impacts on outcome processing.

Topic Area: ATTENTION: Other

Greater Theta and Delta Synchrony When Viewing Built versus Natural Environments in a Passive Oddball Task

Poster C9, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Salif Mahamane[1], Nick Wan[1], Allison Hancock[1], Alexis Porter[2], Kerry Jordan[1]; [1]Utah State University, [2]Carnegie Mellon University

Previous spectral analyses have shown greater alpha synchrony in adults while viewing or immersed in natural environments compared to built. These results are consistent with attention restoration theory (ART), which posits that natural environments – which better engage bottom-up attention – more effectively restore attentional resources than built environments. In an ERP study (n = 60) in which nature and built scenic images alternated roles as standard (p = .80) and target (p = .20) stimuli between trial blocks, we ran spectral analyses of data from the 1000ms window beginning at stimulus onset, comparing average power on five bandwidths (alpha, theta, delta, beta, gamma) between natural and built environments. A repeated-measures ANOVA revealed main effects of channel and stimulus showing significantly greater theta synchrony immediately following built scenes compared to nature scenes. This finding suggests a greater demand on cognitive resources while processing built versus natural stimuli. A second repeated-measures ANOVA revealed main effects of channel and stimulus showing significantly greater delta synchrony immediately following built scenes versus natural. As delta synchrony is implicated in signal detection, this finding may indicate that participants implicitly categorize built and natural environments. There were no significant differences between viewed categories with respect to alpha, beta, or gamma bandwidths. These results are aligned with ART, and our ERP finding that late positive potential activation is greater for built than natural scenes. Implications for future research in this vein will be discussed.

Topic Area: ATTENTION: Other

Revealing the interaction between anxiety-traits and meditation in an attentional reorienting task by brain oscillations

Poster C10, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Shao-Yang Tsai[1], Satish Jaiswal[1], Wei-Kuang Liang[1], Chi-Hung Juan[1]; [1]National Central University

Prior studies have demonstrated that meditation may improve cognitive functions such as attention and executive control (see a review by Tang et al., 2015). However, the underlying mechanisms for such improvements remain unclear. Therefore, we aimed to investigate the modulating effect of meditation on the mechanism of contingent reorienting in a rapid serial visual presentation (RSVP) task (Chang et al., 2013, 2016) with electrophysiological recordings. We recruited 24 meditators who had experienced meditation at least for one year, and 24 non-meditators without any prior experience of meditation. All subjects were college students and completed two sessions of experiment in two separate days. The two sessions differed in the manipulation of resting versus meditating state for 30 minutes in a counter balanced order. After meditating or resting, they performed the RSVP task. The questionnaire data that was collected before the experiment, showed that meditators had lower trait of anxiety and less avoidance from unpleasant things as compared to the control group, but displayed equal degree of mindful trait within the group. In behavioral results, meditation condition had better facilitation effects of attentional capture as compared to resting condition for both groups. We also found that only meditators' anxiety trait is negatively correlated with mindfulness trait, but no correlation for control group. Event-related potentials analysis showed that meditators had larger N2pc when distractor appeared. The EEG frequency data revealed that meditators' right frontal gamma power was stronger than control group after meditation which may indicate better efficiency in attentional reorienting.

Topic Area: ATTENTION: Other

Neural Correlates of Educational Engagement

Poster C11, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Gad Touchan[1], Samantha Cohen[2], Denise Robles[1], Stella Ferrari[1], Simon Henin[1], Lucas Parra[1]; [1]City College of New York, [2]CUNY Graduate Center

Although student engagement is correlated with academic success, the mechanism by which this attentional focus translates into improved performance is unknown. We hypothesized that the level of neural reliability evoked by educational stimuli, measured via the inter-subject correlation (ISC) of electroencephalography (EEG), would predict both attention to and retention of the stimuli. To assess this, the knowledge base of 20 subjects was assessed before and after exposure to educational videos. The reliability of each individual's evoked responses, recorded while watching the videos, was compared to their peers to establish a metric for their relative attentional engagement with the stimuli. Neural reliability correlated with an improvement on test scores after exposure to the educational videos. ISC could also discriminate the attentional state of subjects with perfect accuracy. This suggests that ISC is a marker of the stimulus-related attentional mechanisms necessary to achieve comprehension. In the future, ISC may be used as a metric when designing and assessing educational content and presentation style.

Topic Area: ATTENTION: Other

The effect of cerebellar lesions on visual attention during motor-cognitive dual-task performance

Poster C12, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Erika Künstler[1], Albrecht Günther[1], Carsten Klingner[1], Otto Witte[1], Peter Bublak[1]; [1]Jena University Hospital

Cerebellar involvement in motoric coordination has long been established; however, increasing evidence implicates the cerebellum in executive functions, for example in dual-tasking, the concurrent execution of two tasks. The current study therefore assessed how acquired cerebellar lesions affected the simultaneous performance of a cognitive and a motoric task in infarct patients compared to controls. The patient group consisted of 20 individuals with unilateral cerebellar infarcts, isolated strictly to the cerebellum. A healthy matched control group was also tested. Both groups completed a motoric tapping task and a visual attention test under single-task conditions, as well as both tasks simultaneously in a dual-task condition. The visual attention task, based on the Theory of Visual Attention, provided estimates of the size of the storage capacity of the visual short-term memory (VSTM; parameter K), as well as the processing speed (parameter C) of participants. C remained stable between the single and dual-task conditions in both groups, although K was significantly reduced in patients in the dual task (p=0,008), but not in controls. In patients, tapping performance also decreased in the dual task condition (p=0,009), whilst the performance of controls remained stable. Furthermore, the lateralization of the infarct had no significant effect on tapping performance, indicating that diminished performance in the dual-task arose due to cognitive dual-tasking costs, rather than from motoric deficits. These findings suggest that the size of the attentional focus, as reflected by VSTM, is adversely affected in cerebellar lesions, rather than processing speed, leading to performance decrements in dual-tasking.

Topic Area: ATTENTION: Other

Racial Colorblindness: Ironic Attentional Processing of Racial Stimuli

Poster C13, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Andre' Oliver[1], Avi Ben-Zeev[1], Mark W. Geisler[1]; [1]San Francisco State University

Does racial colorblindness, a racial strategy that espouses that race does not and should not matter when interacting with others (Wolsko, et. al., 2000), lead to an increased attention to race via ironic activation? Specifically, we examined whether people who endorse higher levels of racial colorblindness [employing the Colorblind Racial Attitudes Scale (CoBRAS); Neville et. al., 2000] exhibit an attentional bias to racial cues (Black/White male faces). Participants completed a modified visual dot-probe task followed by the CoBRAS. Using the dot-probe task, we provide evidence for an ironic attention effect, such that individuals who endorse higher levels of colorblindness show more attention to racial stimuli (Black and White male faces). A 2x2 mixed factorial ANOVA (Colorblindness: High versus Low by Target Race: Black vs. White), was significant, $F(1, 85) = 5.12$, $p. = .026$, $\eta^2 = .1$ and revealed that a higher level of colorblindness was associated with greater attention (fasters RTs) to both the Black, $t(85)= 2.01$, $p. = .048$, $d = .43$, and White male targets, $t(85)= 2.56$, $p = .012$, $d = .56$. This suggests, ironically, faster reaction times and greater activation of attention to racial stimuli occurs when one endorses greater levels of racial colorblindness. This paradigm will be used to address the cognitive underpinnings of colorblindness, ironic activation, and attentional processing of race in relation to event related potential (ERP) studies.

Topic Area: ATTENTION: Other

Learning outcomes and brain-to-brain synchrony between students vary by teaching style: evidence from classroom EEG experimentation

Poster C14, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Dana Bevilacqua[1], Suzanne Dikker[1,2], Ido Davidesco[1], Lu Wan[3], Kim Chaloner[4], Mingzhou Ding[3], David Poeppel[1]; [1]New York University, [2]Utrecht University, [3]University of Florida, [4]Grace Church High School

How does the human brain support real-world learning? In this research, we used wireless EEG headsets to collect neurophysiological from groups of students and their teacher while they engaged in high school biology lessons. Prior research conducted in one school found that brain-to-brain synchrony between students (quantified as inter-brain coherence; Total Interdependence or TI, Wen et al., Neuroimage, 2012) predicted social dynamics and classroom engagement, factors found to be critical for student learning (Reyes et al., J. Educ. Psychol., 2012). Specifically, student ratings (e.g. engagement) and brain-to-brain synchrony between students were higher when students viewed lesson-related videos compared to listening to their teacher's lectures. In this study, we recorded EEG from a similar classroom setup in a second New York City high school. Six recording sessions occurred during scheduled classes over the semester and were organized to compare teaching styles—two lesson-related videos interleaved with two lesson lectures. Students completed a multiple-choice quiz after each class to measure their retention of that lesson's content from videos and lectures. Replicating findings from the first school in preliminary analyses of one session, a student's brain-to-brain synchrony with the other students as a group was higher for the video segments compared to the lecture segments. Furthermore, student retention was higher for video content then lecture content across all six sessions, but only for content presented in the second half of class. Together, our findings provide further evidence regarding how to investigate the neural basis of real-world learning and academic outcome in group settings.

Topic Area: ATTENTION: Other

The effects of time pressure on flanker task performance investigated using the drift diffusion model

Poster C15, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Chia Ning Chiu[1], Neil G Muggleton[1,2,3]; [1]National Central University, [2]University College London, [3]Goldsmiths

Time pressure can be an important factor affecting decision making and can be manipulated with relative ease for cognitive tasks by, for example, limiting stimulus presentation time or limiting the time allowed to make a response. While changes in response times or accuracy rates can be indicative of the effectiveness of such manipulation, the offer less insight into the underlying reasons for the change. Alternative analysis of such data may offer insight into, for example, whether stimulus processing changes of or if there is a change in the confidence levels needed to make a decision. One analytical approach is use of the drift diffusion model (DDM), which has being increasingly employed in the assessment of cognitive performance and can provide a more specific assessment of the results obtained from task performance than that based on response times or accuracy alone (e.g. Ratcliff & Rouder, 1998). The present study examined the effects of different time limits for making a response on a flanker task (Eriksen & Eriksen, 1974). Twelve participants (mean age= 21.08 ± 2.02 years) performed this task with time limits to make a response of 0.5, 1, and 3 seconds, assumed to be associated with different levels of time pressure. Analysis showed changes for the different time limits for several measures, with a lower drift rate (or the rate of approach to a decision level) for incongruent trials being seen for the higher time pressure condition, an effect that may be consistent with pressure changing the pattern of performance.

Topic Area: ATTENTION: Other

Prior knowledge of category size impacts search

Poster C16, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Brianna McGee[1], Chelsea Echiverri[1], Benjamin Zinszer[2], Rachel Wu[1]; [1]University of California, Riverside, [2]University of Rochester

Prior research has shown that category search is similar to 1-item search (as measured by the N2pc ERP marker of attentional selection) because items in a category can be grouped into one attentional template. The present study investigated whether the perceived size of a familiar category impacts the attentional template used when searching for a category or specific items from that category. Critically, the perceived size of the categories was based on prior knowledge, rather than the experimental stimuli. We presented participants with sixteen items: eight from a smaller category (social media logos) and eight from a larger category (manufacturing company logos). We predicted that search for smaller categories would rely on a better-defined attentional template compared to larger companies, and therefore produce a larger N2pc. Twenty adult participants completed four search tasks: Search 1) specific social media logo (e.g., Facebook); Search 2) specific manufacturing logo (e.g., Xbox); Search 3) any social media logo; Search 4) any manufacturing logo. Neither reaction time nor accuracy differed between searches for social media logos or manufacturing logos, and familiarity measures showed that both categories were equally familiar to the participants. However, only searches in the social media category (for either a specific item or any item from the category) produced a significant N2pc. No N2pc was found in either item or category search for manufacturing logos. Our results show that participants' knowledge about a category's size influences the way they search for both a specific item from the category and the whole category.

Topic Area: ATTENTION: Other

The effect of emotional expectation on episodic encoding in young and older adults

Poster C17, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Brittany Corbett[1], Lisa Weinberg[1], Audrey Duarte[1]; [1]Georgia Institute of Technology

In everyday life, negative events often happen without notice, such as a car accident or a robbery but little is known about memory for unexpected emotional events. This study investigated if being prepared to experience a negative event can change the way it is encoded for younger and older adults. In an fMRI paradigm, participants viewed negative and neutral pictures preceded by cues that were either reliable predictors of the valence of the image (valid) or cues that were unreliable predictors of the valence (invalid). Participants were asked to rate the emotional intensity of these pictures during encoding and to complete a recognition task immediately after scanning. Negative stimuli preceded by an invalid cue were rated more intensely than negative stimuli preceded by a valid cue, particularly for older adults. While young adults' memory was superior for invalidly cued events, older adults' memory was better for validly cued events. Imaging results showing an age-related increase in negative cue-related activity in the orbitofrontal cortex (OFC) suggest that older adults may engage anticipatory processes to support emotional encoding. Consistent with behavioral performance, posterior parietal activity predictive of encoding success was greater for invalid events than valid events in the young, and for valid than invalid events in the old. In contrast to existing findings from the cognitive, non-emotional domain, these results suggest that older adults are able to use cues to anticipate emotional events and improve their memory performance.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

Dissociation Between Perceived and Felt Emotions in Musical Anhedonia

Poster C18, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Emily Przysinda[1], Matthew Sachs[2], Yvonne Leung[3], Tima Zeng[1], Psyche Loui[1]; [1]Wesleyan University, [2]University of Southern Califonia, [3]Western Sydney University

Music elicits emotions in all human cultures, but several recent reports have demonstrated the existence of specific musical anhedonia: the lack of emotional response to music. Here we report a case study on BW, a subject with musical anhedonia. BW self-reported a socially debilitating lack of emotional experience from music, despite years of musical training and intact emotional response to visual art. Baseline perceptual testing showed normal audiometric responses and normal sensitivity to musical pitch. The Physical Anhedonia Scale showed normal hedonic responses overall, but below-average scores on auditory items specifically. The Barcelona Music Reward Questionnaire and the Aesthetic Experience Scale-Music both showed abnormally low (>3SD below published norms) scores on all subscales of musical emotion and reward. However, BW showed normal responses to auditory and musical emotional identification and categorization tests including the Emotional Bursts (Vocal and Instrumental subtests) and Macquarie Battery for Emotional Prosody. Preliminary results from Diffusion Tensor Imaging showed that compared to age-matched controls, BW has less volume in white matter pathways from the right superior temporal gyrus to the anterior insula and medial prefrontal cortex. Together, results support a dissociation between perceived and felt emotion. Emotional content from auditory signals can be perceived and identified without being accessible to emotional experience. The neural mechanism underlying this dissociation likely involves a disconnect between temporal lobe regions that acquire and store perceptual cues for emotion, and insula and MPFC that link these cues to changes in arousal, thus impairing the emotional experience of music.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

Impaired proactive control under threat of shock

Poster C19, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Tara Miskovich[1], Kenneth Bennett[1], Daniel Stout[2,3], Christine Larson[1]; [1]1University of Wisconsin-Milwaukee, [2]Center of Excellence for Stress and Mental Health, VA San Diego Healthcare System, [3]Department of Psychiatry, University of California San Diego

According to the dual-mechanisms of control theory, proactive control is impaired in individuals with high anxiety, while reactive control is intact. We aim to extend this line of research to state anxiety by demonstrating differential recruitment of proactive control when under uncertain threat to delineate a potential mechanism of cognitive difficulties in anxiety disorders. We recorded event-related potentials on 31 undergraduates, while they performed the AX-CPT, alternating between threat of shock and safe conditions. The AX-CPT provides a measure of proactive control as trials rely on maintenance of goal-relevant information. While monitoring a series of letters, participants respond "yes" when they see an X (probe) only when it follows an A (cue). Proactive control is assessed on BX trials where the probe is followed by an invalid cue (B), requiring the need to override prepotent responses to the X. Here, we demonstrate that the late positive potential (LPP), a well-validated event-related potential associated with sustained attention and goal-maintenance, was attenuated when maintaining B, compared to A, cues ($p = 0.046$) in threat compared to safe conditions. Moreover, LPP amplitude for B cues predicted BX probe accuracy and reaction time, but only under threat of shock, indicating that increases in the LPP under threat may reflect successful sustained maintenance of important cue information to override prepotent responses. These findings provide a neural measure of proactive control under states of anxiety; providing a better understanding of the neural mechanisms underlying impaired maintenance of goal-related information under in anxiety disorders.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

Common Neural Substrates of Down-Regulating Negative Emotion and Social Threat

Poster C20, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Teodora Stoica[1], Lindsay Knight[1], Leonard Faul[1], Farah Naaz[1], Brendan Depue; [1]University of Louisville

The relationship between the neural mechanisms underlying regulation of negative emotion and social threat perception and has not been fully elucidated. The current fMRI study aimed to investigate common mechanisms underlying the down-regulation of negative emotion and social threat perception. FMRI data was correlated with subjective behavioral ratings of negative pictures as well as fearful human faces. In addition, independent component analysis (ICA) was used to extract common networks during an emotion regulation (ER) and social threat task (STT). Behavioral results showed that ratings from the ER and STT correlated strongly. Functional results indicated a similar pattern of activation in the right hemisphere for both tasks, with robust activation in the inferior frontal junction (IFJ), medial frontal gyrus (MFG) and inferior frontal gyrus (IFG). Functional data correlated with behavioral ER ratings revealed increased rIFG and bilateral inferior parietal sulci (IPS) for better down-regulation, as well as decreased amygdala activation during the STT. Results using ICA analysis indicated common components across tasks, which loaded heavily on the right IFJ, IFG and lateral inferior parietal cortex. Selected components were also found to predict behavioral ER and STT ratings, whereby higher expression of components was related to more down regulation of negative emotion and social threat perception, respectively. The results suggest higher utilization of indicated functional networks and brain regions is related to a higher rate of down-regulating negative emotion and social threat perception.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

Social attention bias in Williams syndrome and Autism spectrum disorder

Poster C21, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Kelsie Boulton[1], Melanie Porter[1,2]; [1]Macquarie University, Sydney, Australia, [2]ARC Centre of Excellence in Cognition and its Disorders, Macquarie University, Sydney, Australia

With their contrasting social profiles, Williams syndrome (WS) and Autism Spectrum Disorder (ASD) provide a unique opportunity to explore attention patterns towards social stimuli. While past studies have reported increased attention to positive social perceptual stimuli (happy faces) in WS, findings in ASD fail to show this effect, suggesting decreased attention to socially relevant information. Currently, no study has considered whether this increased attention in WS, and corresponding lack of attention in ASD, extends beyond perceptual cues. This study explored patterns of attention towards social stimuli in these populations when semantic instead of perceptual cues were provided. Adolescents and adults with WS and ASD, as well as neurotypical controls were trained to memorise biographical vignettes depicting trustworthy or untrustworthy characters, paired with neutral faces. Participants then completed a dot-probe task to look at potential biases in attention. Significant differences in attention patterns were observed, with WS individuals exhibiting an increased bias towards trustworthy faces, compared to both ASD and controls. This is similar to the findings of attention bias towards positive social perceptual stimuli reported in WS. Consistent with prior studies using perceptual stimuli, no bias in attention towards trustworthy or untrustworthy faces was observed in ASD or neurotypical participants. These results indicate that the bias in attention towards positive social stimuli in WS spans across both perceptual and conceptual cues. Theoretical and practical implications of this study, including potential links between attention patterns and aberrant amygdala reactivity in WS, are discussed.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

Inverse EEG Theta Peak Frequency Oscillation in Frontal- and Parietal-midlines Predicts Lower Cognitive Control and Working Memory in Individuals with High Trait Anxiety

Poster C22, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Salahadin Lotfi[1], Kenneth Bennett[1], Maryam Ayazi[1], Erin Peterson[1], Shannon Cavanaugh[1], Christine Larson[1], Hanjoo Lee[1]; [1]University of Wisconsin-Milwaukee

Anxiety is often associated with impaired cognitive function and an excessive allocation of attentional resources toward threat-related stimuli. This dysfunctional allocation allows unnecessary threat-related information to enter working memory (WM), maintaining irrelevant anxious cognitions and consuming cognitive resources which in turn interferes with ongoing behavior. Recent evidence also shows that cognitive control (CC) is a critical component of WM capacity. Strong CC enables individuals to filter out irrelevant information during cognitive tasks. CC has been linked to electroencephalogram theta peak frequency (TPF) in Frontal-midline region such that lower TPF is indicative of higher CC. In contrast, higher TPF in Parietal-midline region is also associated with higher WM performance. The main purpose of study is to investigate the association between CC, WM and TPF in Frontal-midline and Parietal-midline regions of individuals with high trait anxiety. EEG recordings were collected from a sample of undergraduate students (N=27) who scored 44 or above on the STAI-Trait Anxiety Inventory. Results revealed a significant negative correlation between TPF of Frontal-midline and a negative stimuli selectivity bias in an emotional Stroop task(r= -0.394). Results also indicate a significant negative correlation between TPF of Parietal-midline and WM performance (r=-0.425). Moreover, there were also significant negative correlations between TPF of Frontal-midline and three measures of stress, anxiety, and rumination(r=-0.533 & -0.482). These data suggest that TPF in Frontal-midline and Parietal-midline regions may be neural markers predicting impaired negativity-related cognitive control and low working memory performance in trait anxious individuals, further supporting the relationship between CC, WM, and anxiety.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

The Effects of Acute Psychosocial Stress on Oculomotor Saccadic Adaptation

Poster C23, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Delia A. Gheorghe[1], Muriel T.N. Panouillères[2], Nicholas D. Walsh[1]; [1]University of East Anglia, [2]University of Oxford

Early-life stressors and stress-related psychopathology have been reported to affect cerebellar structure and function. However, the mechanism through which stress affects cerebellar function in healthy individuals is unknown. The aim of the current experiment was to test the effects of experimentally-induced stress on forward saccadic adaptation in 49 young healthy men and women. Saccadic adaptation is a form of motor learning, which facilitates error-driven adaptive changes in saccade size. Cerebellar integrity is necessary for successful sensorimotor adaptation in humans. Stress induction was achieved by employing the offline version of the Montreal Imaging Stress Task (MIST), shown to generate significant physiological responses. In the experiment, participants matched for gender and age were exposed to either an experimental or a control condition. Saliva for cortisol determination was collected before, immediately after, 10 or 30 minutes after the MIST. Saccadic adaptation was assessed 10 minutes after stress induction, when cortisol levels reached their peak. Participants in the experimental group reported significantly more stress symptoms than controls. Adaptation was elicited using the classic double-step target paradigm with a 30% target eccentricity. Previous data collected in our lab showed that this paradigm induces a strong adaptation effect, explaining 89% of gain variance in healthy volunteers. Similarly, behavioural analyses showed that control participants demonstrated a significant increase in gain. This effect was not present for men and women exposed to the stressor. Initial results indicate that acute stress reduces the ability to acquire saccadic adaptation, potentially via perturbations to cerebellar circuits.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

Relative Preservation of Emotion Recognition Abilities in Women Compared to Men with Parkinson's Disease

Poster C24, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Colleen Frank[1], Emily Flandermeyer[2], Tara Lineweaver[2]; [1]University of Michigan, [2]Butler University

Successful emotion recognition is necessary for healthy relationships. Although Parkinson's disease (PD) is primarily characterized by decreases in motor movements, it can also be associated with deficits in emotion recognition through both auditory and visual modalities. Because past research has also documented that gender plays a role in emotion recognition, PD could differentially affect men and women. The goal of this study was to document the magnitude and specificity of emotion recognition impairments that accompany PD and to determine whether gender plays a role in these deficits. This study examined the abilities of men and women with PD to recognize specific emotions through emotional facial expressions and emotional prosody compared to healthy controls. This study included 28 PD patients (14 men, 14 women) and 40 (20 men, 20 women) age-matched healthy control participants. The PD group displayed deficits on both the emotional facial expression recognition task and the emotional prosody recognition task. In addition, women outperformed men on both tasks. Diagnosis interacted with gender to affect prosody recognition, and to a lesser extent facial expression recognition. Specifically, men with PD showed much stronger impairments in their ability to recognize angry, fearful, and surprised tones of voice than women with PD and struggled to recognize disgusted facial expressions. These results may be used to create specialized interventions for PD patients to help them maintain healthy, social interactions.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

Incidental haptic sensations influence judgment of crimes: neural underpinnings of embodied cognitions

Poster C25, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Michael Schaefer[1], Claudia Denke[2], Claudia Spies[2], Andreas Heinz[2], Andreas Ströhle[2], Lillia Cherkasskiy[3], Hyunjin Song[4], John Bargh[3]; [1]Medical School Berlin, Germany, [2]Charité – Universitätsmedizin Berlin, Germany, [3]Yale University, CT, USA, [4]Arizona Christian University, AZ, USA

Many extralegal factors that may influence judicial outcomes have been discussed. Here we investigated the experience of incident haptic sensations on the harshness of sentences recommended by judges and juries. Based on recent theories of embodied cognitions, which claim that cognitive representations are structured by metaphorical mappings from sensory experience, we hypothesized that tactile priming with hard objects would produce recommendation of harder punishments. Furthermore, the theory of embodiment predicts that this effect should be based on sensorimotor brain activation during the judging process. In order to test this assumption we presented participants scenarios that described various crimes while scanning their brain activity with fMRI. After each scenario participants were asked to rate how strong they would sentence the delinquents. Before reading the scenario the participants were primed either with a hard or a soft object (or not primed at all). Results revealed that hard priming led participants to recommend harder punishments. This effect was accompanied by an involvement of somatosensory brain areas during the judging phase (only when being primed with a hard object before). The results are in line with the simulation assumptions of the theory of embodiment and propose a central role of the sensorimotor cortices for embodied metaphors. We conclude that incidental tactile experiences may influence our abstract cognitions and even how hard we are on crimes.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

The Effects of Self-Selected Music on Cortical Asymmetries

Poster C26, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Trevor C. J. Jackson[1], Christine R. Jimenez[1], Mark W. Geisler[1]; [1]San Francisco State University

Alpha asymmetry in frontal areas has been found to correlate with emotionally valenced stimuli (Davidson, Ekman, Saron, Senulis, & Friesen, 1990; for review, see Davidson, 1998), including music (Schmidt and Trainor, 2001). Few studies, however, have investigated what might be driving this effect, and whether preference and self-selection can modulate alpha asymmetry. The current study investigated whether self-selected music can modulate alpha asymmetry, and whether affect or arousal ratings were related to higher instances of alpha asymmetry. EEG was collected at bands of interest that included alpha (8-13 Hz), theta (4-8 Hz), and beta (13-30 Hz), and was recorded from Fz, F3, F4, Cz, C3, C4, Pz, P3, and P4. Thirty-two participants (N = 32) chose a personal song that they would rate as most positive, and one song that was rated as most negative. Participants then listened to white noise (as a control) and each musical excerpt (in a counterbalanced order) for 45 seconds. Results indicated that participants showed significantly increased alpha asymmetry in the right hemisphere over time, however no significant differences arose between the selected song and white noise conditions. Additionally, no relationship was detected between affect and arousal ratings and cortical asymmetries. Implications, as well as other studies further investigating the role preference can play on modulating cortical asymmetries, will be discussed.

Topic Area: EMOTION & SOCIAL: Other

Enhancing social attention mechanisms via noninvasive brain stimulation

Poster C27, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Eva Wiese[1], Eric Joshua Blumberg[1], Aziz Abubshait[1], Raja Parasuraman[1]; [1]George Mason University

When we interact with others, we use nonverbal cues to understand, explain and predict their behavior. For example, gaze direction informs about what others are interested in and allows us to infer their intentions and action goals. Observing changes in gaze direction in others triggers shifts of attention to the gazed-at location – a process that is enhanced when the gazer is believed to have a mind. Attributing mind to others is associated with activation in the social brain network, including the anterior cingulate cortex (ACC), and the temporo-parietal junction (TPJ). In the current experiment, we used transcranial direct current stimulation (tDCS) to investigate the causal role of these two areas for modulating low-level mechanisms of social cognition, such as attending to gaze signals. The gaze cues were sent either by an agent with a mind (i.e., human) or without a mind (i.e., robot) and participants (N= 90) performed the task with both agents after random assignment to one of three conditions: active stimulation to the ACC, active stimulation to the TPJ (both at 2mA for 30 minutes) or sham stimulation (2mA ramp-up and immediate ramp-down). Active stimulation to the ACC significantly increased gaze cueing for the intentional, but not the non-intentional agent, while stimulation to the TPJ had the opposite effect; sham stimulation did not affect gaze cueing in either agent. The results indicate that stimulation of ACC enhances top-down control mechanisms relevant to gaze cueing, while stimulation of TPJ emphasizes the bottom-up features of the gaze signal.

Topic Area: EMOTION & SOCIAL: Other

Perception of distributive justice is context-dependent as revealed by the N400 effect and behavioral data.

Poster C28, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Benjamin Ernst[1], Manuela Sirrenberg[1]; [1]Catholic University of Eichstätt-Ingolstadt

As social beings, humans try to uphold distributive justice when resources are allocated. However, what is just is not always self-evident, as resource allocation can be guided by distinct principles: Merit, equality, and need. Previous research suggests that which principle is preferred is context-dependent. Specifically, it is seems that the dominant principle in an occupational context is merit, while it is equality in a private context, and need in the context of state intervention. In the present study, we propose that an allocation is considered to be particularly fair, if the applied principle fits the context. Importantly, we hypothesized that these preferences should not only manifest in explicit ratings, but also more implicitly in the form the N400, an electrophysiological marker of word processing. To this end, we asked participants to rate their agreement with statements set in different contexts (occupation, private, state intervention) describing resource allocation in accordance with a specific principle (merit, equality, need). These statements ended either with 'is fair' or 'is unfair'. Ratings, as well as response times, showed the predicted pattern, clearly reflecting context-dependent preferences. Moreover, the N400 effect, i.e., the difference in activity following the final word 'fair' versus 'unfair', was most pronounced following merit-related statements in the occupational context and equality-related statements in the private context. However, this component did not reveal a dominant principle in the state intervention context. Together, our results show that the perception of distributive justice is context-dependent and suggest that justice-related preferences manifest already before the explicit rating.

Topic Area: EMOTION & SOCIAL: Other

Resting-state temporal dynamics and mind-wandering frequency during reading

Poster C29, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Erik Erwin Jahner[1,2], Xiao-Fei Yang[1], Mary Helen Immordino-Yang[1]; [1]USC, [2]University of California Riverside

The frequency of unintended mind-wandering during reading varies between individuals; several brain networks identified during rest have previously been associated with this phenomenon. An assumption behind resting-state analysis is that neural cooperation between regions is reflected through temporal synchrony of BOLD activation, however these networks may be an emergent property of sequential activity patterns (Mitra & Raichle, 2016). By applying a cross-covariance function to BOLD activity patterns across regions, one can capture some of these temporal dynamics. Resulting "projection maps" representing average latency of a region may reveal group differences not discoverable by traditional resting-state analysis (Mitra, Snyder, Constantino, and Raichle, 2015). In the present study this lag-analysis was conducted on the resting-state scans of 31 adolescents who subsequently read a narrative presented on 17 slides, between which participants were probed for mind-wandering frequency. Correlations between mind-wandering frequency and lag-map projections were then evaluated. Results of this exploratory analysis suggest that the latency of regions implicated in internal thought, reading, and voice awareness correlate with mind-wandering frequency: individuals who mind-wandered more frequently showed an increased latency of the precuneus ($p<.01$, $r=.43$, uncorrected), a region implicated in the regulation of internal thought, and the posterior insula ($p<.005$, $r=.50$, uncorrected), a region implicated in bodily awareness; increased latency in traditional reading regions of visual-word-form area ($p<.005$, $r=.51$, uncorrected) and Broca's area ($p<.005$, $r=.50$, uncorrected); and negative latency at the middle temporal sulcus implicated in voice perception ($p<.005$, $r=-.51$, uncorrected). These results suggest temporal dynamics during resting-state may be predictive of mind-wandering frequency.

Topic Area: EMOTION & SOCIAL: Other

Role of two embedded syntaxes for belief attribution in adults with typical development and with autism: A behavioral experiment

Poster C30, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Morgane Burnel[1,2,3], Marcela Perrone-Bertolotti[1,2], Stephanie Durrleman[4], Anne Reboul[3], Monica Baciu[1,2]; [1]Univ. Grenoble Alpes, LPNC, F-38040 Grenoble, France, [2]CNRS, LPNC UMR 5105, F-38040 Grenoble, France, [3]Univ Lyon, CNRS, Institute for Cognitive Sciences - Marc Jeannerod (UMR 5304), F-69675 Bron, France, [4]Psycholinguistics Department, Faculty of Psychology and Educational Sciences, University of Geneva

Introduction. The role of syntax during belief attribution in healthy adults is not completely understood and still unexplored in adults with autism. Embedded syntax could be useful for the development of Theory of Mind (ToM) (Development account, DA) or more largely, over the lifespan, for ToM reasoning (Reasoning account, RA). Two hypotheses are currently explored, one suggesting embedding of a proposition into another (Relatives and Complements sentences) and another one suggesting false proposition into a true one (Complements sentences), both useful for ToM. The goals of this study were (1) to compare DA vs. RA, (2) to evaluate the role of Relatives and Complements syntaxes in belief attribution, and (3) to evaluate the hypothesis of a verbally-mediated strategy to attribute beliefs in adults with autism Methods. Adults with typical development (TD) (n=22) and with autism (n=50) were involved in a forced-choice task including a belief attribution and a control task under four conditions: silence, syllables repetition, relatives sentences repetition and complements sentences repetition. Results and Discussion. Our results for belief attribution in TD shows the significant role of DA compared to RA. Complements and relatives were similarly related to belief attribution in TD but for participants with autism, results showed increased rates of errors during repetition task for complements compared to relatives. This result suggests that adults with autism use complements syntax to compensate the ToM deficits.

Topic Area: EMOTION & SOCIAL: Other

Age and Modulation of BOLD Response to Task Difficulty: the Protective Effects of Crystallized Knowledge

Poster C31, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Zhang Jingting[1], Zhuang Song[1], Patricia A. Reuter-Lorenz[2], Denise C. Park[1]; [1]University of Texas at Dallas, [2]University of Michigan

We have previously reported that older adults, compared to young, are less able to modulate the magnitude of the Blood Oxygenation Level Dependent (BOLD) response to task difficulty on a semantic judgment task (Kennedy et al., 2015). Here we investigated whether neural enrichment factors, such as crystallized knowledge, might be protective of modulatory capacity in the context of healthy aging. We studied 463 participants (20-89 years) who judged ambiguous (Hard) and unambiguous (Easy) words for animacy in an fMRI block design. Age and crystallized ability were entered as separate steps in hierarchical regression models to assess whether crystallized knowledge accounted for variance in modulation beyond age. We found that older adults had decreased modulation of BOLD response to difficulty in medial frontal and bilateral inferior frontal gyri (IFG), but after controlling for age, better crystallized knowledge predicted more modulation in these frontal regions. Moreover, a second analysis showed that higher modulation in these frontal regions predicted better performance in reasoning and executive function across the adult lifespan. Additionally, higher modulation in medial frontal and right IFG predicted better working memory in both the middle-aged (45-64 years) and younger-old (65-80 years) groups but not the very old group (80-89 years). These effects remained even after we corrected crystallized ability for fluid intelligence. Our findings suggested that high modulatory capability is impaired with age and is important for cognitive functions and that crystallized knowledge appears to be a type of cognitive reserve that protects modulation of brain activity in core control regions.

Topic Area: EXECUTIVE PROCESSES: Development & aging

Doubly Dissociable Neuromorphological Correlates of Memory and Perceptual Inhibition in Healthy Aging

Poster C32, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Teal Eich[1], Ray Razlighi[1], Derek Nee[2], John Jonides[3], Yaakov Stern[1]; [1]Columbia University, [2]Florida State Univerity, [3]University of Michigan

Declines in working memory (WM) are a ubiquitous finding within the cognitive-aging literature. A unitary inhibitory selection mechanism that guides attention towards task-relevant information and resolves interference from task-irrelevant information has been proposed to underlie such deficits. Here, we tested whether the time point in the information-processing stream where inhibition occurs affects older relative to younger adults' performance. Participants were tested on a set of tasks tapping perceptual and memory inhibition. We found that although older adults were impaired relative to younger adults in inhibiting information on both a perceptual and memorial level, the performance across tasks was not correlated, suggesting dissociable inhibitory processes. To further explore this possibility, we assessed the relationship between cortical thickness and inhibitory performance across the two tasks in a subset of the older adults. We found that worse memory inhibition was associated with cortical thinning in the left Ventral Lateral Prefrontal Cortex (VLPFC), a brain area previously shown to be associated with inhibiting information from WM, but not in the right Superior Parietal Lobule (SPL), an area implicated in the top-down control of attention. On the other hand, while impaired perceptual inhibition was associated with reduced cortical thickness in the right SPL, it was not associated with thinning in the left VLPFC. These results demonstrate a double dissociation between older adults' performance on two types of inhibitory control tasks and cortical thinning in specific brain areas, and argue against a unitary view of inhibitory control processes.

Topic Area: EXECUTIVE PROCESSES: Development & aging

Incentive effects on cognitive control in younger and older adults: Behavioral and ERP evidence

Poster C33, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Farrah Kudus[1], Ryan S. Williams[2], Benjamin J. Dyson[3], Julia Spaniol[1]; [1]Ryerson University, [2]University of Toronto, [3]University of Sussex

Motivational incentives exert both transient and sustained effects on cognitive control. While incentive processing is relatively intact in healthy aging, cognitive control shows age-related decline. How gains and losses affect cognitive control mechanisms in older adults is still unclear. Here we examined this issue using a flanker task with financial incentives. Participants included 24 healthy younger adults (mean age: 20.5 years) and 24 healthy older adults (mean age: 73.63 years). Participants made speeded responses to the direction of a central arrow that was flanked by same-direction (congruent) or different-direction (incongruent) arrows. A visual cue at the beginning of the trial indicated incentive availability. Incentive blocks contained a mix of incentive (gain or loss) and non-incentive trials, whereas non-incentive blocks contained non-incentive trials only. On incentive trials, participants gained/avoided losing $0.10 for fast and accurate responses. Incentives promoted speed at the expense of accuracy, particularly for younger adults. Examination of cue-locked, target-locked, and feedback-locked ERP components revealed age-related similarities and differences. Enhancement of motor preparation following incentive cues (cue-locked CNV amplitude) was similar for younger and older adults, but the attentional response to the target (P3 amplitude) was sensitive to incentives in younger adults only. Performance monitoring (ERP amplitude difference in response to negative vs. positive feedback) was limited to the loss domain in younger adults. In older adults, performance monitoring was reduced and seen across gain and loss domains. Overall, these findings are consistent with age-related decline of incentive-based modulation of cognitive control, despite preserved anticipatory responses to incentive signals.

Topic Area: EXECUTIVE PROCESSES: Development & aging

Cognitive Control and Adaptive Learning in Adolescents

Poster C34, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Ilyoung Kim[1], Jeanyung Chey[1]; [1]Seoul National University

Successful adaptation is crucial for everyday-life functioning, especially for the adolescents who are in education courses. In this process, not only the final achievement but also the learning trajectories are important, reflecting individual differences in efficiency. At this point, cognitive control, the ability to make a goal-directed decision despite distracting stimuli could be influential. However, less is known about the exact relationship between cognitive control ability and adaptive learning. Here the main questions are whether those with more attentional resources also learn faster and better by common neural mechanism, and whether this instant adaptation process could predict the longer-term learning trajectory. In this study, 66 eighth-grade students underwent task fMRI using multi-source interference task[MSIT](Bush & Shin, 2006). RT difference between incongruent and congruent trial was used as interference index and the time taken until one gets the minimum incongruent RT was used as learning speed. There was no correlation between cognitive control ability and learning speed. When comparing activation patterns, the spatial map positively associated with learning speed shared some of the regions which were positively related to RT difference, while both were included in MSIT main-effect map. Further, the learning clusters overlapped with the clusters where the activation changed after 6-week cognitive control training. All together, these demonstrate that the adolescents who strived to learn faster used their attentional resources fully but not successfully, resulting lower performance for a limited time. Nevertheless, this short-term adaptation process helped changing neural activation as well as behavioural performance in the long-term perspective.

Topic Area: EXECUTIVE PROCESSES: Development & aging

Different Functional Neural Correlates of Executive Deficits in Amnestic Mild Cognitive Impairment according to High and Low Beta-amyloid Burden

Poster C35, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Eun Hyun Seo[1], IL Han Choo[2]; [1]Chosun University, Gwangju, Korea, [2]Chosun University Hospital, Gwangju, Korea

Background: Although considerable number of amnestic mild cognitive impairment (aMCI) individuals show low beta-amyloid protein (Aβ) deposition (aMCI_Aβ-), little is known about the neural basis for cognitive deficits, particularly executive deficits. Therefore, this study aimed to identify the functional neural correlates of executive deficits in aMCI_ Aβ-, and compared to aMCI with high Aβ burden (aMCI_Aβ+). Methods: Data were selected from the Alzheimer's Disease Neuroimaging Initiative (ADNI) database. Based on mean florbetapir standard uptake value ratio (SUVR), aMCI group was divided into aMCI_Aβ- (n=230) and aMCI_Aβ+ (n=268). Downloaded FDG-PET images were preprocessed and analyzed using statistical parametric mapping 8. Correlation between the ADNI composite scores for executive function (ADNI-EXE) and regional cerebral glucose metabolism (rCMglc) were analyzed using multiple regression model with age, gender, and education as covariates. Statistical threshold was $p < 0.001$, uncorrected for multiple comparison. Results: For aMCI_Aβ-, significant positive correlations between ADNI_EXE and rCMglc were found only in the bilateral cingulate cortex. For aMCI_Aβ+, significant positive correlations between ADNI_EXE and rCMglc were found in the bilateral parietal, temporal, and frontal regions. These patterns of correlation were remained unchanged when clinical severity was added as covariate. Conclusions: Our findings indicate that executive deficit in aMCI depends on different functional brain regions according to Aβ burden level. Executive deficit in aMCI_Aβ- is associated with cingulate gyrus, whereas executive deficit in aMCI_Aβ+ is associated with typical AD signature regions.

Topic Area: EXECUTIVE PROCESSES: Development & aging

The impact of interruptions on task performance: Comparing younger and older adults in an event-related spectral perturbation study

Poster C36, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Stefan Arnau[1], Kristina Küper[1], Edmund Wascher[1]; [1]Leibniz Research Centre for Working Environment and Human Factors (IfADo)

The ability to maintain task performance, even if a task is interrupted by an unrelated and interfering task, is crucial for reliable information processing. With increasing age, cognitive processing becomes especially vulnerable to irrelevant information. However, does this phenomenon also appear when cognitive resources have to be distributed across two unrelated tasks? We used a nested task design. For the primary task, subjects had to memorize a specific stimulus feature, which could either be displayed by the first or the second of two sequentially presented stimuli. In one third of the trials, this sequence was interrupted by a math task. As expected, the nested math task strongly affected older participants' performance on the primary task. Time-frequency analysis of the EEG uncovered the use of different strategies across age groups. Older participants showed a larger frontal theta amplitude in response to the cue that signaled the relevant task feature of the primary task. This may reflect higher mental effort when encoding the task itself. In younger participants, on the other hand, induced theta was larger in response to the cue preceding the interruption task, suggesting that younger subjects had sufficient resources available for strategic task execution. The strategic allocation of top down resources is also reflected by an occipital alpha decrease, which was stronger in response to the presentation of relevant compared to irrelevant task features. The data support the notion, that processing capacities decrease with increasing age, leading to a strategic allocation of resources in favor of a primary task.

Topic Area: EXECUTIVE PROCESSES: Development & aging

Age-Related Stereotype Threat Effects on Metacognition

Poster C37, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Natasha Fourquet[1], Barbara J Knowlton[1], Castel Alan[1]; [1]University of California, Los Angeles

Aging is associated with negative stereotypes about memory. When older adults are reminded of these stereotypes prior to a task, their performance is negatively affected. The current study used a value directed remembering paradigm to see whether stereotype threat affects metacognitive processes in older adults. Participants were assigned to a neutral (Mage=64.17) or negative (Mage=68.00) condition. Participants in the negative condition read a passage on memory decline in older adults, while those in the neutral condition read about preserved cognitive abilities. Both groups completed a gambling task that asked them to bet on the likelihood that they would remember a particular word. If they recalled the word they bet on they received the amount of points the word was worth (points shown on the screen), but lost those points if they failed to recall it. No significant differences were found between conditions in number of bets or amount of words recalled. However, participants in the negative condition obtained a significantly lower score than those in the neutral condition ($F(2,84)= 6.59, p=.002$). These groups also showed significant differences in calibration scores (i.e., number of bets-number of words recalled; $t(42)=2.07$, $p=.045$), suggesting that participants in the negative group were making more ineffective bets. These findings suggest that when older adults are under stereotype threat, their ability to make accurate judgments about their memory is reduced. Furthermore, these results highlight that stereotype threat disrupts metacognitive processes in older adults, and that these effects on metacognition may be more robust than effects on memory performance.

Topic Area: EXECUTIVE PROCESSES: Development & aging

Moderating Effect of White Matter Integrity on Task-Related Brain Activation

Poster C38, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Melanie Lucas[1], Helena Blumen[2], Meltum Izzetoglu[3], Roee Holtzer[1,2]; [1]Ferkauf Graduate School of Psychology, Yeshiva University, Bronx, NY, [2]Albert Einstein School of Medicine, Yeshiva University, Bronx, NY, [3]School of Biomedical Engineering, Science, and Health Systems, Drexel University, Philadelphia, PA

As part of normal aging white matter integrity (WMI) decreases and there is a tendency for cortical overactivation with increasing executive demands. There is a paucity of research examining factors that may influence cortical overactivation. This study used diffusion-weighted imaging (DWI) and functional near infrared spectroscopy (fNIRS) to determine whether WMI moderated the change prefrontal cortex (PFC) oxygenation levels assessed under single and dual-task walking conditions. Specifically, we hypothesized that lower (i.e., worse) WMI would be associated with a greater increase in PFC oxygenation levels from single to dual-task walking conditions. Methods: Participants (n=62) were community-residing older adults. fNIRS was used to measure changes in oxygenated hemoglobin (HbO2) during walking. An overall Fractional Anisotropy (FA) values derived from DWI were used to quantify WMI. Linear mixed effects models were used to assess the effect of dual-tasking on gait velocity and PFC HbO2 Levels. Covariates included age, gender, education and a disease comorbidity index. Results: As expected, gait velocity declined ($beta=1.86$; $p<.001$) but PFC HbO2 levels increased ($beta=1.03$; $p=<.001$) from single- to dual-task walking. However, WMI moderated the effect of dual-tasking on PFC oxygenation. Specifically, lower WMI was associated with a greater increase in PFC HbO2 levels from single to dual-task walking ($beta=.58$; $p<.001$). Conclusion: We propose WMI as a mechanism underlying inefficient brain response to cognitive demands of locomotion.

Topic Area: EXECUTIVE PROCESSES: Development & aging

Development of the Frontal Aslant Tract (FAT) Using Restricted Diffusion Imaging (RDI)

Poster C39, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Dea Garic[1], Iris Broce[1], Heidy Zetina[1], Anthony Steven Dick[1]; [1]Florida International University

The present study aims to characterize age-related differences in microstructure of the Frontal Aslant Tract (FAT). The FAT is a fiber pathway connecting posterior inferior frontal gyrus to pre-supplementary motor area and based on its connectivity is proposed to support language and executive function (Broce et al., 2015). Recent research using spin density of restricted diffusion modeling has shown that increases in restriction diffusivity (RDI) are associated with increases in cell density (Yeh et al, 2016). Similarly, other research shows that neuronal processes, particularly higher packing density and number of axonal membranes, are the primary contributor to diffusion indices (Winston, 2012). Thus, we focus on RDI to assess age-related differences in the FAT. This is the first study to investigate this in typically developing children. We tracked 129 participants (70 females, age range= 0-18 years, M= 8.67) using high angular resonance diffusion-weighted imaging. Regions of interest were manually drawn based on previous anatomical definitions (Catani et al, 2012). We tested the effects of age on RDI values in both left and right FAT using robust regression. RDI in the whole brain increased significantly with age, $\beta = 0.916$, $t(115) = 19..806$, $p < 0.001$. Also, after controlling for whole brain RDI and gender, RDI in the left FAT increases with age, $\beta = 0.143$, $t(115) = 2.884$, $p = 0.007$. Broadly, these results have important implications for developmental models of white matter connectivity and provide a working framework for future investigation of atypical white matter connectivity in the FAT.

Topic Area: EXECUTIVE PROCESSES: Development & aging

Childhood development of behavioral and brain network changes related to basal ganglia: resting-state functional connectivity of striatal regions varies with performance on cognitive tasks in children

Poster C40, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Rachel K. Spooner[1], Nicholas Christopher-Hayes[1], Julia M. Stephen[2], Vince D. Calhoun[2], Yu-Ping Wang[3], Tony W. Wilson[1], David E. Warren[1]; [1]University of Nebraska Medical Center, [2]University of New Mexico, [3]Tulane University

The basal ganglia contribute to behavioral and cognitive abilities such as skilled motor performance, executive functions, and feedback-driven learning, but the developmental trajectory of functional brain changes supporting maturation of these abilities is not well-characterized. Here, we report preliminary findings from the Developmental Chronnecto-Genomics project (Dev-CoG) dataset. We analyzed fMRI data from children (N=49, age=9-14) to measure the relationship between behavioral performance on cognitive tests and whole brain resting-state functional connectivity (rs-FC) using anatomically-derived striatal seeds for the caudate and putamen. NIH Toolbox tasks were selected to test the hypothesis that striatal connectivity would be related to executive functions and motor performance. Selected tasks included flanker, card sort, list sort, pattern comparison, and grooved pegboard. The caudate and putamen were manually traced from T1 MRI and were used as unique seeds in separate whole-brain rs-FC analyses. Resting-state fMRI (rs-fMRI) data were collected using identical multiband sequences (voxel size: 3.3×3.3×3.0 mm; TR: 460 ms; TE: 29 ms; 650 measurements) for 5-minute eyes-open and 5-minute eyes-closed conditions. We evaluated covariation of cognitive performance and striatal rs-FC. Results indicated that the rs-FC of the caudate and putamen covaried significantly with cognitive performance of tasks including pattern comparison. These preliminary findings suggest that specific behavioral and cognitive abilities are related to changes in striatal rs-FC with other brain regions during childhood, congruent with previous findings in adults. This study addresses an important gap in the current understanding of the development of brain systems that support skilled motor performance, executive functions, and cognitive flexibility.

Topic Area: EXECUTIVE PROCESSES: Development & aging

Additive effects of two DRD2 polymorphisms on working memory performance, and striatal functional and structural MRI measurements

Poster C41, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Xin Li[1], Micael Andersson[2], Lars Nyberg[2], Jonas Persson[1]; [1]Aging Research Center (ARC), Karolinska Institute and Stockholm University, [2]Umeå Center for Functional Brain Imaging (UFBI), Umeå University

The neurotransmitter dopamine (DA) is critical for high-level cognition, including working memory (WM). The D2 subtype of DA receptors has the highest densities in striatum, including caudate and putamen. The T allele of the C957T polymorphism of the D2 receptor gene (DRD2) has been associated with reduced extrastriatal D2 receptor availability and lower striatal DA levels, and the A1 allele of the DRD2/ANKK1-TaqIA polymorphism is related to reduced density of striatal DA D2 receptors. Here we examined the combined effects of these two DRD2 polymorphisms on WM manipulation, brain volume and brain activation in younger (n=191) and older (n=111) adults. We further investigated whether these effects were magnified in old age. Participants were scanned while performing a WM task in which the information to be kept in memory was maintained (low fronto-striatal demand) or manipulated (high fronto-striatal demand). Results showed that individuals who carry two beneficial alleles, compared to carriers of 1 or 0 beneficial alleles, were reliably better in the manipulation WM condition, had larger right caudate volume, and exhibited less BOLD activation in the left caudate nucleus, suggesting more efficient caudate function. Moreover, the genetic effects on striatal volume and activity were only seen in older adults, suggesting magnification of genetic effects on brain volume and functional brain activity in aging. These results demonstrate an addictive effect of two DRD2 polymorphisms on striatal structure and function, and that this effect is related to manipulation of information in WM, and provides new evidence for magnified genetic effects in aging.

Topic Area: EXECUTIVE PROCESSES: Working memory

Revealing unattended working memory representations with fMRI

Poster C42, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Annelinde Vandenbroucke[1,2], Derek Nee[3], Elizabeth Lorenc[2], Mark D'Esposito[2]; [1]Donders Center for Cognitive Neuroscience, Rabdoud University Nijmegen, the Netherlands, [2]UC Berkeley, California, USA, [3]Florida State University, Florida, USA

When using working memory, we focus on a current item, while simultaneously storing relevant information for later use. In a previous study, we showed that visual cortex is engaged in storing stimulus-specific information when working on a current problem, while information that needed to be maintained for future use, but was currently not attended to, was neither actively maintained nor suppressed (see also Lewis-Peacock et al., 2012; LaRocque et al., 2013). This information might be maintained in an activity silent format, possibly through a change in synaptic weights (Mongillo et al., 2008; Stokes, 2015, Wolff et al., 2015). Research using monkey physiology and EEG has shown that when an unrelated neutral stimulus (impulse) is presented during memory maintenance, this silent representation can be revealed using the impulse evoked activity (Stokes et al., 2013; Wolff et al., 2015). In this study, we investigated whether this could be achieved with fMRI, and if so, where in the brain these silent representations could be read out. Participants remembered two orientations, of which one was currently-relevant, while the other was unattended

and stored for future use. During the memory maintenance period, we presented a “bullseye” pattern that was unrelated to the task. This resulted in increased classification accuracy in early visual cortex during the maintenance period specifically for the unattended item. This finding suggests that the memory representation for this unattended item is maintained in visual cortex, albeit in a silent code that can be read-out from fMRI data using evoked responses.

Topic Area: EXECUTIVE PROCESSES: Working memory

Oscillatory mechanisms for orienting attention towards internal representations: effects of aging

Poster C43, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Sara Aurtenetxe[1], Eveline van Bijnen[1], Roy P.C. Kessels[1], Joukje M. Oosterman[1], Anna C. Nobre[2], Ole Jensen[3]; [1]Donders Institute for Brain Cognition and Behaviour, Radboud University, [2]Oxford Centre for Human Brain Activity, University of Oxford, [3]School of Psychology, University of Birmingham

Selective attention to external information modulates the neural oscillatory patterns of our brain. Processing relevant information is believed to be supported by oscillations at higher frequencies (gamma range, >30 Hz), whereas blocking irrelevant information is believed to be supported by oscillations at low frequencies (alpha range, 8-13 Hz). In a similar manner, directing attention to internal representations (as revealed in retro-cue paradigms) is shown to be supported by analogous mechanisms. Working Memory (WM) functions decline with age. However, how aging affects the attentional orienting to representations held in WM needs further investigation. In the current study, 20 young and 20 older participants performed a retro-cue task while their respective neural activity was recorded with magnetoencephalography (MEG). In addition, each participant underwent structural brain image scanning and neuropsychological assessment. Centrally presented retro-cues induced lateralized patterns of alpha power in occipital sensors depending on whether the relevant stimuli were located left or right during the encoding. This lateralization was reduced in the older adults. Our preliminary findings demonstrate a role for alpha oscillations when directing attention towards internal representations. Furthermore, these results indicate that the ability to modulate alpha oscillations when orienting to internal representation is diminished in the elderly. In future work we will identify the brain structures associated with the reduced ability to modulate the alpha activity.

Topic Area: EXECUTIVE PROCESSES: Working memory

Compensation or restoration: Optimizing tDCS-enhanced visual working memory in older adults

Poster C44, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Hector Arciniega[1], Filiz Gözenman[2], Marian Berryhill[1]; [1]University of Nevada, Reno, [2]Yaşar University

Working memory (WM) permits maintenance of information over brief delays and is an essential executive function. Unfortunately, WM is subject to show age-related decline. Some evidence supports the use of transcranial direct current stimulation (tDCS) to improve visual WM. A gap in knowledge is an understanding of the mechanism characterizing these tDCS linked effects. Here, we tested two competing possibilities in older adults using different tDCS montages. In older adults, greater bilateral frontal activation is associated with cognitive task performance and is interpreted as compensation. If tDCS facilitates compensation, we predicted we would see superior WM performance after bilateral frontal tDCS. In contrast, if restoration of a more youthful pattern of right lateralized brain activity is superior, the unilateral frontoparietal tDCS would be better. We tested these predictions in healthy older adults (60-75 years). As our previous findings showed that WM capacity predicts differential responses to a tDCS protocol, we included an independent measure of WM capacity. Participants completed 3 sessions of 20 minutes of 2 mA anodal tDCS including bilateral frontal, right frontoparietal, and sham. During stimulation participants performed a visual long-term memory (LTM) control task and visual WM task. The results demonstrated no effect on the LTM task, and a greater benefit for the WM task when participants received the right unilateral stimulation, consistent with the prediction of restoration. This pattern was clearest in older adults with low WM capacity, suggesting tDCS-linked cognitive benefits might be optimized when returning to a more youthful pattern of brain activity.

Topic Area: EXECUTIVE PROCESSES: Working memory

Effects of emotion, load, distraction, and dopamine tone on working memory and associated neural function in veterans with mTBI and/or PTSD

Poster C45, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Michael Ballard[1,2], Taylor Vega[1,2], Andrew Kayser[1,2]; [1]Weill Institute for Neurosciences, University of California, San Francisco, [2]VA Northern California Health Care System

Individuals with a history of mild traumatic brain injury (mTBI) and post-traumatic stress disorder (PTSD) often report persistent memory deficits, increased distractibility, and feeling overwhelmed in emotional situations. Studies of working memory in these populations typically employ tasks that don’t include emotional arousal or distraction, potentially leading to equivocal results. We administered an emotional working memory task with distraction to veterans with mTBI and/or PTSD in the

context of a pharmacological intervention, tolcapone, thought to selectively enhance cortical dopamine tone and thereby to improve task performance. Seventeen (40 planned) veterans have received a single dose of tolcapone and placebo in counterbalanced fashion while fMRI images were obtained. Memory was worse for fearful versus neutral faces, and after distraction by congruent (faces) relative to incongruent (places) stimuli. Response times were also slower following arousing versus neutral distractors, consistent with greater activation in ventral visual areas, lateral temporoparietal regions, and the posterior cingulate during presentation of arousing versus neutral distractors. On high load trials, subjects' memory accuracy was lower and response times higher than on low load trials, but neural activation was not greater. However, a main effect of drug condition was found in multiple regions including the fronto-parietal attention network and striatum during encoding in the high-minus-low load conditions. Our task thus demonstrates potential effects of emotion, load, distraction, and dopamine tone on working memory in individuals with mTBI and/or PTSD, and once sufficiently powered, will be used to investigate individual differences in behavioral and neural responses to tolcapone.

Topic Area: EXECUTIVE PROCESSES: Working memory

Exploring the Relationships Between Early-Life Environments of Scarcity, Parenting Style, and Working Memory in Childhood: A Cross-Species Study

Poster C46, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Stephen H. Braren[1], Rosemarie E. Perry[1], Cristina M. Alberini[1], Regina M. Sullivan[2], Clancy Blair[1]; [1]New York University, [2]New York University School of Medicine

Early-life environments of resource scarcity, such as poverty, have enduring negative consequences on neurocognitive development. However, the specific mechanisms by which these detrimental effects operate remain unclear. Evidence from human studies suggests that parenting style may have protective potential in buffering against negative developmental outcomes. Although such human research is critical, assessing causality and exploring neurobiological mechanisms in the human is difficult. Thus, in the present study, we introduce a rodent model of scarcity and explore its impact on rodent caregiving style and working memory of offspring, and compare it to findings from a concurrent human study assessing the mediating effect of parenting on child's working memory. Using data from a large, longitudinal sample of children and families in rural poverty, we first established that high levels of poverty significantly predicted poor working memory performance and cortisol levels in early childhood. We then found that sensitive parenting partially mediated these negative effects of poverty. In the rodent model of early-life scarcity, rodent mothers were provided with insufficient nesting materials, so that they could not build a proper nest for their pups, resulting in rough mother-infant interactions and elevated corticosterone levels in pups. Following these early-life rearing conditions, juvenile offspring were assessed in a working memory test (spontaneous alternation). Results revealed that juvenile rodents reared in scarcity conditions displayed significant working memory impairments with effects in the dorsal hippocampus. This research demonstrates the utility of rodent models in understanding the impacts of early-life stress on parenting and neurocognitive development in children.

Topic Area: EXECUTIVE PROCESSES: Working memory

EEG dissociates acute brain injury patients from controls during visuospatial working memory

Poster C47, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

James Broadway[1], Rebecca Rieger[1], Kevin Wilson[1], Andrew Mayer[2], James Cavanagh[1]; [1]University of New Mexico, [2]Mind Research Network

Mild traumatic brain injury (mTBI) is a prevalent affliction for which accurate and objective diagnosis continues to pose major challenges to clinicians, hampering effective treatment. Moreover, little is known about neurocognitive correlates of acute-stage (< 2 weeks post-injury) mTBI. Here we report results from an initial cohort of a large-scale longitudinal study of individuals with mTBI. Acute-stage mTBI patients (N = 12) and healthy age-matched controls (N = 14) were administered a large battery of neuropsychological tests assessing general intelligence and cognitive function, as well as questionnaires assessing somatic, cognitive, and emotional symptoms. To assess cognitive function, participants performed a visuospatial working memory (VSWM) task while EEG was recorded. Accounting for inter-individual variability in age and somatic complaints, patients were less accurate than controls under low and high WM load, but groups did not differ in the ability to filter distracting information. Patients had significantly diminished EEG power (~1-18 Hz) during active maintenance in all conditions, and significantly diminished higher-frequency (~12-18 Hz) power for load-dependent maintenance (high minus low). These findings suggest EEG may be a potentially useful biomarker of cognitive difficulties associated with VSWM in mTBI.

Topic Area: EXECUTIVE PROCESSES: Working memory

Predicting Individual tDCS-Linked Working Memory Benefits Through Resting-State fMRI

Poster C48, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Adelle Cerreta[1], Ryan Mruczek[2], Marian Berryhill[1]; [1]University of Nevada, Reno, [2]Worcester State University

Working memory (WM) improvement is sought in training protocols because it is essential for most cognitive tasks. New reports suggest WM improvement follows cognitive training paired with anodal transcranial direct current stimulation (tDCS) targeting frontoparietal networks. One unexpected observation is that general benefits across participants emerge after multiple paired sessions, whereas only a subset of participants benefit after a single session. One explanation is that some participants have greater connectivity in task-relevant networks so a single tDCS session elicits improved WM performance, whereas participants with less connectivity may require more sessions to achieve similar benefits. We term this the Hypothesis of tDCS: Deepen or Grow (HOT:DOG). To test HOT:DOG we collected resting-state fMRI (rs-fMRI) connectivity scans prior to conducting a 5-session tDCS+WM training study. This permitted evaluations of correlations between default mode network (DMN) connectivity at rest and first day performance, echoing the single session paradigms, and with final day performance, echoing multiple session paradigms. The top and bottom third of OSPAN scores on Day 1 correlated with a significant difference in DMN connectivity in the right occipital lobe (MNI: 54, -66, 17), while Day 5 average task performance correlated with a significant difference in DMN connectivity in right occipitotemporal cortex (MNI: 48, -50, -4). These results show that after both a single session and 5 sessions of tDCS, participants with stronger DMN connectivity at rest exhibited higher WM performance scores. Further research will pinpoint the location and amount of stimulation necessary to grow connections in the low performing groups.

Topic Area: EXECUTIVE PROCESSES: Working memory

Competitive and independent encoding of episodic versus procedural memory

Poster C49, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Sungshin Kim[1], Joel Voss; [1]Medical Social Sciences, Feinberg School of Medicine

Episodic memory and procedural memory have different operational characteristics and depend on distinct neural systems. Nonetheless, many findings suggest that they compete for limited resources in that procedural learning harms consolidation of newly encoded episodic memories, and vice versa. However, little is known regarding the dynamics of their interactions during learning. We developed a novel paradigm involving interleaved motor adaptation learning and object-location association learning in order to identify interactions between these learning types and corresponding fMRI correlates. Immediately prior to object-location learning trials, subjects learned offsets of reaching movements via visual feedback, which was selectively presented on a subset of trials in order to vary procedural learning. In 15 subjects, subsequent memory performance was significantly reduced for object-location associations for trials with feedback versus trials without feedback, but only for trials early in the course of procedural learning. In later stages of procedural learning when reaching accuracy had plateaued, memory was comparable for feedback and no-feedback trials. These findings suggest that procedural learning and episodic learning are competitive, particularly when demands are greatest during the early stages of procedural learning (i.e., the fast component), whereas procedural and episodic learning are independent at later stages (i.e., the slow component). fMRI correlates of the competition versus independent operation of procedural and episodic learning obtained using this task will be discussed.

Topic Area: EXECUTIVE PROCESSES: Working memory

Attention modulates relative lateralization of N170 for single letters in Japanese Hiragana

Poster C50, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Tomoki Uno[1], Ayumi Seki[2], Tetsuko Kasai[2]; [1]Graduate School of Education, Hokkaido University, [2]Faculty of Education, Hokkaido University

Fluent reading requires the integration of letters into a letter string and rapid conversion of letters to sounds, which are considered to be reflected by N170 component of event-related potentials (ERPs). The relative lateralization of N170 is modulated by the transparency of language, suggesting that it reflects early phonological mapping (Maurer & McCandliss, 2007). Moreover, it has been recently reported that the lateralization of N170 might be modulated by the integration of letters and/or attention: single alphabetic letters, and interspaced or unattended Hiragana letter strings elicited atypical N170 distributed over bilateral occipito-temporal sites (Stevens et al., 2012; Okumura et al., 2014, 2015). To explore the essential factors for the lateralization of N170, the present study examined ERPs in response to single letters of transparent Hiragana and alphanumeric symbols in two tasks. In experiment 1, participants responded to the color change of the fixation that was presented 1.21° below letters/symbols. Therefore, they were asked to keep attention away from letters/symbols. In contrast, in experiment 2, participants responded to the color change of letters/symbols. In this task, they had to keep attention on stimuli. As results, unattended single letters elicited greater negative enhancement than symbols at bilateral occipito-temporal scalp sites during 200–240 ms poststimulus (experiment 1). However, we observed left-lateralized N170 (140-200 ms) for attended single letters (experiment 2). These results showed that left-lateralized N170 could be elicited even by single letters when they are transparent and attended, suggesting that it is involved in the phonological mapping facilitated by attention for letters.

Topic Area: LANGUAGE: Lexicon

Second-language reading proficiency is related to changes in N170s?

Poster C51, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Osamu Takai[1], Anthony Herdman[1]; [1]University of British Columbia

Successful reading comprehension requires efficient word recognition, which is generally taught starting with learning single letters. We examined perceptual processing of single letters for late Chinese learners of English with two differing proficiency levels in English: advanced (L2adv) and moderate (L2mod). Monolingual English speakers (L1) were a control group. Participants performed a visual target detection task, while we measured their event-related potentials (ERPs) to alphabetic letters and pseudoletters. The ERP differences evoked by these stimuli were regarded as differences in the participants' familiarities with each of the stimuli; the more proficient in reading English, the greater the familiarity with letters. Results showed significantly larger and delayed N170 responses to pseudoletters than letters in all groups. Such letter effects were the largest for L1 group bilaterally over parietal-occipital scalp regions (PO7/PO8), moderate for L2adv group predominantly over left parietal-occipital scalp regions, and modestly small for L2mod. In the right-hemisphere, the letter effect between L2adv and L2mod group was compatible. Thus, results revealed a reading-proficiency effect on the N170 whereby the letter effect was in the order of L1 > L2adv > L2mod over the left-hemisphere. We also found P2 differences between letters and psuedoletters, and this effect was L1 > L2adv = L2mod in the right-hemisphere. In conclusion, reading proficiency in a second-language was associated with changes in N170 responses to single letters within the left-hemisphere. These results also indicate that early neural stages of orthographic processing can be altered by learning to read a second language later in life.

Topic Area: LANGUAGE: Lexicon

Cross-language interaction in auditory and visual word processing in bilinguals: Electrophysiological and behavioral evidence

Poster C52, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Katharine Donnelly Adams[1], Fatemeh Abdollahi[1], Ping Li[1], Janet G. van Hell[1]; [1]The Pennsylvania State University

Research with proficient bilinguals indicates that both languages are activated during lexical processing, even when bilinguals process words in only one language. Evidence for this cross-language lexical activation comes from studies showing that cognates (words that share semantics, phonology, and orthography across languages) are read faster than noncognates (Van Hell & Tanner, 2012). Previous studies typically presented cognates and noncognates visually. Recently, we presented cognates and noncognates in a behavioral auditory and visual lexical decision task, testing proficient bilinguals, and observed a cognate facilitation effect in visual but not in auditory lexical decision. This suggests that bilinguals can use language-specific auditory cues to direct processing towards one language only. In two ERP experiments, we examined the neural time course of cross-language activation during visual and auditory lexical processing, and the role of language-specific auditory cues. English beginning learners of Spanish read (Exp.1) or listened to (Exp.2) cognates and noncognates presented in Spanish or English while performing a go-no go task. Results for the visual presentation showed a delayed N400 for the Spanish words, which was more negative for noncognates (larger N400) than cognates. Visual presentation of English words showed a small increased negativity (N400) for noncognates relative to cognates. In the auditory presentations, there were no differences between cognates and noncognates in either language. These results indicate that mode of presentation (visual or auditory) modulates the co-activation of languages, and that early L2 learners employ phonological cues to constrain lexical access to only one language, similar to more proficient bilinguals.

Topic Area: LANGUAGE: Lexicon

Effects of Iconicity on Cross-modal Translation Priming in Hearing Learners of American Sign Language and Deaf Native Signers: An ERP Study

Poster C53, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Megan Mott[1], Katherine J. Midgley[1], Phillip J. Holcomb[1], Karen Emmorey[1]; [1]San Diego State University

This study examines cross-modal translation priming (printed English to ASL signs) in individuals with minimal knowledge of ASL and in deaf native signers. EEG was recorded as participants watched video clips of a signer producing 80 ASL signs (40 signs primed by a congruent English translation/ 40 primed by an unrelated English word). Half of the ASL targets were iconic signs (signs that have a non-arbitrary mapping between form and meaning) while the other half were non-iconic (based on normative ratings). ERPs time-locked to the onset of the video clips were averaged across a group of 20 native signers and a group of 24 hearing speakers of English who had recently learned all 80 signs through associative learning protocols in a laboratory setting (each English/ASL pair presented 5 times across two learning sessions). ERPs of the hearing learners showed expected repetition effects (an increased negativity to unrelated translations compared to congruent translations) beginning 600ms after clip onset for iconic signs, and at 800ms for non-iconic signs. Repetition effects (for both sign types) were evident in the ERPs of deaf signers 500ms after clip onset. These results suggest that, while cross-modal translation priming effects are observed in the ERPs of hearing learners of ASL within the first few hours of instruction, the time-course of these effects is delayed compared to native users of ASL. These results also suggest that iconicity of a sign facilitates priming for new learners of ASL, but does not affect the time-course of processing for native signers.

Topic Area: LANGUAGE: Lexicon

Neural correlates for naming disadvantage of the dominant language in bilingual word production

Poster C54, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Yongben Fu[1], Di Lu[1], Chunyan Kang[1], Junjie Wu[1], Fengyang Ma[2], Guosheng Ding[1], Taomei Guo[1]; [1]Beijing Normal University, [2]University of Cincinnati

The present study investigated the neural correlates of naming disadvantage of the dominant language under the mixed language context. Twenty one unbalanced Chinese-English bilinguals completed a cued picture naming task while being scanned with functional magnetic resonance imaging (fMRI). Behavioral results showed that naming pictures in the second lanuage (L2) was significantly slower than naming pictures in the first language (L1) under a single language context. When comparing picture naming in L2 to naming in L1, enhanced activity in the left inferior parietal lobule and left cerebellum was observed. On the contrary, naming pictures in Chinese (L1) was significantly slower than naming in English (L2) under the mixed language context. The fMRI results showed that bilateral inferior frontal gyri, right middle frontal gyrus, and right supplementary motor area were activated to a greater extent in L1 than in L2. These results suggested that the dominant language was inhibited to a greater extent to ensure the production of the second language under the mixed language context. Therefore, more attentional control resources were recruited when bilinguals produced the dominant language. The present study, for the first time, reveals neural correlates of L1 naming disadvantage under the mixed language context.

Topic Area: LANGUAGE: Lexicon

Electrophysiological evidence of the cognate facilitation effect during bilingual visual word recognition

Poster C55, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Karla Orihuela[1], Hélène Giraudo[1], Noémie te Rietmolen[1], Albert Kim[2]; [1]University of Toulouse, [2]University of Colorado, Boulder

Visual word recognition of cognates (words that have the same linguistic derivation across languages and share form and meaning with different degrees of overlap) has been shown to be facilitated for bilinguals (when compared to monolinguals, or non cognate words). The aim of the study was to explore this “cognate facilitation effect” in order to better understand mental lexical representations. Bilingual (Spanish-English) and Monolingual (English) participants performed a delayed lexical decision task (on English only words and English - Spanish cognates) while EEG data was recorded. A facilitation effect was observed between groups, not only behaviourally (faster reaction times) but also neurophysiologically (as the amplitudes for the N400 component were smaller for the bilinguals in the cognate condition). Moreover, bilingual participants showed a different distribution for words depending on their cognate status: a more left lateralised distribution in the frontal areas for cognates, and a more central distributed activation was obtained for non cognate words. We interpret the data as evidence of the shared representations cognates have (because of the formal and semantic overlap across languages) in the bilingual mental lexicon.

Topic Area: LANGUAGE: Lexicon

A Cross Linguistic Comparison of Category- and Letter- Fluency: Mandarin and English

Poster C56, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Nancy Eng[1,2], Melissa Salzberg[1], Jet Vonk[1,2], Nakyung Yoo[1]; [1]Hunter College of CUNY, [2]The Graduate Center of CUNY

Verbal fluency tasks are widely applied in a variety of languages, but whether the quality and quantity of responses are comparable across structurally different writing systems is debatable. For example, since there are no letters in a logographic, non-alphabetic language such as Chinese, the mechanisms speakers use to generate a list of words in a letter fluency task might be structurally different than those used by speakers of alphabetic languages. In this study we investigated lexical retrieval strategies and approaches in letter and category fluency tasks among monolingual Mandarin speakers compared to monolingual English speakers. We found that the responses of Mandarin speakers are both qualitatively and quantitatively different in letter fluency, and qualitatively different in category fluency. Statistically significant findings suggest that differences in task completion among non-English-speaking populations are important to consider when using this extensively utilized cognitive and linguistic measure in research and clinic. Moreover, these findings shed light on the language specific word retrieval strategies in healthy Mandarin-speakers. Without the requisite linguistic backdrop, responses from speakers of different languages may be inaccurately viewed as atypical, etc.

Topic Area: LANGUAGE: Lexicon

EARLY FEEDBACK FROM FRONTAL TO OCCIPITO-TEMPORAL CORTEX DURING VISUAL WORD RECOGNITION

Poster C57, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Yu Li[1], Sachiko Kinoshita[1], Paul Sowman[1], Anne Castles[1]; [1]Macquarie University

Previous studies have shown that skilled readers can rapidly differentiate visual words from symbol strings by about 200 ms after stimulus onset. A recent MEG study further found that during the very early stages of visual word processing, activity in the left inferior frontal gyrus (left IFG) exerts a stronger top-down influence on the left ventral occipito-temporal cortex (left vOT) for real words than for meaningless symbols (Woodhead et al., 2014). However, questions remain about the nature of this top-down influence, specifically whether it reflects lexical-semantic or phonological effects. The aim of the current study was to shed light on this question using

dynamic causal modelling (DCM). Fifteen adults participated in a MEG experiment in which they viewed four types of visual stimulus: real words (RW), pseudowords (PW), consonant strings (CS) and false fonts (FF). Six reading-related nodes were chosen in the DCM analysis. Through the specific contrasts of RW vs PW (lexical-semantic effect), PW vs CS (phonology effect) and CS vs FF (low-level letter effect), we were able to examine the nature of the early top-down influences. The results showed that within 200 ms after stimulus onset, the connection from left IFG to left vOT was stronger for PW than for CS and for RW than for PW, indicating that both lexical-semantic and phonological information are implicated in the top-down influence from the left IFG to left vOT. These results add to our understanding of the nature of high-level feedback effects during the early stages of visual word recognition.

Topic Area: LANGUAGE: Lexicon

Phonological and semantic priming in American Sign Language: An ERP study

Poster C58, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Brittany Lee[1,2], Katherine J. Midgley[1], Phillip J. Holcomb[1], Karen Emmorey[1], Gabriela Meade[1,2]; [1]San Diego State University, [2]University of California, San Diego

Although previous ERP studies have demonstrated N400 semantic priming effects for sign language, almost nothing is known about the neural dynamics of form-based priming or how semantic and phonological priming effects interact in a visual-gestural language. Using ERPs, this study investigated the time course of phonological and semantic priming in American Sign Language (ASL). Deaf ASL signers viewed pairs of ASL signs (with a 1300 ms stimulus onset asynchrony) and judged semantic relatedness. Half of the semantically unrelated signs were phonologically related and half were not. Phonological relatedness was defined as sharing two out of three phonological units: location, handshape and/or movement. Results show effects of both semantic and phonological relatedness. Target signs in semantically related pairs elicited faster responses and smaller amplitude N400s than those in semantically unrelated pairs, mirroring the classic semantic priming effects reported for spoken word recognition. Target signs in phonologically related pairs also elicited smaller amplitude N400s than targets in phonologically unrelated pairs, paralleling the N400 priming effects observed for rhyming words in spoken language. However, phonological overlap interfered with semantic relatedness judgments such that responses were slower for phonologically related pairs than for phonologically unrelated pairs. We hypothesize that similarity in form interfered with participants' ability to reject a semantic relationship between the signs. Overall, the results indicate a similar time course of lexical access for signed and spoken languages and that spreading activation between form-related lexemes is modality independent.

Topic Area: LANGUAGE: Lexicon

Bilingual aphasia: exploring the relationship between language control and lexical access

Poster C59, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Desiree Sasunian[1], Pia Etchegoin[1], Kathryn Tidaback[1], Kareem Darwiche[1], Teresa Gray[1]; [1]San Francisco State University

Bilinguals must control two languages (Green, 1998); however, the relationship between language control (LC) and lexical access (LA) is unclear. In bilingual adults with aphasia (BAA), deficits in LA may be confounded by the necessity to control two languages. The current study aims to examine these relationships in BAA. Preliminary data have been collected from 3 Spanish-English neurologically healthy bilingual adults (NHBA) and 3 Spanish-English BAA matched on age and education. We project to recruit 10 NHBA and 10 BAA. Participants completed two linguistic control tasks that included congruent and incongruent conditions, requiring inhibition of irrelevant information and tapped LC (linguistic-control task: LC-Task) or LA (semantic task: S-Task). Based on Gray and Kiran (2016), we expected both groups to exhibit the congruency-effect: faster/more accurate responses on congruent conditions relative to incongruent conditions. For each group and task, 2-way repeated-measures ANOVAs were performed to evaluate the effect of condition (congruent/incongruent) x language (Spanish/English) for RT and accuracy. Results are significant at $p < .05$. On the LC-Task for RT, NHBA and BAA within-subjects results revealed a significant main effect of congruency (NHBA: $F = 16.03$; BAA: $F = 11.14$). On the S-Task for accuracy, BAA within-subjects results revealed a main effect that was trending on significance ($F = 5.78$; $p = .07$). For RT, NHBA within subjects results revealed a main effect was trending on significance ($F = 5.97$, $p = .07$). Preliminary results suggest a possible association between LC and LA, suggesting that LC may influence LA.

Topic Area: LANGUAGE: Lexicon

Blind individuals do not develop a reading area in ventral occipitotemporal cortex

Poster C60, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Judy Kim[1], Shipra Kanjlia[1], Lotfi Merabet[2], Marina Bedny[1]; [1]Johns Hopkins University, [2]Harvard Medical School

Reading acquisition leads to specialization for visual words in ventral occipital-temporal cortex (vOTC) (Cohen & Dehaene, 2004). What causes reading-selectivity in this particular anatomical location? The neurobiology of Braille, a tactile reading system used by blind individuals, provides a window into this question. A recent study of blind Braille readers found responses to Braille in a similar location of vOTC as sighted individuals (Reich et al., 2011), leading to the suggestion that vOTC has modality-independent predispositions for reading (Hannagan et al., 2015). However, the visual cortex of blind individuals participates in high-level language processing

(Bedny et al., 2011). Does vOTC become specialized for Braille or language in blindness? Blind participants (n=10) performed a memory probe task with Braille words, consonant strings, tactile shapes, auditory words, and backward sounds (Experiment 1). Sighted participants (n=15) completed an analogous task with visual words, consonant strings, false fonts, auditory words and sounds (Experiment 2). Both groups performed an auditory sentence comprehension task with syntactically complex and simple sentences (Experiment 3). We find that vOTC function is different across groups. In blind individuals, vOTC responds more to Braille words than to consonant strings. By contrast, the sighted vOTC responds more to consonant strings than to visual words. VOTC of blind but not sighted adults is sensitive to grammatical structure of sentences. We conclude that vOTC of blind individuals does not specialize for Braille, but rather, responds to language generally. The neurobiology of reading is shaped by visual experience and the modality of the reading system.

Topic Area: LANGUAGE: Lexicon

Connectivity of the language system revealed by direct brain stimulation during awake neurosurgery

Poster C61, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Bram Diamond[1], Frank E. Garcea[1,2], Benjamin Chernoff[1], Raouf Belkhir[1], Alex Teghipco[1], Susan O. Smith[3], Eduardo Navarrete[4], Webster H. Pilcher[3], Bradford Z. Mahon[1,2,3]; [1]University of Rochester, [2]Center for Visual Science, [3]University of Rochester Medical Center, [4]University of Padova

There is a long history of research in cognitive neuropsychology and cognitive neuroscience that implicates left temporal and frontal regions in language processing. While structural and functional magnetic resonance imaging (MRI) studies have described the connectivity of the language system, it remains poorly understood how disruption of functional connectivity in the language system affects language processing. Here we present case AE, a 26 year-old individual who underwent language mapping during an awake neurosurgical procedure to remove a left supra-Sylvian tumor. Preoperatively, AE was cognitively intact across a number of tasks probing language processing, visuomotor ability, working memory, and semantic memory. AE completed a series of structural (DTI) and functional MRI scans to evaluate language organization and processing in his brain. During AE's awake neurosurgical procedure, he was asked to name pictures from visual presentation while portions of the left temporal, parietal, and frontal lobes were electrically stimulated; the stimulation points were acquired and registered to the pre-surgical fMRI data. We observe a strong correlation between the functional connectivity to Broca's area of each point of intraoperative stimulation (connectivity measured with pre-operative imaging), and intraoperative naming latencies on correct naming trials: AE was slower to name pictures when regions that were stimulated expressed stronger functional connectivity to Broca's area. Control analyses demonstrated that neither functional connectivity between stimulated regions and Wernicke's area, nor primary motor areas accounted for variance in intraoperative picture naming latencies. These data provide causal evidence of how disruption of language networks affects online processing in picture naming.

Topic Area: LANGUAGE: Lexicon

Multivariate analyses reveals distributed and overlapping neural representations of bilinguals' first and second language

Poster C62, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Emily S. Nichols[1], Marc F. Joanisse[1], Gao Yue[2], Liu Li[2]; [1]The University of Western Ontario, [2]Beijing Normal University

Currently it is thought that bilingual speakers coactivate their two languages during speech, and that they maintain similar, overlapping lexical representations for both. Despite L1 and L2 sharing a network of structures, bilinguals are still able to function in one language without much intrusion of the other, indicating that there is some degree of distinction of the two languages in the brain. The present study examined whether brain areas that are involved in both L1 and L2 word recognition are reliably representing each language differently. Twenty-six English-Mandarin bilingual adults performed a lexico-semantic recognition task in both languages. We then used Representational Similarity Analysis to examine which brain regions reliably showed different patterns of activity for each language. A split-half correlation technique was used to identify regions in which activity patterns correlated more within-language than between-language. The left medial temporal gyrus and the right cuneus showed separate representations for both English and Mandarin, while the left superior temporal gyrus and the left inferior frontal gyrus represented Mandarin more consistently than English. Interestingly, none of these areas showed differences in level of activation between L1 and L2 in a univariate contrast. The present results show a distinction of language-specific vs. domain-general processing in word recognition, and provide a possible mechanism for how bilinguals maintain each language within an integrated lexicon.

Topic Area: LANGUAGE: Lexicon

Multilayer neural network modeling of speech envelope prediction errors

Poster C63, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Jona Sassenhagen[1], Benjamin Gagl[1], Christian J. Fiebach[1]; [1]University of Frankfurt

Understanding speech critically relies on top-down, predictive processing. This allows effective encoding of bottom-up sensory information like the speech envelope. We hypothesize that the cortical auditory perception system entrains to the speech envelope in order to predict the speech envelope in the future. Then, bottom-up signaling can focus on the unpredicted sensory events (i.e. prediction errors) only. Therefore we expect that brain regions showing entrainment to the speech envelope should also reflect speech envelope prediction errors. In a naturalistic language study, we modeled the raw audio envelope of the speech stream with a 5-layer recurrent neural network. We "pre-trained" this model on multiple hours of audio books, before allowing it to "entrain" on the actual stimuli and their particular characteristics. This model described the data better than models without “pre-training” (reflecting a benefit from general knowledge of speech) or without "entrainment" (reflecting a benefit from factoring in specifics of the speaker and the acoustic environment). Prediction errors are calculated by letting the models sequentially predict the (previously ‘unseen’) speech stimulus envelope and taking the absolute of the difference to the real envelope. These prediction errors are entered into a regression model to predict continuous MEG data from 14 subjects listening to the speech stimuli, controlling for both the actual speech envelope and its first derivative. We observed that prediction errors are reliably reflected by activity at Wernicke’s area around 55 ms. This indicates that neuronal signaling of speech signals is optimized by predictive processes, allowing neuronal efficient spoken language perception.

Topic Area: LANGUAGE: Other

Predicting tonal language learning aptitude from individual differences in brain morphology and microstructure

Poster C64, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Dimitrios Donavos[1], Anita Bowles[1,2]; [1]University of Maryland Center for Advanced Study of Language, [2]Rosetta Stone, Ltd.

For adult second language (L2) learners of tonal languages such as Mandarin Chinese, which use pitch to signal lexical contrasts, accurately perceiving and producing lexical tone can present a significant challenge. To help identify learners who are most likely to succeed and learners who might benefit from particular types of training, Bowles et al. (2015) examined potential components of aptitude for mastering L2 lexical tone. Across five laboratory sessions, 160 native English speakers with no previous tone language experience received training on Mandarin words and completed tests of pitch ability and musicality, as well as measures of general cognitive ability and L2 aptitude. Pitch ability was the strongest predictor of word learning, and both pitch ability and musicality improved predictions beyond measures of general cognitive ability and L2 aptitude. These findings suggest that pitch-specific perceptual measures are critical components of measuring aptitude for tonal language learning. The present study involves a subset of 75 participants from the larger behavioral study who received high resolution structural (MPRAGE) and diffusion tensor imaging (DTI) functional magnetic resonance imaging (fMRI) scans prior to beginning the word-learning task. We investigated whether individual differences in morphology and microstructure of grey and white matter, specifically right hemisphere posterior parietal regions implicated in tonal and visuo-spatial learning of Mandarin (Qi et al., 2015), could predict Mandarin word-learning performance and whether that predictive power exceeded what was achieved with behavioral measures alone. Implications for the relationship between morphological structure and successful tonal language learning will be discussed.

Topic Area: LANGUAGE: Other

Reading naturalistic text alters the information processing timeline: Evidence from concurrent self-paced reading and electroencephalography

Poster C65, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Shannon McKnight[1], Albert Kim[1]; [1]University of Colorado, Boulder

We recorded brain activity during word-by-word reading of short factual narratives on various science related topics in a self-paced reading paradigm. This approach departs from most previous EEG research on language processing, which has focused on the processing of individual sentences or single word recognition, with particular design constructions, at controlled presentation rates. However, EEG and ERP are especially useful in evaluating the neural processes underlying reading in more naturalistic paradigms due to millisecond-by-millisecond recording of scalp potentials over a number of different locations. By allowing people to control the rate of presentation, we created a naturalistic reading setting. Based on previous work in sentence processing and word recognition, we expected to observe a progression in word-onset-locked ERP sensitivity from low-level visual characteristics to high-level semantic and contextual characteristics over time. For example, we expected to see correlations between P1 activity, length, and visual complexity, and correlations between N400 activity and lexical frequency. We did observe correlations between P1/N170 activity and length. However, we observed correlations between lexical frequency and the earlier P2 component with only a marginal effect of frequency at N400. We hypothesize that the temporal dynamics of word recognition are altered in more natural reading settings. This hypothesis is based on the idea that top down contextual information increases in short stories relative to individual sentences or words. More work is needed in order to leverage language models of context to better examine the impact context can have at individual word recognition during reading.

Topic Area: LANGUAGE: Other

Thinning of the Left Middle Temporal Gyrus is Associated with Word Retrieval Difficulties in Tempora

Poster C66, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Clara Yoon[1], Victor Kang[1], Joo Sung Yi[1]; [1]New York University

Epilepsy is the fourth most common neurological disorder, with temporal lobe epilepsy (TLE) accounting for 60% of all epileptic diagnoses. The temporal lobe is also involved in language processing, and TLE patients often demonstrate language impairments, suggesting that damage to the temporal lobe, particularly the middle temporal gyrus, may lead to observed language impairments. However, a direct link has not yet been established. Thus, the present study 1) compared differences in middle temporal gyrus cortical thickness (MTGCT) between TLE patients and controls, 2) compared differences in language aptitude, assessed by the Boston Naming Test (BNT), between left-lateralized TLE (L-TLE) patients and controls, and 3) correlated MTGCT with language aptitude in L-TLE patients. Relative to controls, TLE patients were found to have decreased MTGCT localized to the hemisphere that was ipsilateral to their seizure onset zone. Reduced MTGCT was directly associated with decreased BNT performance in L-TLE patients. In combination, these results show that TLE is accompanied by cortical atrophy and impaired language if the side of the seizure focus is in the left (language dominant) hemisphere, supporting the view that language impairment and diminished structural integrity of the middle temporal gyrus are a result of localized seizure activity in TLE.

Topic Area: LANGUAGE: Other

ERP Brain Responses to Emoji-Generated Irony

Poster C67, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Benjamin Weissman[1], Darren Tanner[1]; [1]University of Illinois at Urbana-Champaign

The few ERP studies investigating irony processing have found increased P200 and P600 effects to ironic vs. non-ironic utterances (Regel et al. 2011, Spotorno et al. 2013). Entirely distinctly, emoticons have repeatedly been demonstrated to be capable of signaling sarcasm or irony (e.g., Dresner & Herring 2010, Filik et al. 2016). This study bridges these two strands of research and investigates ERP responses to irony-producing emojis, the question being whether or not emoji-generated irony is processed similarly to word-generated irony. Native English-speaking participants read short positively- or negatively-valenced sentences, which were followed by either a congruent, incongruent, or ironic (winky-face) emoji ("You are such a jerk [smile/frown/wink]"); one-third of sentences were followed by comprehension questions. ERPs were time-locked to presentation of the emoji. Preliminary results a clear P200 effect to the ironic emoji. No clear P600 emerged in the grand mean analysis; however, individual differences in question-answering behavior were apparent and associated with differing brain responses to the emoji stimuli. P200 effects were found in all participants, but those who interpreted the ironic sentences non-literally showed an additional P600 effect to the ironic emoji and a small N400 effect to the incongruent emoji. Our study is the first to investigate the neural correlates of how emojis are processed in linguistic contexts, and moreover provides a link between individual differences in interpretation of commonly-used graphical-linguistic pragmatic markers and on-line neural processes.

Topic Area: LANGUAGE: Other

Magnitude Processing in Bilingual Developmental Dyscalculia

Poster C68, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Alejandro Martinez[1], Elena Salillas[1]; [1]Basque Center on Cognition Brain and Language (BCBL)

Developmental Dyscalculia (DD) is a learning difficulty in children with normal intelligence which affects the acquisition of school level arithmetic skills and magnitude representation. Most research has focused on monolingual children and little is known about how bilingual DD children process magnitude. Given the impact that the language for early math learning (Language of Learning math - LLmath) has in our core magnitude processing (Salillas and Carreiras, 2014; Salillas et al., 2015) here we explore the implications of having one preferred language for math in an already defective DD numerical knowledge. We compared the distance effect in bilingual DD children and their matched controls in both languages: LLmath and in the Other Language (OL) in a numerical adaptation task where the deviants' numerical distance relative to the standards was manipulated. The stimulus were sequences presented in LLmath or in OL. Both groups showed a significant ERP distance effect for LLmath albeit with different scalp distribution. However, a distance effect did not appear for the DD group with input in OL. Additionally, source estimation analyses of the ERP distance effects showed focal posterior parietal activations in LLmath for the control group but an involvement of frontal areas for OL. The DD group showed activations in left hemisphere perisilvian, frontal and inferior parietal when computing distance from LLmath. These results suggest that bilinguals process magnitudes differently in the two languages; whereas bilingual DD can only process magnitudes in the preferred language (LLmath) by using additional executive and linguistic regions in the process.

Topic Area: LANGUAGE: Other

The influence of the cortical thickness of Planum Temporale on word tone processing in Swedish native speakers

Poster C69, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Andrea Schremm[1], Mikael Novén[1], Merle Horne[1], Mikael Roll[1]; [1]Lund University

In Swedish, tones on word stems function as predictive cues to upcoming grammatical suffixes. Invalid matching of these linguistic tonal cues to suffixes affects native speakers of Swedish in their linguistic processing (Roll et al., 2010). Planum Temporale (PT) has previously been found to be involved in processing Thai (Xu et al., 2006) and Swedish tones (Roll et al., 2015), and in phonological processing generally (Graves et al., 2008). The present study investigated the relationship between cortical thickness (CT) of PT and the processing of tones in suffixed word stimuli by Swedish native speakers using magnetic resonance imaging (MRI). The average CT of PT was extracted from each participant using the Freesurfer analysis suite on T1-weighted image volumes. The results show that individual participants' response time advantage for valid over invalidly cued suffixes positively correlated with CT in the left PT which suggests that the CT of left PT affects native linguistic tone processing. Interestingly, comparing responses to real word (stem + suffix) stimuli with comparable pseudoword test stimuli (pseudostem + suffix), similar results for CT are found, albeit not in PT, but instead in Broadmann Area 44. This might suggest that suffixed pseudowords cannot be processed in the same way as existing inflected words. PT has been proposed to play a role in lexical phonological access (Graves et al., 2007, 2008). Thus, the present results might indicate that the CT of the left PT facilitates accessing stored whole-word phonological representations of inflected word forms, not available for pseudowords.

Topic Area: LANGUAGE: Other

Involvement of the visuo-orthographic system during spoken sentence processing

Poster C70, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Samuel Planton[1], Valérie Chanoine[2], Julien Sein[3], Jean-Luc Anton[3], Bruno Nazarian[3], Christophe Pallier[4], Chotiga Pattamadilok[1]; [1]Aix Marseille Univ, CNRS, LPL, Aix-en-Provence, France, [2]Labex Brain and Language Research Institute, France, [3]Aix Marseille Univ, CNRS, Centre IRMf, INT UMR 7289, Marseille, France, [4]INSERM-CEA, Cognitive Neuroimaging Unit, Neurospin Center, Gif-sur-Yvette, France

The left ventral occipito-temporal cortex (vOT) is the key area of the visuo-orthographic system. However, some studies also reported its activation during speech processing tasks, especially those that rely on metaphonological or orthographic knowledge. These findings suggest such cross-modal activation is supported by top-down mechanisms. Yet, little is known about the involvement of the vOT during natural speech processing situations. Based on the assumption that top-down activation of the vOT is more likely to occur in demanding speech processing situations, we conducted an fMRI experiment manipulating two factors: (1) task demands (semantic vs. low-level perceptual task), and (2) the quality of the spoken input (sentences were clearly presented vs. degraded by conversation noise background). Results revealed vOT activation in all experimental conditions, at the same location as the one observed during visual word processing. Interestingly, the level of activation significantly increased in the semantic compared to perceptual task. However, in contrast to our expectation, while the degradation of the spoken input by conversation noise tended to increase activation in the superior temporal or inferior frontal cortex, reflecting a greater difficulty to process a noisy signal, it significantly reduced the activation of the vOT observed in the semantic task. We concluded that the involvement of the visuo-orthographic system during speech processing is supported by two complementary mechanisms. First, a task-dependent mechanism that recruits all available linguistic information during high-level language processing. Second, spontaneous, stimulus-driven activation of orthographic representations by spoken input, which is diminished in degraded hearing conditions.

Topic Area: LANGUAGE: Other

Neural correlates of referential processing: Event-related potentials for ambiguity versus resolution

Poster C71, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Les Sikos[1], Harm Brouwer[1], Matthew Crocker[1]; [1]Saarland University

Successful language comprehension involves establishing reference. In the Event-Related Potential (ERP) signal, referential ambiguities (e.g., David shot at John as _he_...) elicit a sustained negativity (Nref) relative to controls (David shot at Linda as _he_...; Van Berkum et al., 1999). The processes underlying this effect are, however, poorly understood: it is unclear whether Nref is simply a marker of ambiguity, or if it is sensitive to the _degree_ of ambiguity. We investigated whether Nref amplitude is proportional to the number of potential antecedents for a referential expression using a visual-world paradigm and manipulating the number of competitor candidates. Native-German participants (N=22) answered Yes/No questions (e.g., Is the _ball_ that is striped on the right?) while viewing displays containing four objects arranged around a central fixation cross. Displays contained one (1-ref), two (2-ref), or three (3-ref) objects of the same type (e.g., ball), of which only one matched the pattern in question (e.g., striped). Participants previewed displays but subsequently maintained fixation while questions were presented visually, word-by-word. Results show that both temporarily ambiguous conditions (2-ref, 3-ref) elicited an Nref effect at the critical word (e.g., ball) relative to unambiguous controls (1-ref) but did not differ from each other. This pattern of results suggests that Nref is simply a marker of ambiguity. A secondary question investigating the correlates of reference resolution found equal magnitude P600-effects at disambiguation (e.g., striped) for both ambiguous conditions relative to control. We discuss the implications for the functional interpretation of these ERP components in referential processing.

Topic Area: LANGUAGE: Other

Language Improvement in Aphasia Therapy is Reflected by the Mismatch Negativity to Meaningful and Meaningless Constructions, but not by That to Ungrammatical Strings

Poster C72, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Guglielmo Lucchese[1], Friedemann Pulvermüller[1,2], Benjamin Stahl[1,3], Felix Dreyer[1], Bettina Mohr[4]; [1]Brain Language Laboratory, Freie Universtät Berlin, 14195, Berlin Germany, [2]Berlin School of Mind and Brain, Humboldt-Universität zu Berlin, 10099 Berlin, Germany., [3]Charité Universitätsmedizin Berlin, Campus Mitte, 10117, Berlin Germany, [4]Charité Universitätsmedizin Berlin, Campus Benjamin Franklin, 12203, Berlin Germany

Clinical language performance and neurophysiological correlates of language processing were measured before and after intensive language therapy in patients with chronic (time post-stroke > 1 year) post stroke aphasia (PSA). As event-related potential (ERP) measure, the mismatch negativity (MMN) was recorded in a distracted oddball paradigm to short spoken sentences. Critical 'deviant' sentence stimuli where either well-formed and meaningful, or syntactically, or lexico-semantically incorrect. After 4 weeks of speech-language therapy (SLT) delivered with high intensity (10.5 hours per week), clinical language assessment with the Aachen Aphasia Test (AAT) battery demonstrated significant linguistic improvements, which were accompanied by enhanced MMN responses. More specifically, MMN amplitudes to grammatically correct and meaningful mini-constructions and to 'jabberwocky' sentences containing a pseudoword significantly increased after therapy. However, no therapy-related changes in MMN responses to syntactically incorrect strings including agreement violations were observed. While MMN increases to well-formed meaningful strings can be explained both at the word and construction levels, the neuroplastic change seen for 'jabberwocky' sentences suggests an explanation in terms of constructions. The results confirm previous reports that intensive SLT leads to improvements of linguistic skills in chronic aphasia patients and now demonstrate that this clinical improvement is associated with enhanced automatic brain indexes of construction processing, although no comparable change is present for ungrammatical strings. Furthermore, the data confirm that the language-induced MMN is a useful tool to map functional language recovery in PSA.

Topic Area: LANGUAGE: Other

A brain index of semantic prediction

Poster C73, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Luigi Grisoni[1], Natalie McCormick Miller[1,2], Friedemann Pulvermüller[1,2]; [1]Freie Universität Berlin, Brain Language Laboratory, Department of Philosophy and Humanities, 14195 Berlin, Germany, [2]Berlin School of Mind and Brain, Humboldt Universität zu Berlin, 10099 Berlin, Germany

Most neuroscientists agree on the eminent importance of predictive mechanisms for understanding basic as well as higher brain functions. In spite of a large amount of electrophysiological (EEG) studies on preactivation and prediction in language understanding (Kutas & Federmeier, 2011), a direct EEG signature of semantic predictions in language understanding is still missing. Testing adult human participants, we show that, already before the presentation of a critical word, context-induced semantic predictions are reflected by an event-related potential (ERP), which we call the Semantic Readiness Potential (SRP). The SRP precedes critical words both in affirmative and negative sentence contexts with specific expected continuation, but not in unpredictable negated contexts. Specific semantic predictions are indexed by SRP sources within the motor system – in dorsolateral hand motor areas for expected hand-related words (e.g. "write"), but in ventral motor cortex for face-related words ("talk"). Compared to affirmative sentences, predictable negated ones led to medial prefrontal and more widespread motor source activation, consistent with predictive semantic computation of alternatives to the negated expected concept. Processing of semantic alternatives in negated sentences is further supported by N400 responses, which showed the typical enhancement to incongruent sentence endings only in predictable-affirmative contexts, but not in predictable-negated ones. These brain dynamics reveal the interplay between predictive and resolution (match vs. error) processing in semantic sentence understanding.

Topic Area: LANGUAGE: Semantic

Readers select perspective in comprehension independent of pronoun: evidence from fMRI during narrative comprehension

Poster C74, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Franziska Hartung[1,2], Peter Hagoort[2,3], Roel M. Willems[3,4]; [1]University of Pennsylvania, [2]Max Planck Institute for Psycholinguistics, [3]Donders Institute for Brain, Cognition, and Bahavior, [4]Center for Language Studies, Radboud University

Perspective is a crucial feature for communicating about events. Yet it is unclear how linguistically encoded perspective relates to cognitive perspective taking. There is evidence that personal pronouns referring to agents can influence perspective taking. However, most evidence is based on isolated sentences, and it has been suggested that these effects are driven by task strategy effects rather than being true correlates of natural comprehension. Here, we tested the effect of perspective taking with personal pronouns referring to the protagonists of short literary stories. Participants (N=52) listened to two literary narratives, one with 1st (I) and one with 3rd (she) person pronouns referring to the protagonist, while brain activity was measured with fMRI. After each story, participants responded to questionnaires regarding their engagement with the story and their subjective experience of perspective taking. When comparing action events with 1st and 3rd person pronouns, we found no evidence for a neural dissociation depending on the pronoun. A split sample approach based on the self-reported experience of perspective taking, revealed three comprehension preferences. One group showed a strong preference for 1st person perspective, another showed a strong preference for 3rd person perspective, and a third group experienced 1st and 3rd person perspective taking simultaneously. Comparing brain activations of the groups revealed that the different preferences were associated with different neural activations when readers engaged with the narratives. Our results suggest that comprehension is perspective dependent: not on the perspective suggested by the text, but on the reader's (situational) preference.

Topic Area: LANGUAGE: Semantic

Semantic grounding in a neurocomputational model including realistic connectivity and spiking neurons

Poster C75, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Rosario Tomasello[1,2], Max Garagnani[1,4], Thomas Wennekers[3], Friedemann Pulvermüller[1,2]; [1]Freie Universität Berlin, Brain Language Laboratory, [2]Humboldt-Universität zu Berlin, Berlin School of Mind and Brain, [3]University of Plymouth, Centre for Robotics and Neural Systems (CRNS), [4]Goldsmiths, University Of London

Previous neurocomputational work has addressed the question why and how many cortical areas contribute to semantic processing and, specifically, why semantic hubs involved in all types of semantics contrast with category-specific areas preferentially processing certain meaning subtypes. However, much of the pre-existing work used either basic neuron models or much-simplified connectivity so that a more sophisticated and biologically-realistic model would be desirable. Here, we applied a neural-network model replicating anatomical and physiological features of a range of cortical areas in the temporal-occipital and frontal lobes to simulate the learning of semantic relationships between word-forms and specific object perceptions and motor movements of the own body. The two neuronal architecture differed in the level of detail with which cortico-cortical connectivity was implemented. Furthermore, one model adopted a mean-field approach by using graded-response neurons, whereas the other implemented leaky integrate-and-fire neurons. Equipped with correlation-based learning rules and under the impact of repeated sensorimotor pattern presentations, both models showed spontaneous emergence of specific tightly interlinked cell assemblies within the larger networks, interlinking the processing of word-form information to that of sensorimotor semantic information. Both models also showed category-specificity in the cortical distribution of word-related circuits, with high-degree connection hub areas central to the network architecture exhibiting involvement in all types of semantic processing and only moderate category-specificity. The present simulations account for the emergence of both category-specific and general-semantic hub areas in the human brain and show that realistic neurocomputational models at different levels of detail consistently provide such explanation.

Topic Area: LANGUAGE: Semantic

The neural basis of the integration of speech and gesture: A brain stimulation approach

Poster C76, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

wanying zhao[1], Kevin Riggs[1], Igor Schindler[1], Henning Hollo[1]; [1]University of Hull

Previous neuro imaging studies have reported activity of the left middle temporal gyrus (pMTG) and the left Inferior frontal gyrus (LIFG) during co-speech gesture comprehension. It is currently unclear, however, which of these brain areas play a causal role in gesture-speech integration. The current study builds on the paradigm of Kelly et al., (2010) which provides a reaction time index of gesture-speech integration. Briefly, participants were presented with co-speech gestures (e.g., typing while saying 'write'), with gender and semantic congruency of audio-visual stimuli being manipulated. Based on a naming study, gestures were split into pantomimes (that can be easily understand without the involvement of speech) and iconics (that need speech to be disambiguated). In the first experiment, 5 pulses of repetitive Transcranial Magnetic Stimulation (rTMS) were delivered 'on-line' to left pMTG during each video item. The participant's task was to respond to the gender of the speaker as quickly and accurately as possible. Results show pMTG is crucial for the integration of speech and pantomimes. In the second experiment, 'offline' 40 seconds theta-burst TMS (TBS) was either applied to the left IFG, the left pMTG or a control area, followed by the experimental task. Results show that LIFG is also involved in the integration of speech and pantomime. This suggests that LIFG and pMTG both have a role of unifying meaning from different modalities when both gesture and speech have clearly defined meanings in isolation.

Topic Area: LANGUAGE: Semantic

A causal role of motor systems in processing concrete and abstract nouns? – Evidence from voxel based lesion symptom mappings in brain tumor patients.

Poster C77, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Felix R. Dreyer[1], Thomas Picht[2], Dietmar Frey[2], Friedemann Pulvermüller[1,3]; [1]Freie Universität Berlin, [2]Charité Hospital Berlin, [3]Berlin School of Mind and Brain

The current approach investigated semantic processing in a cohort of 37 tumor patients with left hemispheric, peri- and extrasylvian lesions, using a speeded lexical decision task, which applied words from different semantic categories as target stimuli that were matched for a range of psycholinguistic properties on a lexical and sub-lexical level. Categories included concrete hand-action related Tool nouns (e.g., 'hammer'), non-action Animal nouns ('toad'), and Abstract Emotional nouns ('love'), which had neither transparent action related-, nor sensory semantics, as confirmed by semantic ratings. Data were analyzed using a non-parametric voxel based lesion symptom mapping approach to compare performance between patients with and without a lesion for every voxel. Results indicate a perisilvian cluster to be most crucial for Animal nouns, whereas a large dorsal pre- and postcentral cluster (Brodmann Areas 2-6) was related to performance on Tool nouns. For Abstract Emotional nouns, a cluster spanning Inferior Frontal and Middle Temporal Gyrus along with ventral precentral areas (BA 6) was revealed as relevant. These results point to a causal, rather than a mere epiphenomenal role of both peri-and extrasylvian areas, including primary and pre-motor areas, for the processing of concrete action-related nouns and that of abstract emotional ones as well.

Topic Area: LANGUAGE: Semantic

Semantic Word Category Deficits in Neurodegenerative Diseases

Poster C78, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Zubaida Shebani[1,2], Karalyn Patterson[1,3], Peter J. Nestor[4], Lara Z. Diaz-de-Grenu[3,5], Kate Dawson[3], Friedemann Pulvermuller[1,6,7]; [1]Medical Research Council, Cognition and Brain Sciences Unit, Cambridge, [2]Linguistics Department, College of Humanities and Social Sciences, United Arab Emirates University, UAE, [3]Department of Clinical Neurosciences, University of Cambridge, [4]German Center for Neurodegenerative Diseases (DZNE), Magdeburg, Germany, [5]Tecnalia Research and Innovation Center, Health Division, Neurotechnology Unit, Bizkaia Technology Park, Derio, Spain, [6]Brain Language Laboratory, Department of Philosophy and Humanities, WE4, Freie Universität Berlin, Berlin, Germany, [7]Berlin School of Mind and Brain, Humboldt Universität zu Berlin, Berlin, Germany

It has long been recognized that perisylvian language cortex and some neighbouring extrasylvian regions play a major role in lexical and semantic processing. However, the involvement of additional cortical areas in the processing of different semantic word categories remains controversial. We investigated word processing in two groups of patients whose neurodegenerative diseases affect specific parts of the brain while leaving 'core' language areas intact. The aim was to determine whether brain regions affected in each patient group make a necessary contribution to the processing of different semantic word categories. Cohorts with (i) Semantic Dementia (SD), who have anterior temporal-lobe atrophy, and (ii) Posterior Cortical Atrophy (PCA), who have parieto-occipital atrophy, performed tests of immediate and delayed serial recall (ISR, DSR), on words from five different semantic categories: colour (e.g., yellow), form (oval), number (seven), spatial prepositions (under) and function words (also). Word-frequency was matched between the two visual word categories (colour and form) and across the three other categories (number, prepositions, function words). In both ISR and DSR, SD patients were reliably impaired relative to controls on words from the colour and form categories. ISR performance in the PCA cases did not show a clear category specific pattern, but in DSR, a clear category difference emerged with significantly poorer performance on spatial prepositions. The patterns of performance on the serial recall tasks as a function of semantic category demonstrates that specific extrasylvian regions of the brain are differentially involved in the processing of different semantic categories of words.

Topic Area: LANGUAGE: Semantic

Effective Connectivity of Aphasic Bilingual Semantic Processing

Poster C79, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Robert Buckshaw II[1], Erin Meier[1], Swathi Kiran[1]; [1]Boston University

Making semantic decisions involves low level (bottom-up) processing (mediated by inferior temporal, middle temporal, and angular gyri) and higher level (top-down) cognitive control processes (mediated by inferior, middle, and superior frontal gyri). It is also known that bilingual individuals need to additional cognitive control mechanisms to suppress one language when using the other for such tasks. However, it is unknown how left hemisphere damage impacts language network connectivity in bilingual speakers. In the present study, fMRI and Dynamic Causal Modeling (DCM) were used to investigate how effective connectivity of semantic networks differs between Spanish-English bilingual adults with aphasia (BAA) and healthy, age-matched bilingual controls (BHC). Specifically, Bayesian Model Selection (BMS) was used to determine if participants' networks differed according to top-down versus bottom-up processing preference and network lateralization (left, right, or bilateral). Four BAA and four BHC completed a semantic word triplet judgment fMRI task in both languages, and both conditions of interest (i.e., Spanish Semantic, English Semantic) were used in DCM. For controls, group-level results indicated no preference for bottom-up or top-down processing for English but a strong preference for top-down processing for Spanish. Best-fit models for controls were primarily left-lateralized for English and bilateral for Spanish. Single-subject BMS in patients indicated that model fit differed from controls but varied from patient to patient in terms of top-down versus bottom-up processing and lateralization. In conclusion, healthy Spanish-English bilinguals have a clear pattern for semantic processing including a pertinent cognitive control aspect for Spanish, and post-stroke this pattern is diminished.

Topic Area: LANGUAGE: Semantic

Gesture Comprehension and Verbal Working Memory

Poster C80, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Seana Coulson[1], Ying Choon Wu[1], Megan Bardolph[1], Tania Delgado[1]; [1]University of California, San Diego

Behavioral research on the comprehension of co-speech iconic gestures has produced conflicting accounts of the import of verbal working memory (WM). Here we use scalp recorded event-related brain potentials (ERPs) to examine this issue. Electroencephalogram (EEG) was recorded as 14 healthy adults engaged in multimodal discourse comprehension and a concurrent verbal memory task. Each trial began with participants hearing either 1 (low load) or 4 (high load) digits to be remembered. The discourse comprehension task involved watching a video of a speaker describing everyday objects, and using either congruent or incongruent co-speech gestures. Comprehension was tested by asking participants whether a photograph presented after each video was either related or unrelated to the scene described by the man in the video. After responding to the photograph, participants indicated the numbers they had heard at the beginning of the trial in the order that they heard them. ERPs time-locked to the onset of the first word in each video revealed a larger P600 component 500-700ms to words accompanied by incongruent than congruent gestures. ERPs time-locked to the last word in each video revealed no effects of gesture congruity, and a slow-rising anterior negativity beginning 500ms post-stimulus that was

larger for low than high load trials. Results point to independent effects of verbal memory load and speech gesture congruity, consistent with models that suggest a minimal role for verbal WM in gesture comprehension.

Topic Area: LANGUAGE: Semantic

The neural representation of verbs and nouns meaning

Poster C81, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Giulia V. Elli[1], Connor Lane[1], Marina Bedny[1]; [1]Johns Hopkins University

Prior studies found that partly distinct brain regions process nouns and verbs (Martin et al., 2995; Bedny & Caramazza, 2011). Do these regions encode fine-grained distinctions among words? We asked whether noun-responsive regions are more sensitive to differences among nouns, whereas verb-responsive regions are more sensitive to differences among verbs using multivoxel pattern analysis (MVPA). Participants judged the similarity of pairs of words – verbs: sound emission (e.g. “to boom”), light emission (e.g. “to sparkle”), mouth action (e.g. “to bite”), hands action (e.g. “to caress”); nouns: birds (e.g. “the crow”), mammals (e.g. “the lion”), natural places (e.g. “the marsh”), manmade places (e.g. “the shed”). We identified regions in the left hemisphere showing larger responses for verbs – the posterior middle temporal gyrus (MTG) and inferior frontal cortex (IF) – and regions showing larger response for nouns – the inferior temporal (IT) and the inferior parietal (IP) cortices. A linear support vector machine (SVM) classifier was trained on half of the data (e.g. even runs), and then tested on the other half (e.g. odd runs). We successfully decoded among verbs and nouns in all ROIs (all $p<0.01$), the classifier was significantly more accurate for nouns in IP ($t(12)=2.67$, $p<0.05$) and IT ($t(12)=3.51$, $p<0.01$), and for verbs in MTG ($t(12)=2.11$, $p=0.05$). There was no difference in the classifier accuracy in IF ($t(12)=1.12$, $p=0.29$). These results suggest that verb-responsive regions (lMTG) are more sensitive to semantic differences among verbs, whereas noun-responsive regions (IP and IT) are more sensitive to distinctions among nouns.

Topic Area: LANGUAGE: Semantic

Neuroimaging Evidence for Individual Differences in L1 Lexical Semantic Processing

Poster C82, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Lisa Beck[1], Lyam Bailey[2], Morgan Johnson[3], Ella C. Dubinsky[4], Kaitlyn M. Tagarelli[5], Timothy Bardouille[6], Aaron J. Newman[7]; [1]Dalhousie University

Previous models of native (L1) language processing have assumed that all L1 speakers show homogeneity in language proficiency and corresponding neural activity. However, there is a growing body of research suggesting that proficiency is not homogeneous within an L1 population, and that individual variability in this and in other cognitive factors may influence how and where in the brain language is processed. We investigated this relationship by using magnetoencephalography (MEG) to assess the time course, strength, and localization of neural activity associated with lexical semantic processing. This activity was elicited by the reading of either semantically congruent sentences (eg., Jenny lit the candles on the birthday cake), or anomalous counterparts containing a lexical semantic violation on the terminal word (eg.,*Jenny lit the candles on the birthday mine). Imaging data were analyzed in the 300-500 ms post-stimulus time window, with predictor variables including scores of language proficiency and other cognitive measures such working memory and executive functioning. Key findings include a positive correlation between the magnitude of the neural activity (the N400 effect) and grammar proficiency, as well as a right lateralization of this effect with increasing vocabulary proficiency. Our findings provide further evidence that there is individual variability in proficiency and other cognitive measures within a group of L1 speakers, and that these differences do modulate measurable characteristics of the neural activity associated with lexical semantic processing. Sensor- and source- level data will be used to demonstrate, both visually and quantitatively, the extent to which this modulation occurs.

Topic Area: LANGUAGE: Semantic

Investigating semantic representations in brain with fMRI and LSA

Poster C83, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Sverker Sikström[1], Johan Mårtensson[1]; [1]Department of psychology, Lund university

Participants studied words, and pictures describing the words, while being scanned with functional magnetic resonance imagining. Latent semantic analysis (LSA), based on Google-ngrams, was used to generate semantic representations of the words used as stimuli material. Functional data analysis was conducted by using MVPA/RSA as outlined in Kriegskorte, Mur & Bandettini (2008). Fibertracking was performed by creating estimations of native space tracts between the distinct brain regions that were activated during the fMRI task. This was done in FSL/FDT. Individual ROIs from cortical areas were estimated using the Freesurfer software package and used as starting regions for the MVPA/RSA analysis. Connectivity indices along with semantic dimensions were compared for representational similarity using RSA. The results showed that the semantic similarity between words using LSA predicted the representation similarity in the brain using RSA.

Topic Area: LANGUAGE: Semantic

"I deny my expectations. Even so, I predict": Differential electrophysiological effects of concession and result connectives in discourse comprehension

Poster C84, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Edward Alexander[1], Einat Shetreet[2], Connie Choi[1], Ming Xiang[3], Gina Kuperberg[1,4,5]; [1]Department of Psychology, Tufts University, [2]Department of Linguistics, Tel Aviv University, [3]Department of Linguistics, University of Chicago, [4]MGH/MIT/HMS Athinoula A. Martinos Center for Biomedical Imaging, [5]Department of Psychiatry, Massachusetts General Hospital

We used event-related potentials (ERPs) to compare comprehenders' use of two types of discourse connectives to predict upcoming events: "Therefore", which tells comprehenders to expect a specific causal relationship (Result), and "Even so", which tells comprehenders to deny expectations, based on their real-world knowledge (Concession). Participants read two-sentence contexts followed by a third sentence, presented word by word, beginning with either "Therefore" or "Even so". ERPs were measured on critical words that rendered scenarios coherent or incoherent ("Elizabeth aced/failed her test… Therefore/Even so, she CELEBRATED…"). The amplitude of the N400 between 355-390 ms was reduced on coherent (versus incoherent) critical words following "Even so", but not following "Therefore". A posteriorly distributed late positivity was larger to incoherent (versus coherent) critical words, regardless of the preceding connective, and, between 750-1000 ms, this effect was larger following "Even so" than following "Therefore". These findings suggest that, while both connectives influenced online neural processing, "Even so" led comprehenders to generate stronger predictions about upcoming events than "Therefore".

Topic Area: LANGUAGE: Semantic

Age-related differences in the functional connectivity of the medial temporal lobe support successful memory encoding

Poster C85, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Lingfei Tang[1], Andrea Shafer[1], Ryan Liddane[1], Hager Alkhafaji[1], Noa Ofen[1]; [1]Wayne State University

Recent neuroimaging evidence suggests that the functional maturation of the medial temporal lobe (MTL) contributes to age-related improvement in successful memory encoding. In line with resting-state functional MRI studies in adults, limited evidence from such studies in children suggests a differential pattern of functional connectivity between anterior and posterior portions along the long-axis of the MTL. Furthermore, there is a limited evidence for age-related differences in hippocampal functional connectivity that may be relevant to memory functioning in children. Little is known about the age-differences in MTL functional connectivity that directly underlie successful memory formation, and whether the distinction between anterior and posterior portions of the MTL carry significant explanatory value in observed developmental effects. We collected functional MRI data from 97 participants (ages 8-25) while they studied scenes for a later recognition test. Memory-related activation (for subsequently remembered versus forgotten scenes) was assessed in a priori defined regions located along the long-axis of the hippocampus, entorhinal cortex, and parahippocampal cortex. Memory-related activation in anterior and posterior MTL increased with age, but not in the middle portion of the MTL. Using psycho-physiological interaction analyses, we found that anterior MTL regions showed age-related increase in coupling with regions in the occipital and temporal lobe. In contrast, posterior MTL regions showed age-related increase in negative coupling with regions in the default mode network. These findings suggest that the protracted functional maturation along the long-axis in the MTL supports age-related improvement in memory functioning.

Topic Area: LONG-TERM MEMORY: Development & aging

Fixation reinstatement supports visuospatial memory in older adults: An eye movement compensation effect.

Poster C86, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Jordana Wynn[1,2], Rosanna Olsen[2], Malcolm Binns[2], Bradley Buchsbaum[1,2], Jennifer Ryan[1,2]; [1]Department of Psychology, University of Toronto, [2]Rotman Research Institute, Baycrest Hospital

Research suggests that older adults can compensate for age-related cognitive deficits by over-recruiting cognitive and/or neural resources relative to younger adults. Yet, it remains unclear whether compensatory activity extends to other domains. In the present study, we investigated whether recapitulation of encoding fixations during memory maintenance, an effect that has been previously linked to memory retrieval in younger adults, can support performance on a visuospatial-memory-based change detection task in older adults. Consistent with theories of compensation, older adults showed greater reinstatement of encoding fixations during a post-study, stimulus-free delay period than younger adults, and this reinstatement supported age-equivalent behavioral performance. Fixation reinstatement also correlated with performance in younger adults, but only when memory loads were high. The present findings provide novel evidence of compensatory fixation reinstatement in older adults and advance a critical role for eye-movement-monitoring in aging and memory research.

Topic Area: LONG-TERM MEMORY: Development & aging

The role of prior knowledge during automatic and controlled memory retrieval in younger and older adults

Poster C87, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Tarek Amer[1,2], Kelly S. Giovanello[3], Cheryl L. Grady[1,2], Lynn Hasher[1,2]; [1]University of Toronto, [2]Rotman Research Institute, [3]University of North Carolina at Chapel Hill

Older adults typically show associative memory deficits relative to younger adults. This deficit, however, is mediated by the meaningfulness of the materials used and consistency of the information with prior knowledge. Older and younger adults, for example, show equivalent associative memory for realistic, but not unrealistic, prices of groceries. This effect has been interpreted as facilitative learning through schematic support. The current study examines the role of memory retrieval on this effect. Using the same paradigm, older and younger adults retrieved realistic and unrealistic item prices in a speeded automatic retrieval condition, or in a slowed controlled retrieval condition. There were no age differences in memory for realistic prices in either condition, however, younger adults showed better memory for unrealistic prices in the controlled retrieval condition only. These results suggest that age-related deficits in memory for arbitrary associations can be, at least partly, accounted for by impairments in controlled retrieval.

Topic Area: LONG-TERM MEMORY: Development & aging

Age effects on resting state functional connectivity preceding and following an associative learning task.

Poster C88, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

gwenaelle catheline[1,2], manon Edde[1], georges Di-scala[1], bixente Dilharreguy[1], sandra Chanraud[1,2]; [1]INCIA, UMR CNRS 5287, Université de Bordeaux, Bordeaux, France, [2]EPHE, PSL Research University.

Associative learning task is more difficult for aging subjects than for young subjects. We hypothesized that the difficulties encountered by aging subjects during the achievement of the task could leave a mark on resting state functional connectivity. In this purpose, we compared rest fMRI before and after an associative learning task in 17 healthy young subjects (24.7 + 2.7 years) and in 14 elderly subjects (65.5+ 2.6 years). Before the task, aging subjects present underconnectivity in various brain regions including occipito-cerebellum network, temporo-frontal network and striato-temporal network. After the task, the pre-task differences were maintained and two other networks present an underconnection in aging subjects compared to young subjects: parahippocampal-cerebellum 4-5 and an hippocampo-frontal networks. We have then tested the association between the level of performance of aging subjects and the level of connectivity of these two networks. A significant correlation was observed between the level of performance and the level of connectivity between the left parahippocampal cortex and the right 4-5 cerebellum measured following the task (rho = 0,536, $p < 0,05$). In contrast no association was observed with the level of connectivity of the hippocampo-frontal network. Basal resting state connectivity is different between young and older subjects, and this difference is maintained post-task. Moreover, we highlight the involvement of a parahippocampal-cerebellum network for the successful achievement of this associative learning task for the elderly.

Topic Area: LONG-TERM MEMORY: Development & aging

Normal older adults' performance on a famous faces task is related to gray matter thickness and amyloid-beta in ApoE4 carriers

Poster C89, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Rachel Bell[1], Stephanie L. Leal[1], Taylor Mellinger[1], Kaitlin Swinnerton[1], William J. Jagust[1]; [1]University of California, Berkeley

Many older adults experience difficulty retrieving names, and note a "tip-of-the-tongue" (TOT) phenomenon. To explore this, we added a time limit to the Northwestern University Famous Faces Task which requires participants to name famous people in a set of photographs. TOTs were counted when participants knew semantic information or a partial name, but did not get full naming points within 5 seconds. Cognitively normal older adults (n=73, MMSE=28.86 +/-1.19, age=56-94, education=16.74 +/-1.89) also completed neuropsychological testing, a 1.5T structural MRI, a PiB PET scan measuring amyloid-beta, and ApoE4 genotyping. Age positively correlated with TOT score (p=.033, $r\tau$=.158), and score variability increased with age. To explore age-related variation, we regressed age on TOT score and divided subjects into one of two groups, either better or worse than expected for age. The group with fewer TOTs (for age) had greater mean gray matter thickness in bilateral parahippocampal gyrus (L:p=.004, R:p=.024), right inferior temporal lobe (p=.029), right temporal pole (p=.041), and right frontal operculum (p=.018) controlling for gender and education. TOT scores didn't differ significantly by PiB status with the same covariates, but PiB positive ApoE4 carriers (n=10) had TOT residual scores correlated with amyloid-beta burden (p=.03, $r\tau$=.50), while PiB positive ApoE4 non-carriers (n=12) did not. This study suggests face-naming ability is related to gray matter atrophy in regions associated with memory and face recognition and that amyloid-beta and ApoE4 status together are associated with a greater number of TOT responses.

Topic Area: LONG-TERM MEMORY: Development & aging

Age-related differences in time course of brain activation and connectivity during feedback-based associative learning.

Poster C90, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Sandra CHANRAUD[1,2], Georges DI-SCALA[1], Maud DUPUY[1], Bixente DILHARREGUY[1], Michèle ALLARD[1,2,3]; [1]INCIA - Université de Bordeaux, UMR 5287-CNRS, Bordeaux cedex, France, [2]EPHE, PSL Research University, Bordeaux, France, [3]CHU de Bordeaux, Bordeaux, France

In young subjects, first-order rules learning is accompanied by decreased cerebellar activity as responses become automatic. In aging, both automatization abilities and cerebellar integrity are questioned. Here, we aimed at investigating cerebellar time-locked activity during automatization of a learning task in aging. Older (OS, n=15, 60-70 years old) and younger (YS, n=15, 20-30 years old) adults were included and performed on an associative learning task, involving trial and error discovery of the correspondence between figures and responses keys. There was two reinforcement levels: High learning (HL; 100% of feedback) and Low Learning (LL; 50 % of feedback), for different rates of automatization. Imaging data were collected using a 3.0 Tesla Philips Achieva scanner and, preprocessed and analyzed with SPM8 in a group x time x conditions interaction, in a parametric F-design including time and dispersion derivatives. A PPI analysis was conducted with 2 different time windows of the task as specific conditions. The performance of OS progressed slowly but reached at the end, a level comparable to that of YS at the beginning of the task. Different time-related activations were revealed between-groups in the cerebellum lobule VI and in the hippocampus. By the end of the task, the effective connectivity in OS in comparison to YS was higher between the cerebellum and the cingulate cortex and lower between the cerebellum and the hippocampus. Activation results might reflect neural decrements related to cognitive slowing; and difficulty to maintaining cerebello-hippocampal connectivity while performing on the task may induce inefficient encoding of stimuli.

Topic Area: LONG-TERM MEMORY: Development & aging

Associations between region-specific structural brain integrity and cognitive abilities in old age: A multivariate, longitudinal, structural equation modeling approach

Poster C91, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Sandra Düzel[1], Andreas Brandmaier[1,2], Simone Kühn[3], Ulman Lindenberger[1,2]; [1]Max Planck Institute for Human Development, Berlin, Germany, [2]Max Planck UCL Centre for Computational Psychiatry and Ageing Research, Berlin, Germany, [3]University Clinic Hamburg-Eppendorf, Hamburg, Germany

Older individuals differ greatly in cognitive functioning, and these differences are assumed to reflect differences in the structural integrity of specific brain regions. However, delineating change-change associations between brain and behavior has often been elusive. We apply multivariate latent difference modeling to two-occasion longitudinal data from the Berlin Aging Study II to examine the extent to which individual differences in level and change of region-specific latent constructs of structural brain integrity in hippocampus (HC), prefrontal cortex (PFC) and occipital cortex (OCC) are related to individual differences in latent constructs of cognitive abilities representing episodic memory (EM), working memory (WM), and fluid intelligence (Gf). Full-information maximum likelihood was used to also include individuals who had not participated in MR imaging session. The total sample consisted of 1537 healthy older individuals aged 61 to 88 years, and the imaging subsample of 342 individuals aged 61 to 82 years. Region-specific factors of brain integrity were based on T1-weighted, magnetization transfer, an diffusion imaging as fallible indicators of local gray matter tissue density, solid proton pool, and mean diffusivity of water, respectively. Initial modeling results show that higher levels of EM and HC integrity were associated with less decline in HC integrity. This finding is consistent with the hypothesis that hippocampal integrity helps to to maintain EM in old age.

Topic Area: LONG-TERM MEMORY: Development & aging

Aging effects on perceptual and conceptual memory: transformations from short-term to long-term memory

Poster C92, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Anisha Adke[1], Caitlin R. Bowman[1], Dagmar Zeithamova[1]; [1]University of Oregon

Healthy memory function involves remembering both general features (conceptual memory) as well as the specific perceptual details that distinguish between similar events (perceptual memory). It is posited that aging reduces perceptual memory to a greater degree than conceptual memory. Here, we tested if this age-related decline is due to deficits in the initial encoding of perceptual details or because perceptual information shows greater decay over time than conceptual information. Short-term (five second delays) and long-term (30+ minute delays) memory for both conceptual information and perceptual details were compared between young and older adults. In both the short- and long-term tasks, participants studied images of objects followed by a perceptual or conceptual memory test. On perceptual test trials, participants distinguished between target images and highly similar lures. During conceptual memory trials, participants were shown a word and asked if an item with that name had been studied. In the short-term memory task, young and older adults performed well and comparably for both conceptual and perceptual memory, suggesting that older adults do not show a deficit in initial encoding of perceptual details into short-term memory. Long-term memory in young adults was significantly better for conceptual information than perceptual details. Unexpectedly, older adults did not show the same conceptual advantage. Instead, older adults showed similar levels of forgetting for both conceptual and perceptual information. Thus, forgetting seems to be the largest contributor to long-term memory decrement in older adults, and this decline can be equal for both conceptual information and perceptual details.

Topic Area: LONG-TERM MEMORY: Development & aging

An electocorticography (ECoG) study of memory formation in children

Poster C93, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Qin Yin[1], Lingfei Tang[1], Mo Malik[1], Andrea Shafer[1], David Chen[1], Eishi Asano[1,2], Noa Ofen[1]; [1]Wayne State University, [2]Children's Hospital of Michigan

Evidence from non-invasive neuroimaging methods has shown that episodic memory formation in children is supported by activity in the medial temporal lobes (MTL) and lateral prefrontal cortex (PFC), with the latter having a protracted functional development compared to the former. Intracranial EEG, also referred as ECoG, provides novel and exciting opportunities to investigate the temporo-spatial dynamics of neural activities for memory formation. Recent ECoG studies have shown increased power in theta (4-7 Hz) and gamma (30-150 Hz) bands. Here, we tested 12 epilepsy participants (aged 6-17) who underwent extraoperative ECoG as part of clinical management. Participants studied pictures of indoor and outdoor scenes, and were informed that their memory of the scenes would be tested in a following recognition test. Data were recorded using a 192-channel digital system with platinum grid and strip electrodes. We examined changes in theta power for subsequently remembered vs. forgotten scenes in surface electrodes placed on MTL and lateral PFC. Event-related spectral changes were determined through wavelet time-frequency decomposition for 2500 ms pre- to 1000 ms post-response onset. Preliminary analysis showed that successful memory formation was associated with an early decrease followed by later increase in theta in both MTL and lateral PFC. Interestingly, the increased theta power occurred to the posterior MTL before the response and to the anterior MTL afterward. Additional analyses will examine the temporo-spatial dynamics in gamma band frequency as well as cross frequency coupling. Our findings will yield a deeper understanding of the electrophysiological mechanisms underlying memory development.

Topic Area: LONG-TERM MEMORY: Development & aging

Using functional magnetic resonance imaging to guide positron emission tomography analyses in mild cognitive impairment.

Poster C94, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Shaina L. Garrison[1], Chris M. Foster[2], Daniel Kaufer[1], Kathleen Welsh-Bohmer[3], David Lalush[1,4], Kelly S. Giovanello[1]; [1]University of North Carolina at Chapel Hill, [2]University of Texas at Dallas, [3]Duke University, [4]North Carolina State University

The current study compared metabolic activity between individuals with mild cognitive impairment (MCI) and age-matched healthy controls within functionally-defined Alzheimer's disease (AD)-signature regions. Participants engaged in associative encoding, and then subsequent associative recognition, while undergoing simultaneous acquisition of fluorodeoxyglucose-positron emission tomography (FDG-PET) and BOLD functional magnetic resonance imaging (fMRI) using a Siemens 3T Biograph scanner. At encoding, participants learned a series of word pairs, either by creating a sentence that included both words or reading a provided sentence. At retrieval, associative recognition memory for the word pairs was assessed. Analysis of the task-based fMRI data revealed that participants with MCI showed greater encoding-related activity in the right middle frontal gyrus and right precuneus, than did control participants. Group differences in metabolic activity were assessed by comparing FDG standardized uptake values (SUVs) between groups, within these functionally defined regions. Results indicated that participants with MCI showed less metabolic activity than control participants in the same regions where they demonstrated functional hyperactivity. These findings provide novel insight into functional neural change associated with MCI. The results also demonstrate differential effects of MCI on task-based functional activity and glucose metabolism in the brain. To our knowledge, this study represents the first investigation to acquire simultaneous multi-modal imaging with the goal of using task-based fMRI to guide analysis of FDG-PET data.

Topic Area: LONG-TERM MEMORY: Development & aging

Disentangling interactions between context switches and the spacing effect

Poster C95, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Lynn Lohnas[1], Lila Davachi[1]; [1]New York University

Improved memory for spaced over massed repetitions is a well-established finding (Cepeda et al., 2006). Yet one intriguing result concerns the interaction between items repeated in the same vs. different encoding contexts: whereas recall probability is greater for massed items repeated in different contexts, recall probability is greater for spaced items repeated in the same context (e.g., Verkoeijen et al., 2005; Maskarinec & Thompson, 1976). Here we consider the role of context switches, as such switches modulate memory and attentional processes (Ezzyat & Davachi, 2014; DuBrow & Davachi, 2013) yet have not been considered in the aforementioned result. Eighteen participants were presented with lists of words while undergoing functional magnetic resonance imaging (fMRI). Participants performed free recall and source recognition for each list. During encoding, each word had an associated task context, and could be presented once, twice massed (lag=0) or twice spaced (lag=5). At each lag, words could be repeated with the same or different contexts. For a massed item presented with different contexts, the second presentation always immediately follows a context switch. Yet attentional and neural processes were impacted by switches; encoding task response times for once-presented items were significantly slower for those items that immediately followed a switch vs. those that did not ($p<.01$). We thus introduced a matched control to the massed items whereby a spaced item repeated in different contexts had the second presentation immediately following a context switch. Overall, our results reflect how encoding contexts modulate fMRI activity and behavior to promote successful encoding.

Topic Area: LONG-TERM MEMORY: Episodic

Neurobehavioural characteristics of limbic encephalitis associated with voltage-gated potassium channel complex antibodies.

Poster C96, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Clare Loane[1], Adriana Roca-Fernandez[1,2], Carmen Lage-Martinez[1,3], Samrah Ahmed[1], Christopher R Butler[1]; [1]Memory Research Group, Nuffield Department of Clinical Neurosciences, University of Oxford, Oxford, UK., [2]Oxford Multiple Sclerosis and Neuromyelitis Group, Nuffield Department of Clinical Neurosciences, University of Oxford, Oxford, UK., [3]Cognitive Disorders Unit, Hospital Universitario Marques de Valdecilla, Santander, Spain.

Limbic encephalitis associated with antibodies to the voltage-gated potassium channel complex (VGKC-LE) often results in memory impairment with accompanying hippocampal damage thus could provide an opportune human model of hippocampal amnesia. However, comprehensive characterisation of the neurobehavioural profile of VGKC-LE patients is currently lacking. A group of VGKC-LE patients (n =17) and matched healthy controls underwent clinical interview, extensive neuropsychology testing as well as structural magnetic resonance imaging (MRI) and resting-state functional MRI (rs-fMRI). Manual delineation of medial temporal lobes (MTL) structures and FreeSurfer cortical parcellation were employed to investigate atrophy patterns. Seed-based connectivity analysis investigated aberrant functional connectivity of the anterior and posterior memory networks. We confirm long-term cognitive impairment is confined to the memory domain. Structural MRI analyses confirms focal hippocampal atrophy with no evidence for a consistent reduction of other sub-cortical or cortical regions. No significant association between hippocampal atrophy measures and memory performance was detected. Reduced functional connectivity was evident from anterior hippocampi to each contralateral temporal pole. Functional connectivity between left anterior hippocampus and right temporal pole was significantly correlated with WMS-IV Word List delayed recall scores ($r = -0.584$; $p = 0.05$) in patients. We have demonstrated that VGKC-LE patients present with persistent memory impairment and focal hippocampal atrophy. However, the presence of hippocampal atrophy alone does not clearly explain the memory deficits. Instead, our data strongly suggest that a functional disturbance at rest is a contributory factor and could explain inconsistencies currently existing in the hippocampal amnesia literature.

Topic Area: LONG-TERM MEMORY: Episodic

Confidence in recognition memory can be inferred from response pressure without explicit instruction

Poster C97, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Josephine A. Urquhart[1], Akira R. O'Connor[1]; [1]University of St Andrews

The neural mechanisms underlying recognition confidence have typically been investigated using explicit instructions, with participants intentionally rating this subjective sensation using discrete numerical scales. However, recent research indicates that confidence is supported by multiple processes. Notably there appears to be a dissociation between: I) primary confidence, the automatic driving force behind a recognition decision outcome, initiated without conscious reflection and II) secondary confidence, which arises after temporally extended metacognitive evaluation post-decision. We aimed to develop an intuitive methodology in order to more effectively record primary confidence. We designed a novel measurement technique, which could be deployed without explicit instruction. In one experiment (n=26), naïve participants rendered old/new word recognition decisions using two buttons. The pressure exerted on these buttons was taken as an alternative measure of response confidence. Results show elevated pressure corresponds to increased accuracy likelihood. Further analysis validated the novel technique, demonstrating the pressure/accuracy relationship captured participant-wise nuances in recollection- and familiarity- based responding consistent with those recorded using a standard discrete numerical scale. Overall, our findings support multiple process accounts of confidence, showing it can be measured concurrently with a recognition decision without requiring explicit self-reflection. In contrast to discrete scales, our novel measurement technique also offers rich temporal information across a single response trial, providing potential insight into evidence accumulation and changes of mind, as well as the resolution and calibration of confidence to accuracy. Accordingly, we suggest it could complement neuroimaging methodologies, aiding the isolation of neural mechanisms supporting confidence-based memory-search and decision-making processes.

Topic Area: LONG-TERM MEMORY: Episodic

Characterizing remote memory in posterior cortical atrophy

Poster C98, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Samrah Ahmed[1], Muireann Irish[2,3,4], Clare Loane[1], Ian Baker[5], Masud Husain[1], Sian Thompson[5], Clare Mackay[1], Giovanna Zamboni[1], David Foxe[2,3,4], John Hodges[2,3,4], Olivier Piguet[2,3,4], Christopher Butler[1]; [1]University of Oxford, [2]ARC Centre of Excellence in Cognition and its Disorders, [3]Neuroscience Research Australia, [4]The University of New South Wales, [5]Oxford University Hospitals NHS Trust, John Radcliffe Hospital

Posterior cortical atrophy (PCA) is a syndrome characterized by progressive disruption of visual processing and neurodegeneration in the parieto-occipital cortex. The most common underlying cause is Alzheimer's pathology. Anterograde memory function and the medial temporal lobes (MTLs) are thought to be relatively preserved. Given that the typical pattern of atrophy in PCA overlaps with brain networks critical for the recollection of personal events, we hypothesized that patients would be

impaired on a test of autobiographical memory. 14 PCA, 18 Alzheimer's disease (AD) patients and 28 healthy controls completed the Autobiographical Interview. Both PCA and AD patients produced significantly less internal detail relevant to the chosen memories, compared with controls. However, the PCA group also produced a significantly greater amount of unrelated external detail compared with controls and AD. Across the lifespan, PCA and AD again showed similarly poor recall of relevant remote memory details compared with controls, with no temporal gradient evident in either group. Correlational analysis in PCA patients revealed a significant relationship between total external details and the Hayling test of inhibitory control, and a trend towards significance between internal details and visual imagery. Our findings suggest that, despite relatively preserved MTL structures, PCA patients have significantly impaired remote memory. We propose that damage to posterior regions of the brain disrupts access to visual information integral to the autobiographical memory trace. Increased provision of external details may be a compensatory strategy due to lack of access to details relevant to episodic memories.

Topic Area: LONG-TERM MEMORY: Episodic

Goal-invariant and goal-dependent retrieval success effects during conceptual and perceptual episodic recollection

Poster C99, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Joseph P. Hennessee[1], Anthony D. Wagner[2], Jesse Rissman[1]; [1]University of California, Los Angeles, [2]Stanford University

Upon re-encountering a previously studied stimulus, a variety of conceptual and perceptual details about the original study episode can be brought back to mind. While it is well documented that an extensive network of frontoparietal regions reliably show elevated activity during successful retrieval, the degree to which these retrieval success effects are modulated by retrieval goals remains a topic of active investigation. We collected fMRI data from 21 participants as they were alternatively cued to make recollective judgments about conceptual or perceptual details of past encounters with object stimuli. Each object had been initially encoded under one of two orienting tasks (naturalness or pleasantness judgments) and one of two screen sizes (large or small). Analyses revealed a core set of regions showing comparable retrieval success effects during both conceptual and perceptual retrieval trials, including left anterior inferior frontal sulcus, intraparietal sulcus (IPS), supplementary motor area, and bilateral precuneus and caudate. Retrieval success effects specific to conceptual recollection were observed across a large swath of left ventrolateral PFC, as well as along the lateral bank of left IPS extending ventrally into angular gyrus. Effects specific to perceptual recollection were observed bilaterally along the medial bank of IPS, as well as in dorsal occipital cortex and lateral inferior temporal cortex. These goal-dependent retrieval success effects could not be solely attributed to retrieval orientation, as they were not observed when contrasting conceptual and perceptual correct rejections. Thus, distinct networks of activation are associated with the recovery and/or monitoring of goal-relevant mnemonic content.

Topic Area: LONG-TERM MEMORY: Episodic

Brain activity underlying reactivation of episodic memories following lesion of the right temporal lobe

Poster C100, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Corinna Haenschel[1], Nareg Khachatoorian[1], Danai Dima[1], Shona Illingworth[2], Catherine Loveday[3], Martin Conway[1]; [1]City University London, London, UK, [2]University of Kent, UK, [3]University of Westminster, London UK

Despite a large mainly right-side temporal lobe lesion, patient Claire (age: 51) can form memories of everyday experiences but rapidly, within 24 to 72 hours, loses access to them. Claire has used a neck-worn camera (SenseCam, SC) that automatically takes wide-angle colour photographs to improve her episodic memory. However, the underlying neurophysiological mechanisms of remembering these photos have not been studied. We tested Claire's episodic memory in response to SC photos using electroencephalography (EEG) in comparison to 12 typical age-matched controls. One week after a predefined 2-hour sightseeing tour, participants EEG was recorded while they viewed short sequences of four pictures that were either taken from their tour, or were novel. For each photo, they were asked to make a recognition judgement, and to judge whether their recognition experience was one of familiarity or recollection. Claire also repeated the task with a second tour but with just an hour between the tour and the EEG recognition test. Control participants showed a decrease in familiarity and an increase in recollection within the sequence of four pictures. Claire showed a similar pattern of remembering to the controls when tested on the same day, but remembered very little after 1 week. In comparison to controls, Claire showed a larger visual and frontal response to recognition, but reduced response on the right parietal side. These data suggest that Claire uses compensatory mechanisms when recognizing the SC photos, drawing from visual and frontal areas and shed light into why SC photos improve her episodic memory.

Topic Area: LONG-TERM MEMORY: Episodic

Resting-state medial temporal lobe connectivity with reward centers predicts how motivation impacts learning

Poster C101, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Lea E. Frank[1], Alison R. Preston[2], Dagmar Zeithamova[1]; [1]University of Oregon, [2]University of Texas at Austin

Memory is influenced by motivation, such as a promise of future monetary reward for remembering an event. Reward-based memory modulation has been shown to rely on interactions between brain structures sensitive to reward, such as the midbrain, and those supporting episodic memory, such as the medial temporal lobe (MTL), during motivated encoding. Here, we tested whether intrinsic connectivity between the memory-related (MTL) and reward-related (midbrain, striatum, orbitofrontal cortex) regions during rest can predict reward modulation and if these connections increase as a function of motivated encoding. Subjects underwent resting-state functional MRI before and after a monetary incentive encoding task in which a potential monetary reward cue (penny, dime, or dollar) was followed by a pair of objects to be remembered. The associated monetary value was awarded to the subject for each correctly recalled object pair. Participants remembered high-value pairs better than medium- and low-value pairs. However, reward modulation of memory varied across individuals. Resting-state fMRI revealed that MTL-midbrain connectivity significantly increased from pre- to post-learning, suggesting that interactions between reward and memory systems can be upregulated in response to a motivated encoding task. Intrinsic connectivity further tracked individual differences in reward modulation, such that subjects who demonstrated greater sensitivity to reward also showed significantly greater intrinsic MTL-striatum and MTL-orbitofrontal connectivity during both pre-encoding and post-encoding rest scans. These results suggest that intrinsic connectivity between reward- and memory-related regions underlies individual differences in reward modulation and highlight the dynamic interactions between these systems that extend beyond the period of learning.

Topic Area: LONG-TERM MEMORY: Episodic

Measuring the impact of short-term training on brain networks using resting state connectivity

Poster C102, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Adam Steel[1,2], Cibu Thomas[1], Aaron Trefler[1], Gang Chen[3], Chris Baker[1]; [1]Laboratory of Brain and Cognition, National Institutes of Health, [2]Oxford Centre for Functional MRI of the Brain, University of Oxford, [3]Statistics and Computing Core, National Institutes of Health

While training has been shown to alter resting-state connectivity, the extent to which such effects are influenced by other factors (e.g. diurnal changes) is unclear. Here, we address these issues using a within-subject design involving 21 healthy adults over four experimental visits. Each visit included two scan sessions, at 1000 and 1400 hours (AM/PM). On two visits, between the AM and PM scans participants trained for 90 minutes on either a visuospatial-learning (VSL) or a motor sequence-learning (MSL) task. On the remaining two visits, participants received no training to test for diurnal changes in connectivity. We focused on connectivity strength with the bilateral hippocampi (HIPP) and motor cortices (MC), given their involvement in VSL and MSL, respectively. Both MC and HIPP networks showed diurnal fluctuations in connectivity. After controlling for diurnal fluctuations, the effect of VSL on HIPP was evidenced by a training-related decrease in connectivity between the hippocampi and sensorimotor-, premotor-, and lateral prefrontal cortex, but an increase in connectivity with anterior medial place area and putamen. Pre-training connectivity between HIPP and ventral prefrontal cortex predicted VSL. In contrast, MSL evoked an increase in connectivity between MC and temporal and occipitotemporal cortices, but a decrease in connectivity between MC and the caudate nucleus. Better performance in MSL was positively correlated with an increase in connectivity between MC and putamen and cerebellum. These results suggest that resting-state fMRI can detect task-specific effects of training, but also underscore the importance of controlling for potential confounds in connectivity analyses.

Topic Area: LONG-TERM MEMORY: Skill learning

The consolidation of explicit, but not implicit probabilistic sequence learning is associated with anterior delta and theta activity of post-learning Non-REM sleep

Poster C103, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Zsofia Zavecz[1,2], Peter Simor[3], Karolina Janacsek[1,2], Kata Horváth[1,2], Csenge Török[1,2], Noémi Éltető[1], Orsolya Pesthy[1], Dezso Nemeth[1,2]; [1]Eötvös Loránd University, Budapest Hungary, [2]Hungarian Academy of Sciences, Budapest, Hungary, [3]Budapest University of Technology and Economics, Budapest, Hungary

Post-learning sleep and sleep-specific neural oscillations can facilitate off-line memory consolidation. Some of these oscillatory patterns might also be functional during a wakeful quiet rest state, however, the influence of wakeful rest on memory consolidation was only scarcely investigated. Furthermore, the beneficial impact of sleep on non-declarative, procedural skills, especially sequence learning is less conclusive. Here, we applied a complex perceptual-motor probabilistic sequence learning task in order to investigate the consolidation of two learning processes: 1) implicit statistical learning, a fundamental mechanism of the brain, which extracts and represents regularities, and 2) explicit sequence learning which is a higher-order type of learning with explicit access to the represented regularities. Young adults (N = 60) after performing the task were randomly allocated into one of three different groups to spend a one-hour off-line period in 1) a relaxed resting state, 2) an active wakeful state, or 3) asleep. EEG power was analyzed throughout the off-line period. On a behavioral level, we found no differences between these groups: statistical learning and explicit sequence learning was preserved in all groups after the off-line period. Interestingly, however, within the nap group, in frontal electrode sites, spectral power comprising the delta and theta frequency range was positively associated with the consolidation (gain) of explicit sequence learning, but not of statistical learning. Our findings indicate, that sleep-specific cortical oscillations might facilitate the consolidation of sequence learning only if an explicit representation of the sequence structure can be acquired.

Topic Area: LONG-TERM MEMORY: Skill learning

Statistical learning: Manipulation of timing in the reconsolidation phase

Poster C104, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Csenge Török[1,2], Karolina Janacsek[1,2], Dezso Nemeth[1,2]; [1]Hungarian Academy of Sciences, Institute of Cognitive Neuroscience and Psychology, [2]Eotvos Lorand University, Institute of Psychology

Statistical learning has been defined as sensitivity to regularities, patterns and statistical dependencies in the environment. However, the processes of consolidation and reconsolidation of this learning mechanism are still unclear. The aim of the present study was to investigate how statistical learning and its consolidation is affected by modifications of temporal parameters in the reconsolidation phase. Fifty-three healthy young adults participated in the experiment. Statistical learning was measured by the Alternating Serial Reaction Time Task (ASRT). The response-to-stimulus-interval (RSI) was fix in the learning phase. After a six-hour delay, in the reconsolidation phase, participants were assigned to one of two groups: one group performed the ASRT task with random RSI, while the other group performed the task with the same fix RSI as in the learning phase. Performance was then tested after a 16-hour delay with fix RSI in both groups. Both the manipulated and the control groups showed significant statistical learning in the learning phase, with no group differences. Furthermore, we found no performance decrease neither in the reconsolidation phase nor in the testing phase, both groups' statistical learning was retained to a similar extent, despite the manipulation of temporal parameters. These findings demonstrate the robustness of both statistical learning and its consolidation.

Topic Area: LONG-TERM MEMORY: Skill learning

Statistical learning and explicit sequence-learning are differentiated with ERPs during task automatization

Poster C105, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Adam Takacs[1], Andrea Kóbor[2], Zsofia Kardos[3,4], Karolina Janacsek[1,3], Kata Horvath[1,3], Dezso Nemeth[1,3]; [1]Institute of Psychology, Eötvös Loránd University, Budapest, Hungary, [2]Brain Imaging Centre, Research Centre for Natural Sciences, Hungarian Academy of Sciences, Budapest, Hungary, [3]Institute of Cognitive Neuroscience and Psychology, Research Centre for Natural Sciences, Hungarian Academy of Sciences, Budapest, Hungary, [4]Department of Cognitive Science, Budapest University of Technology and Economics, Budapest, Hungary

There are several processes underlying the acquisition of automatic behavior, such as skills and habits. The temporal dynamics of the underlying processes of automatization and their neurophysiological markers are not yet understood. Here we investigated two key learning processes: 1) statistical learning, a fundamental mechanism of the brain, which extracts and represents regularities of our environment and 2) explicit sequence-learning which is a higher-order type of learning with explicit access. Young adults (N = 40) performed a perceptual-motor probabilistic sequence-learning task while EEG was recorded using 64 channels. Although the statistical regularity between non-adjacent trials was unknown to participants, pure statistical learning was found both at the behavioral and neural levels. While the visual N170 was sensitive to statistical regularities, the frontal N2 and the P3 reflected the discrimination and elaborative processing of the explicit sequence structure. Moreover, the P3 became attenuated to sequence stimuli as compared to random ones as the task progressed. Our results indicate that statistical and explicit sequence-learning have different markers at the psychophysiological level: Statistical learning is related to visual ERP components, while explicit sequence-learning is related to components that have been traditionally linked to controlled/declarative processes.

Topic Area: LONG-TERM MEMORY: Skill learning

Knowledge of statistical regularities undergoes similar consolidation in explicit and implicit probabilistic learning

Poster C106, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Kata Horváth[1,2], Csenge Török[1,2], Balázs Török[1,2], Orsolya Pesthy[1], Karolina Janacsek[1,2], Dezso Nemeth[1,2]; [1]Eötvös Loránd University, Budapest, Hungary, [2]Hungarian Academy of Sciences, Budapest, Hungary

Recognition of sequential regularities and patterns in the environment is evolutionarily crucial and underlies the acquisition of our skills and habits. This process can occur with or without awareness. Previous studies have shown that delay between learning and testing sessions leads to forgetting of explicitly learned knowledge. In contrast, performance remains retained in implicit memory tasks. This distinction, however, was observed in studies that used differently structured tasks, and thus measured different learning mechanisms. The aim of the present study was to compare the consolidation of explicit and implicit statistical learning in a unified paradigm. Seventy-one healthy young adults participated in the experiment. Statistical learning performance was tested by the Alternating Serial Reaction Time (ASRT) task, and was retested after a 12-hour delay. Half of the participants were informed about the probabilistic sequence structure (explicit group), while the other half of the participants were unaware of the sequence structure (implicit group). Surprisingly, we found no differences in the offline changes of statistical knowledge in the explicit and implicit groups neither in accuracy nor in RT. Our results suggest that the consolidation of pure statistical knowledge, on mechanism level, is independent of the presence or absence of explicit cues.

Topic Area: LONG-TERM MEMORY: Skill learning

Motor learning deficits in cannabis users

Poster C107, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Shikha Prashad[1], Elizabeth Dedrick[1], Francesca Filbey[1]; [1]University of Texas at Dallas

Despite the importance of motor learning for performing activities of daily living, little is known about the preservation of this ability in cannabis users. Studies have reported cognitive deficits and structural and functional changes associated with cannabis use. Animal models indicate that the basal ganglia, cerebellum, and hippocampus have the highest densities of cannabinoid 1 receptors. Thus, the endocannabinoid system involves complex interactions between cannabis use, cognition, and motor activity that are yet to be investigated. The goal of this study was to examine motor learning deficits in cannabis users. Ten cannabis users (5 females; mean age: 30.3 years) performed the serial reaction time (SRT) task while undergoing electroencephalography (EEG). In the SRT task, learning was assessed via an improvement in response times during the learning blocks. We found that mean response time did not improve, indicating impaired motor learning in cannabis users. Fast Fourier transform (FFT) on the EEG data revealed that alpha power was significantly higher than beta power throughout the SRT task ($p = 0.03$). A decrease in alpha power and an increase in beta power is expected when engaged in a task, but these changes in power were not exhibited within either frequency. The alpha and beta frequency bands may be potential biomarkers for cognitive motor impairments in cannabis use disorder. Taken together, our results suggest impaired motor learning in cannabis users that can be observed behaviorally and neurally. These results are critical for treatment and rehabilitation strategies and have public health and policy implications.

Topic Area: LONG-TERM MEMORY: Skill learning

Additive effects of two dopamine modulating genes on feedback-based cognitive sequence learning in younger adults

Poster C108, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Sylvia Larson[1], Angelica Boeve[1], Mark Gluck[2], Jessica Petok[1]; [1]Saint Olaf College, [2]Rutgers University

Complex sequences of behaviors can be mastered via backwards chaining, where smaller associations are learned in a step-wise fashion in order to acquire the entire sequence of actions. Dopamine supports this type of learning, and research has shown that variations in the dopamine transporter gene (DAT1), which play a role in striatal dopamine availability, influence such feedback-based sequence learning. A polymorphism in the catechol-O-methyltransferase (COMT) gene, which predicts frontostriatal dopamine availability, has also been shown to influence learning during sequencing tasks. Here, we examined whether COMT may interact with DAT1 to influence learning of associations. Participants, grouped by COMT (Val homozygotes and Met-carriers) and DAT1 genotype (9-repeat carriers and 10 homozygotes), completed a backward feedback-based 'chaining' task. With increasing task complexity, COMT status interacted with DAT1; 9-repeat carriers' performance did not change depending on COMT polymorphism whereas, among the 10 homozygotes, fewer Val homozygotes were able to reach criterion relative to Met-carriers. Including only participants who completed the chaining task, performance of 9-repeat carriers differed by COMT status, whereby 9-repeat carrier Val homozygotes made more errors relative to 9-repeat carrier Met-carriers. COMT status did not have a significant effect on 10 homozygotes' performance. Of note, there were no significant effects or interactions of genotype for performance on a retest phase, which ensures participants' ability to learn single associations and rules out the fatigue effect. Results demonstrate additive effects of genes regulating dopamine availability in the prefrontal cortex and striatum on feedback-based sequence learning.

Topic Area: LONG-TERM MEMORY: Skill learning

Neurophysiological Effects of the Presence of an Irrelevant Visual Stimulus on Auditory Neural Activity

Poster C109, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Kristina Backer[1], Andrew S. Kessler[1], Laurel A. Lawyer[1], Lee M. Miller[1], David P. Corina[1]; [1]University of California, Davis

It is well-known that top-down selective attention can modulate brain activity at the level of sensory cortex. However, much less is known about cross-modal interactions that may occur due to exogenous mechanisms of attention. Thus, in this study, we used electroencephalography (EEG) to assess how auditory activity may be affected by the presence of an unrelated, salient visual stimulus. Twenty-five young adult participants passively watched a cartoon, during the presentation of auditory and visual stimuli. The auditory stimuli comprised engineered continuous speech that was designed to elicit both auditory steady-state responses (ASSRs, 41 Hz) and auditory evoked potentials (AEPs). Visual stimuli consisted of two checkered rings that surrounded the cartoon and flickered at a rate of 7.5 or 12 Hz during brief intervals. Sometimes, only the auditory stimulus was present (A-Only); at other times, both the auditory and visual stimuli were concurrent (AV). EEG data were time-locked to voicing onsets in the auditory stimulus, and epochs were separated according to the presence (AV) or absence (A-Only) of the visual flickering. The ASSR was significantly stronger for the AV than A-Only condition. The AEPs showed significant differences between the AV and A-Only conditions, in late sustained responses (~150-450 ms after voicing onset) and in their corresponding topographical patterns. Thus, the presence of a task-irrelevant visual stimulus influenced auditory neural activity, suggesting the contribution of a cross-modal sensory gating mechanism.

Topic Area: PERCEPTION & ACTION: Audition

The Effect of Musicianship and Instrument Type on the Processing of Temporal Features for Speech

Poster C110, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Anne Huntemer-Silveira[1], K.J. Jantzen[1], McNeel G. Jantzen[1]; [1]Western Washington University

Due to the precision required for musical competence, musicians are more sensitive to acoustic features such as onset timing and frequency (Patel, 2011; Levitin, 2006). Musical training may enhance the processing of acoustic information for speech sounds as musicians have a more accurate temporal and tonal representation of auditory stimuli than their non-musician counterparts (Kraus & Chandrasekaran, 2010; Parbery-Clark et al., 2009; Zendel & Alain, 2008). Taken together, this suggests that musical training may enhance the processing of acoustic information for speech sounds. While our previous research did not show a musician advantage for discrimination of temporal cues (Jantzen et al., 2014; Jantzen & Scheurich, 2014) there was a trend suggesting that string musicians had enhanced performance compared to their wind musician counterparts (Davis et. al., 2015). This lack of robust results may have been due to the difficulty of the dichotic paradigm used. Therefore, the current study employed a difference-rating task using pairs of speech stimuli differing in voice onset time along a voiced to voiceless continuum. Subjects rated pairs on a scale from 1 to 7, with 1 being 'no difference' and 7 being 'very different'. Musical training effects and organization of temporal features were reflected in the EEG as observed by location and amplitude of the ERP's. In addition, behavioral results indicate that the pattern of performance on the difference-rating task varied as a function of instrument type and sensitivity to rapidly changing temporal cues that indicate a possible translation of musical cues into functional linguistic cues.

Topic Area: PERCEPTION & ACTION: Audition

Cortical Networks for Intelligible Speech Identified with Reverse Correlation

Poster C111, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Jonathan Venezia[1], Gregory Hickok[2], Virginia Richards[2]; [1]VA Loma Linda Healthcare System, [2]University of California, Irvine

Cortical networks for intelligible speech have been described largely in terms of region-level preferential responses to speech versus non-speech sounds. Here, we present an auditory fMRI paradigm that quantifies the degree to which voxel-wise "speech receptive fields" reflect the acoustic information most important for intelligibility. Our procedure works by filtering spectrotemporal modulations (STMs) from the speech signal at random over many trials and relating the filter patterns to an outcome measure using reverse correlation. In the present fMRI experiment, 10 listeners were presented with STM-filtered sentences and asked to make subjective (yes-no) intelligibility judgments. Behavioral response rate was held constant (50% "yes") using adaptive methods. Voxel-wise single trial response amplitudes were estimated and reverse correlation was used to determine: (a) the STMs that reliably produced "yes" responses (perceptual receptive fields); and (b) the STMs that reliably produced stronger BOLD responses (neural receptive fields). Neural receptive fields were derived independently of perceived intelligibility and were based only on which STMs produced the highest-amplitude single-trial BOLD responses. We then used Mutual Information (MI) to quantify the statistical similarity between neural receptive fields and intelligibility-based perceptual receptive fields. Significant responses were identified using permutation testing ($P < 0.05$). The largest MI responses were observed bilaterally in the transverse temporal sulcus, and in distinct clusters of the posterior, middle, and anterior superior temporal gyrus/sulcus. Weaker but still significant MI responses were observed in the left inferior frontal lobe.

Topic Area: PERCEPTION & ACTION: Audition

Music and the brain: A causal role for the right superior temporal gyrus in expert music ability

Poster C112, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Frank Garcea[1,2], Benjamin Chernoff[1], Bram Diamond[1], Wesley Lewis[1], Samuel Tomlinson[3], Alexander Teghipco[1], Raouf Belkhir[1], Susan Smith[3], Jonathan Stone[3], Elizabeth Marvin[4], Webster Pilcher[3], Bradford Mahon[1,2,3]; [1]Department of Brain and Cognitive Sciences, University of Rochester, USA, [2]Center for Visual Science, University of Rochester, USA, [3]Department of Neurosurgery, University of Rochester Medical Center, USA, [4]Eastman School of Music, University of Rochester, USA

The neural basis of musical ability has been the subject of focused inquiry over several decades, with many studies implicating the right superior temporal gyrus (rSTG) in music perception and production. Because existing neuropsychological evidence involves large lesions, and functional MRI (fMRI), magnetoencephalography, and electroencephalography are inherently correlative measures, there lacks decisive evidence for a causal role of the rSTG in supporting music ability. Here we present case AF, a 26 year-old expert musician who underwent music and language mapping during an awake neurosurgical procedure to remove a low-grade glioma medial and inferior to his rSTG. Preoperatively, AF was cognitively intact and performed at expert levels on standardized music aptitude tests. Three preoperative fMRI experiments identified the rSTG as being involved in i) melody perception and production, ii) repetition of melodies compared to sentence repetition, and iii) perception of melodies compared to perception of a range of environmental sounds. Similar effects were observed in 10 non-musician control patients with left hemisphere tumors. During the surgery, AF's brain was electrically stimulated while he performed a similar task as he did during preoperative fMRI, and the stimulation points were registered to the preoperative fMRI data. When preoperative fMRI "hot-spots" were stimulated, AF presented with "music arrest," but was unaffected in an equivalent sentence

repetition task; multivariate analyses of preoperative fMRI and intraoperative electrocorticography (ECoG) data indicated the highest decoding accuracy for melodies in those same regions of the rSTG. These findings indicate a causal role for the rSTG in music processing.

Topic Area: PERCEPTION & ACTION: Audition

Speech perception and attention in early bilngual adults and children

Poster C113, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Hia Datta[1], Arild Hestvik[2], Valerie Shafer[3]; [1]Communication Sciences and Disorders, Molloy College, [2]Linguistics and Cognitive Sciences, University of Delaware, [3]Speech-Language-Hearing Sciences, The Graduate Center, CUNY

Although it is established that speech perception in a second language is different from the first, the nature of this difference is not completely clear, especially in those who acquire the second language early. We examined English vowel discrimination and attention in 15 Spanish-English early bilingual adults and 15 Spanish-English early bilingual school-aged children compared to their monolingual counterparts, as indexed by the Mismatch Negativity (MMN), Late Negativity (LN) and Processing Negativity (PN). These event-related-potentials were measured while the participants listened to the English short vowel contrast /i/-/e/ in a modified odd-ball paradigm, with and without directed attention. Results indicated no difference in preattentive auditory discrimination of the vowel contrast between the monolingual and bilingual groups as reflected by their comparable MMNs. However, we found that the bilingual adults elicited a larger LN than the monolingual adults indicating a greater sensitivity to reorienting via top-down processing (Čeponienė et al., 2004; Horváth, Roeber, & Schröger, 2009) and a larger PN to all the sounds, suggesting greater overall attention to the sound stream. The bilingual children were, on the other hand, remarkably similar to the monolingual children in all aspects of attention and speech processing, suggesting a certain "bilingual training effect" for attention in speech processing that develops with extensive manipulation of two languages over the lifespan.

Topic Area: PERCEPTION & ACTION: Audition

Differential altered auditory electrocortical responses in young children with and without megalencephaly on the autism spectrum.

Poster C114, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Rosanna De Meo[1,2], Sevan K. Haroontonian[1], Christine Wu Nordahl[2], David G. Amaral[2], Susan M. Rivera[1,2,3], Clifford Saron[1,2]; [1]Center for Mind and Brain, University of California at Davis, Davis, CA, [2]MIND Institute, University of California at Davis School of Medicine, Sacramento, CA, [3]Department of Psychology, University of California at Davis, Davis, CA

Autism spectrum disorder (ASD), characterized by impairments in social communication and repetitive behavior, also includes unusual responses to sensory input as part of its phenotype. The large heterogeneity within ASD is a challenge for understanding its biological basis. This study, part of a larger multi-disciplinary effort to identify autism subphenotypes, investigated the relation between neuroanatomical differences, based on structural MRI, and electrocortical responses to auditory stimuli of increasing loudness in young (26-46 mos.) typically developing (TD) boys and those with ASD. 61-channel ERPs were elicited by randomly interleaved 50, 60, 70, and 80 dB 50-ms tones (ISI 1-2s, ~300 stim/condition). Analyses included data from 33 age-matched boys, of which 22 were diagnosed with ASD (including 11 with, and 11 without, disproportionate megalencephaly) and 11 were TD children. Significant differences in the scalp-surface global power of the electric field evoked by the different intensities were only found in the TD children (130-160 ms and 410-440 ms post-stimulus). Periods of topographical modulations, and by extension, configuration of intracranial generators, were found between the two ASD groups, as well as with the TD group at most intensities. These results suggest graded, loudness dependent, auditory responses only in TD children. While both ASD groups appear to lack these intensity-related modulations, the ASD groups do differ in the configuration of brain generators involved, suggesting an impact of brain morphometry on auditory processing within the ASD group. These data contribute to the effort to delineate ASD subgroups and further characterize physiological mechanisms underlying observable phenotypes.

Topic Area: PERCEPTION & ACTION: Audition

Involvement or irrelevance: Representation of the self vs. other in joint piano performance recorded by dual-EEG

Poster C115, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Madeline Huberth[1], Tysen Dauer[1], Iran Roman[1], Chryssie Nanou[1], Wisam Reid[1], Nick Gang[1], Matthew Wright[1], Takako Fujioka[1]; [1]Stanford University

Music ensembles involve complex social interactions between players in which coordination of actions and monitoring of outcomes are crucial in achieving joint goals. Previous event-related potential (ERP) studies of joint-action tasks have shown that the feedback-related negativity (FRN) is elicited when the outcome of one's own actions, as well as another's actions (oFRN), is different from what is expected. The present study aims to examine if the FRN and oFRN differ depending on the strength of the joint goal in a piano duet task. In particular, we hypothesize that even if the duet players do not produce sound simultaneously, alternating playing would still promote forming a joint goal, thus resulting in feedback processing of the outcomes from both player's parts. Ten pianists were paired to form five pairs and played

short musical pieces during dual-EEG recording face-to-face. No notes were played together, and a note in either player's part was occasionally altered in pitch. Additionally, each pianist played the materials with a computer partner. The FRN was consistently larger than the oFRN, in line with prior studies. The oFRN was also larger when playing with a real human rather than a computer partner. We suggest that FRN/oFRN reflects online monitoring of action outcomes in a musical turn-taking task, which creates a dynamic social context in realtime.

Topic Area: PERCEPTION & ACTION: Audition

A network for auditory-motor coupling: comparison between musicians and nonmusicians

Poster C116, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Shoji Tanaka[1], Eiji Kirino[2,3]; [1]Sophia University, [2]Juntendo University, [3]Shizuoka Hospital

Auditory-motor coupling is critical for musical performance, in which auditory feedback is used to ensure correct or ideal motor output for the performance. Previous studies have demonstrated activation of the operculum while performing or listening to music. The parietal operculum (PO) has functional connections with the auditory and motor areas, suggesting that the PO mediates auditory-motor coupling. We hypothesize that this network also mediates auditory-motor integration for musical performance. If this hypothesis is correct, long-term musical training would change the connectivity of the PO with auditory areas and/or motor areas. To test this hypothesis, we analyzed resting-state functional connectivity of this network in musicians (n = 35) and nonmusicians (n = 35). The ROI-to-ROI functional connectivity analysis showed that, among the Heschl's gyrus (HG), plenum temporal (PT), precentral gyrus (preCG), and postcentral gyrus (postCG), the left PO in musicians had stronger functional connectivity than nonmusicians with all of these regions in the left hemisphere but none of in the right hemisphere ($p < 0.05$, uncorrected). The right PO in musicians had stronger functional connectivity with only the postCG in the right hemisphere but with HG and pre/postCG in the left hemisphere ($p < 0.05$, uncorrected). The direct functional connectivity between HG/PT and pre/postCG did not differ between groups. In contrast to the PO, there were no significant different in any of the connectivity of the central or frontal operculum with the HG, PT, preCG, and postCG. We therefore conclude that musicians have a stronger auditory-motor network connecting through the PO.

Topic Area: PERCEPTION & ACTION: Audition

Distinct prefrontal responses to salient distractors during perception and goal-directed action

Poster C117, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Dan McCarthy[1], Christine Gamble[1], Joo-Hyun Song[1,2]; [1]Department of Cognitive, Linguistic & Psychological Sciences, Brown University, [2]Brown Institute for Brain Science, Brown University

Countless times each day, humans extract detailed information from the world to arrive at decisions and execute appropriate actions. Often, however, we find ourselves susceptible to environmental distractions that can impair this process and have serious consequences. For instance, nearly half a million people are injured or killed due to distracted driving annually in the U.S. alone. Intuitively, one might expect that highly salient distractors cause more disruption than weak ones (e.g., a bright flashing light attracts more attention than when it is dimmed). Indeed, perception-based target selection tasks requiring a keypress response suggest that this is the case. Conversely, however, less salient distractors cause more interference during goal-directed action (Moher, Anderson & Song, 2015). Using fMRI, we found a neural correlate of this salience-driven perception-action dissociation. Specifically, when the target varied across trials, BOLD responses in the right inferior and middle frontal gyri (rIFG/MFG) selectively increase to the presence of a highly salient distractor during action, but show the opposite pattern during perception. In contrast, when the target was predictable and distractors could be more easily ignored, salience-related BOLD changes in the rIFG/MFG were largely absent for both response types. Interestingly, the rIFG/MFG complex has been proposed as a 'circuit breaker' between goal-directed and stimulus-driven attention (Corbetta & Schulman, 2002). Due to the overlap of several regions involved in top-down attention and motor control, we propose that the rIFG/MFG might be selectively modulated to help suppress strong bottom-up distractor signals during goal-directed action, but not perception.

Topic Area: PERCEPTION & ACTION: Other

What do the power and time development of EEG oscillations tell us? Time frequency analysis and event related synchronization in dance experts' perception of music.

Poster C118, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Mari-Anne Rosario[1], Hiroko Nakano[1]; [1]Saint Mary's College of California, Moraga CA USA

We report a spectral analysis of the electroencephalographic (EEG) activity of Argentine Tango dancers with an enthusiasm for tango music and general non-dancers with an enthusiasm for classical and jazz music, to investigate the effect of dance expertise on music listening. EEGs were measured as participants listened to music

from their preferred genre, alternate genres, and silence. Event-related-synchronization (ERS) in the high-alpha and beta bands showed an expertise effect: Dancers showed higher ERS for the preferred condition than alternate. Non-dancers did not show a difference. ERS in high-alpha and beta in Dancers were positively correlated with years of dance experience. Non-dancers did not show a similar correlation. These results suggest that dance experts listen to music differently from non-dance experts, with alpha activity reflecting a greater ease of processing of music structures and beta activity reflecting attentive processes to tempo and rhythm associated with body movements. ERS in the gamma band revealed a preferred music effect, independent of dance experience. Both groups displayed higher ERS in the preferred condition, consistent with theories that gamma reflects the recognition and integration of familiar or meaningful stimuli. Time-frequency analysis (TFA) revealed a preferred music effect, independent of dance experience. In high-alpha, the preferred condition displayed a slower increase than alternate. In beta, the preferred condition increased and alternate decreased. In gamma, the preferred condition displayed a slower decrease than alternate. Both groups displayed similar rates of ERS change, suggesting that dancers are neither faster nor slower than non-dancers in responding to music.

Topic Area: PERCEPTION & ACTION: Other

Functional parcellation of the planum temporale

Poster C119, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Alex Teghipco[1], Prantik Kundu[2,3], Bradley R. Buchsbaum[4], Peter A. Bandettini[5], Gregory Hickok[1]; [1]University of California, Irvine, [2]Icahn School of Medicine at Mt. Sinai, [3]University of Cambridge, [4]University of Toronto, [5]National Institute of Mental Health

The planum temporale (PT) is classically linked to language but has been shown to play a role in a wide range of auditory, speech, and sensorimotor function. Evidence from cytoarchitectonics supports the presence of several subregions within PT and fMRI has demonstrated broad functional-anatomical parcellations along a handful of dimensions including sensory-motor versus spatial processing, speech perception versus production, and spatial versus non-speech auditory processing. Here we use a multivariate approach to functionally parcellate the PT using activation patterns reported in over 10,000 published articles in the Neurosynth database and independently validate the parcellation in a group of 136 participants who performed resting state fMRI. Voxels within a meta-analytically defined functional PT region were clustered based on the likelihood that they coactivated with similar regions of the brain. Clustering was carried out using k-means and an optimal solution was determined, revealing an organization of 9 anatomically segregable clusters. Analysis of cluster similarity on the basis of both resting functional connectivity and coactivation indicated the presence of two supraordinate clusters in PT. Nonparametric tests displayed subtle differences between clusters but highlighted a consistent pattern whereby dorsal clusters of the PT were more connected and coactivated with premotor, motor, and sensorimotor regions. In contrast ventral clusters showed a stronger relationship to the superior and middle temporal gyri, as well as the inferior and superior frontal gyri. These methods shed new light on functional organization within the PT, indicating a constellation of subfields that are broadly organized into dorsal and ventral streams.

Topic Area: PERCEPTION & ACTION: Other

The Influence of Visual Cues on Nonsymbolic Number Comparison and Their Relation to Math Competency

Poster C120, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Eric Wilkey[1], Jordan C. Barone[1], Michele M. M. Mazzocco[2], Stephan E. Vogel[3], Gavin R. Price[1]; [1]Peabody College, Vanderbilt University, [2]Institute of Child Development, University of Minnesota, [3]Institute of Psychology, University of Graz, Austria

Nonsymbolic numerical comparison tasks (whereby a participant judges which of two groups of objects is more numerous) are thought to index the efficiency of the neurocognitive systems supporting the perception of numerical magnitude. Further, behavioral studies show that performance on the task is significantly influenced by the degree of congruency between non-numeric visual parameters, such as surface area and object size, and the number of items. One theory posits that these non-numerical cues require participants to inhibit their visually-based response before making a quantity-based judgment. It is not clear to what extent neural activation patterns during nonsymbolic comparison are influenced by numerical magnitude processing versus inhibition of non-numeric visual cues. In order to investigate this issue, we used functional magnetic resonance imaging (fMRI) to compare the BOLD activation patterns of 38 twelfth-grade students during a nonsymbolic comparison task in which half the trials were size controlled (incongruent) and half were not (congruent). Results indicate that (1) activity in the bilateral superior parietal and anterior cingulate cortex increase parametrically with the difficulty of ratios being compared, (2) the parametric increase differs according to congruency condition in the right intraparietal sulcus (IPS) and inferior frontal gyrus, and (3) ratio-dependent activity correlates to math competency in a third, medial aspect of the right IPS. These results suggest that multiple parietal mechanisms are involved in the comparison of numerical magnitudes that differ according to visual task demands, and further, that a ratio-dependent increase in parietal activity is related math competency.

Topic Area: PERCEPTION & ACTION: Other

pMTG and dlPFC involvement in top-down contextual effects during the perception of other people's actions

Poster C121, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Lucia Amoruso[1], Alessandra Finisguerra[1], Cosimo Urgesi[1,2]; [1]University of Udine, Italy, [2]Scientific Institute (IRCCS) Eugenio Medea

Single-pulse TMS studies suggest that motor activity can be modulated by high-level contextual representations. Specifically, in a series of previous experiments, we observed a facilitation of M1 activity during the observation of actions embedded in congruent contexts and a decrease when these were embedded in incongruent ones. However, direct evidence about the neural areas involved in these modulations is lacking. Here, we used a perturb-and-measure TMS approach, which offers the unique possibility of i) disrupting neural activity in regions of interest using continuous theta burst stimulation, and to ii) measure the consequent functional modulation of M1 activity to observed actions via online spTMS. We administered cTBS over the dorsolateral prefrontal cortex (dlPFC), and the posterior middle temporal gyrus (pMTG). After each "perturb session" participants underwent a "measure session". During the measure session, motor evoked potentials (MEPs) were recorded from hand and arm muscles while participants watched videos of everyday actions embedded in congruent, incongruent or neutral contexts. Video ending was occluded from view and participants had to predict action unfolding. We found that, when interfering with dlPFC activity, both effects were abolished. When disrupting pMTG activity, we observed a facilitation for actions embedded in either congruent or incongruent contexts. Overall, these results suggest that i) the dlPFC might exert a top-down modulation in motor responses by providing contextual information necessary to estimate the probability of a given outcome; and that ii) the pMTG might be involved in a process of semantic retrieval when processing actions embedded in natural contexts.

Topic Area: PERCEPTION & ACTION: Other

Large scale comparison of retinotopic and category selective maps throughout human visual cortex

Poster C122, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Edward Silson[1], Iris Groen[1], Caitlin Van Wicklin[1], Chris Baker[1]; [1]Section on Learning and Plasticity, Laboratory of Brain and Cognition, National Institute of Mental Health, National Institutes of Health

Historically, category-selectivity and retinotopy have been considered as two largely independent organizing principles of human visual cortex, but recent work questions this independence. Here, using functional magnetic resonance imaging (fMRI) we conducted extensive mapping of both retinotopy and category-selectivity in a large group of participants (n=35). Retinotopy was mapped using the population receptive field mapping technique allowing us to define multiple retinotopic maps including V1-V4, LO1, LO2, V3A/B, V7/IPS0. Category-selectivity was mapped by presenting participants with images of bodies, buildings, faces, objects, scenes & scrambled objects, allowing us to define face-, scene- and object-selective regions on both the lateral and ventral surfaces of occipitotemporal cortex. First, across participants we found clear evidence for category-selectivity within early retinotopic visual areas, suggesting that category-level representations can be detected in visual cortex earlier than typically assumed. Second, consistent with our earlier work (Silson et al, 2015, 2016), we found reliable retinotopic representations within category-selective regions, demonstrating a largely preserved representation of visual space within these regions despite contrasting category-selective response profiles. Finally, we compared the patterns of response within category-selective areas and retinotopic maps after matching for visual field coverage. Despite largely equivalent representations of visual space, the patterns of selectivity differed substantially between retinotopic regions and category-selective areas, even for adjacent regions. These different response patterns, despite similar visual field representations, suggest a strong discontinuity in the representation of visual information between more posterior retinotopic and more anterior category-selective regions.

Topic Area: PERCEPTION & ACTION: Vision

Covert simulation of others' actions in real-time

Poster C123, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Julia Hamilton[1], Aleksandra Sherman[1]; [1]Occidental College

Recent research points to the importance of a mirror-neuron system (MNS) in the perception and accurate prediction of action. We sought to test the hypothesis that individuals recruit the MNS during action prediction such that they are covertly simulating other's action in real-time. We measured neural activity using high-density electroencephalograpy, while participants viewed videos of point-light displays (PLDs) depicting upright humans, inverted humans, and animals, followed by an occluder that appeared for either 100ms or 700ms. Participants were then shown a static test posture and tasked with determining whether it was a continuation of the action in the same depth orientation. We varied whether the time between the static test posture and the endpoint of the PLD video corresponded with or did not correspond with the occluder time. Prediction accuracy was significantly higher for upright PLDs, with larger N170s, relative to inverted humans and animals. Interestingly, our neurophysiological data suggests that participants detected differences between corresponding and non-corresponding actions for upright displays, reflected in a larger observer error-related negativity at central sites peaking around 500ms. Additionally, we observed marginally stronger mu-suppression at central sites for corresponding relative to non-corresponding upright displays, indicating involvement of the MNS. Surprisingly, these differences were not reflected behaviorally. Together, our results support the notion that action prediction may be enhanced by one's ability to perform and therefore simulate the observed action. We argue that individuals are indeed covertly simulating others actions, but that this real-time simulation mechanism may be only weakly recruited for PLDs.

Topic Area: PERCEPTION & ACTION: Vision

Perception of size and local/global stimulus features during action preparation: an electrophysiological investigation.

Poster C124, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Xavier Job[1], Jan de Fockert[1], José van Velzen[1]; [1]Goldsmiths, University of London

The classical view that perception and action are functionally distinct processes that serve the selection of stimuli and the programming of actions, respectively, has been challenged in recent years. Behavioural and neuroimaging research has demonstrated that not only can perceptual processing influence motor programming, but the inverse is also possible. Effects suggest that the planning of actions influences early visual processing, such that perceptual features relevant for an upcoming action are facilitated. Here, visual processing of object size and local/global features of compound stimuli during the preparation of power and precision grasping actions is investigated in 16 healthy adults. Participants prepared power or precision grasps before presentation of a large or small task-irrelevant visual probe. Following the probe participants identified a target presented at either the local or global level of a compound stimulus with the prepared grasp. Grasp preparation biased early visual event-related potentials (ERPs) elicited by the probes. Furthermore a behavioural effect of probe size on local/global target detection was modulated by grasp, such that large (vs. small) probes only facilitated global (vs. local) processing during power (vs. precision) grasp preparation. The results extend recent evidence for influences of motor programming on visual processing and provide support for the tight coupling of action and perception.

Topic Area: PERCEPTION & ACTION: Vision

Native language facilitates conscious visual perception

Poster C125, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Martin Maier[1,2], Rasha Abdel Rahman[1,2]; [1]Humboldt-Universität zu Berlin, [2]Berlin School of Mind and Brain

The study of how language influences color perception has been one of the most striking examples of linguistic relativity. Language-specific color categories can influence basic perceptual processes such as visual discrimination. Yet, very little is known about the relationship between language and visual awareness: can language structures influence not only how, but also but if we perceive visual stimuli in the first place? Native-speakers of Greek, who place light and dark shades of blue into different verbal categories, detected more stimuli that contained this color contrast in an Attentional Blink paradigm compared to green tones that contained no linguistic contrast. Crucially, this behavioral advantage was predicted by early electrophysiological brain activity starting around 100 ms after stimulus onset. Language-specific electrophysiological activity resurged in a later time window (220–300 ms) that proved critical for the transition of targets into visual awareness. This pattern was not observed in German controls, who do not distinguish verbally between the “Greek” blues. We argue that linguistic color-categories enhanced the contrast between shades of blue selectively in Greek participants, providing blue targets with a head start in the competition for visual awareness. These results demonstrate that our native language is one of the forces that determine access of visual stimuli to awareness.

Topic Area: PERCEPTION & ACTION: Vision

Differences in activation patterns connected to the level of arousal evoked by watching dynamic stimuli – fMRI study results

Poster C126, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Pamela Sobczak[1], Maria Bierzynska[2], Anna Kozak[3], Maksymilian Bielecki[4], Keerthana Karunkaran[5], Bharat Biswal[6], Jan Strelau[7], Małgorzata Kossut[8]; [1]Department of Psychology, SWPS University of Social Sciences and Humanities, Warsaw, Poland, [2]Laboratory of Neuroplasticity, Department of Molecular and Cellular Neurobiology, Nencki Institute of Experimental Biology, Warsaw, Poland, [3]Laboratory of Neuroplasticity, Department of Molecular and Cellular Neurobiology, Nencki Institute of Experimental Biology, Warsaw, Poland, [4]Department of Psychology, SWPS University of Social Sciences and Humanities, Warsaw, Poland, [5]Department of Biomedical Engineering, New Jersey Institute of Technology, Newark, NJ, USA, [6]Department of Biomedical Engineering, New Jersey Institute of Technology, Newark, NJ, USA, [7]Department of Psychology, SWPS University of Social Sciences and Humanities, Warsaw, Poland, [8]Laboratory of Neuroplasticity, Department of Molecular and Cellular Neurobiology, Nencki Institute of Experimental Biology, Warsaw, Poland

Using movies as a scientific tool in experimental procedures gives a unique opportunity to trigger strong physiological arousal and activate wide neural networks. Movies affect the perception of naturalistic stimuli which enable participants to understand situation from broader perspective and find themselves in so-called “real-life” situation. Here we present a new collection of 18 short movie clips, divided into three categories, which present sports with different value of arousal (extreme vs. neutral sports) and neutral scenes - The Arousing Movie Database. The database has been used in fMRI experiment which was carried out in order to observe differences in brain activity patterns during viewing stimuli differentiated in terms of arousal value. The main effects of movie categories were observed. All results were corrected to family-wise error (FWE) at cluster level ($p<.05$). Our results revealed significant differences between all movie categories in regions associated with visual and motion processing: primary visual cortex, visual temporal area, lingual gyrus, cuneus. High arousing stimuli also produced activations associated with emotion regulation processing: middle frontal gyrus, posterior and anterior cingulate cortex. Moreover, high arousing movies in comparison to low and neutral movies reveal increased activation in inferior and superior parietal lobule, Extrastriate Body Area (EBA) and Fusiform Body Area (FBA), likely in response to visual body perception, motion and action perception and emotional arousal caused by dynamic body motion presented in films depicting high-risk sports.

Topic Area: PERCEPTION & ACTION: Vision

Making sense of objects lying about: How contextual objects shape brain activity during action observation

Poster C127, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Nadiya El-Sourani[1,2], Ima Trempler[1,4], Moritz F. Wurm[3], Gereon R. Fink[2,4], Ricarda I. Schubotz[1,2]; [1]University of Münster, Germany, [2]University Hospital Cologe, Germany, [3]University of Trento, Rovereto TN, Italy, [4]Research Centre Jülich, Germany

It is essential to normal life that we understand what others are doing. Recent findings suggest that action observers consider multiple sources of information in order to integrate them to a coherent scenario. Building on these insights, the current fMRI study is concerned with contextual objects (COs) present during everyday actions. COs are part of a particular scene yet not integrated in the action itself. To investigate whether COs are processed during action observation, 21 subjects watched action videos that either contained a CO or not. To further investigate the impact of the COs on action recognition we modulated two factors: the semantic relationship of the COs to the observed action (Goal Affinity) as well as their spatial relation to it (Location Ergonomics). We found increased activation in the Action Observation Network (AON) for actions containing a CO compared to those which did not. The same network was enhanced by high compared to low Goal Affinity COs, in addition to both middle frontal gyri. Moreover, an interaction contrast revealed high vs. low Goal Affinity to have an additional effect on left ventral premotor and inferior frontal areas, when COs were presented closer to the action. The results suggest that COs have an impact on the processing of observed actions. In particular, if the CO would be easy to integrate in the action in terms of both its semantic relatedness and reachability, the brain seeks to integrate the CO in terms of an overarching action goal.

Topic Area: PERCEPTION & ACTION: Vision

fMRI investigation of part-whole contingencies using 2-D shapes: A partial least squares analysis

Poster C128, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Padmapriya Muralidharan[1], Anthony Cate[1]; [1]Virginia Polytechnic Institute and State University

Proposed frameworks of inferior temporal activity modulation by the basal ganglia in the occurrence of complex visual hallucinations (Middleton & Strick, 1996) as well as evidence for lateralized effects of the parietal-basal ganglia circuit in shape-related object recognition tasks (Schenden et al., 2009) indicate the presence of intricate neural networks crucial for higher-order visual perception. An fMRI investigation of connectivity of part-whole contingencies necessary for shape discrimination was conducted with healthy participants (N=17). The task involved presentation of 2D shapes composed of varying local contour features. Each of the three stimulus blocks consisted of unique parts forming distinct shapes. Presentations were made further distinctive with varying rates and order of repetitions. Hence, distinct block design conditions with different subsets of these shapes permitted a partial least squares analysis in the whole brain with a view to examine effects of part/object variation, repetition and distinctiveness. Patterns of connectivity in occiptotemporal networks consistent with previous literature about increased salience of local and global features emerged. Furthermore, connectivity with basal ganglia structures (caudate tail and substantia nigra) further corroborate the involvement of more anterior cortical and sub-cortical regions in part-whole interactions related to visual shape perception.

Topic Area: PERCEPTION & ACTION: Vision

Communicability of cerebral activities: shaping similar percepts across individuals

Poster C129, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Shahin Tavakol; [1]

We assume that how we perceive the world is similar across individuals, which could be true if our cerebral activities somehow affected those of others and vice-versa. Looking for such brain-to-brain influences, we performed two experiments in which we recorded the event-related potentials (ERPs) of two types of participant duos (e.g., partner-partner and stranger-stranger). The two participants performed an image memorization task side by side in front of the same computer screen without being able to see the image that was simultaneously presented to the other person. Across the four stimulus blocs used, the sameness of the two images, as well as the participants' belief in this sameness, were manipulated. Thus, their beliefs were either consistent or inconsistent with reality. ERPs were more positive within the N400 and the late posterior positivity (LPP) time windows for inconsistent trials as compared to consistent ones. These effects were observed in pairs of partners only and not in strangers. In an ongoing study, we are currently isolating each participant, visually and acoustically, to make sure that the ERP differences are not caused by some detection of subliminal cues (e.g., postural reactions & breathing variations). This time, we are using a single bloc in which both participants believe they are seeing the same image simultaneously, which is, again, either consistent or inconsistent with reality. Thus far, our pilot results replicate the aforementioned ERP effects. As participants cannot see nor hear each other, our data strongly point to covert brain-to-brain influences between pairs of partners.

Topic Area: PERCEPTION & ACTION: Vision

The effect of border-ownership on perception of three dimensional object

Poster C130, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Tomonori Ishizaki[1], Masayuki Kikuchi[1]; [1]Tokyo University of Technology

When we see a scene including objects, figure/ground separation occurs as the function of early and middle stages of the hierarchical visual information processing in the brain.The boundaries separating two adjacent retinal regions is attributed to only one side of them, namely figure region.The property is called as Border-Ownership (BO).Previous studies showed that BO affects the pattern recognition for 2D image.However, such a finding was obtained by the experiments using only 2D stimuli.This study performed psychophysical experiment addressing whether similar effect can be observed or not for 3D objects represented by random dots stereogram.The shapes of stimuli were hemispheres which have convex/concave sections created by adding several Gaussian-shaped local 3D patches whose positions and heights were randomly determined.Subjects were asked to perform matching task which required to choice one of the two object in the test stimuli having the same shape as the sample stimulus.When polarities of BO were the same between sample and test stimuli, correct rate was 88.0%.Meanwhile, when polarities of BO were different between sample and test stimuli, correct rate was 84.9%.Two-way ANOVA for repeated measurement showed that the former correct rate is significantly higher than the latter one($p<.05$).Therefore, factors of BO in 3D space had significant effect for pattern recognition.This result suggests that 3D surface, which was formed as a border of the 3D region, has BO characteristic similar to 2D situation.

Topic Area: PERCEPTION & ACTION: Vision

Scenes shape the neural representation of objects

Poster C131, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Talia Brandman[1], Marius Peelen[1]; [1]University of Trento

Scene context strongly shapes our perception of objects in everyday life, such as when we make out the shape of a distant boat on the water. However, until now, vision neuroscience has largely focused on the dissociation between scene- and object-selective neural pathways, leaving their interaction largely unexplored. Here we used a novel approach in behavioral, fMRI and MEG studies to reveal how scene and object neural processing pathways interact to support context-based perception. Participants viewed degraded objects that were hard to recognize when presented in isolation but easy to recognize within scene context. fMRI results showed that the multivariate representation of the objects' category (animate/inanimate) in object-selective cortex was strongly enhanced by the presence of scene context, even though the scenes alone did not evoke category-selective response patterns. This effect was modulated by concurrent activity in the scene-selective retrosplenial complex. MEG results revealed that scene-based facilitation of category decoding peaked at 320 ms after stimulus onset. Altogether, these results characterize functional interactions between scene- and object-processing pathways, showing that expectations derived from scene context, processed in scene-selective cortex, feed back to shape object representations in visual cortex. Thereby, our findings demonstrate the inferential nature of perception as applied to the visual processing of objects in real-world scenes.

Topic Area: PERCEPTION & ACTION: Vision

Ocular measures provide mechanistic insights into the malleability of reasoning skills

Poster C132, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Belen Guerra-Carrillo[1], Maria Eckstein[1], Pooya Ganjali[1], Silvia A. Bunge[1]; [1]University of California at Berkeley

What are the cognitive mechanisms underlying plasticity in reasoning skills? Our lab has previously shown that intensive preparation for the Law School Admission Test (LSAT) led to improved performance and reduced prefrontal activation during performance of an unpracticed transitive inference test, as well as changes in brain structure and functional connectivity (Mackey et al., 2012-2015). This research leaves open the question of whether practicing reasoning led students to adopt a new problem-solving strategy, or makes them more efficient at identifying and/or integrating relevant information. To gain mechanistic insights, we collected eye gaze and pupillometry data on reasoning tasks before and after students (current N=36) prepared for one of two sections of the LSAT: the Logic Games section, which heavily taxes relational reasoning, and Reading Comprehension, which taxes the ability to quickly identify and answer questions about relevant information in texts. Participants in both groups improved similarly on transitive inference and test of inductive reasoning, but exhibited different underlying mechanisms of change. Reading Comprehension participants exhibited a shorter latency to the first fixation on the relevant relations, interpreted as more efficient identification of relevant relations. By contrast, Logic Games participants exhibited fewer saccades between relational terms during the transitive inference task and had patterns of pupillary response that reflect temporal changes in participants' rule induction, which we interpret as more efficient integration across relations and rules. These preliminary results highlight the utility of eyetracking for gaining insights into the cognitive processes supporting learning.

Topic Area: THINKING: Reasoning

Cognitive models of realistic belief updating

Poster C133, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Nikki Marinsek[1], Michael B. Miller[1]; [1]University of California, Santa Barbara

In order to gain a better understanding of how individuals integrate real-world knowledge and incoming evidence to update their beliefs, we created a belief-updating task that draws on participants' background semantic knowledge and compared participants' belief updates to the predictions of different cognitive models. In the task, participants were instructed to guess which one of two US states was selected based on the ethnicities of randomly selected residents in that state. As residents' ethnicities were revealed one at a time, participants used a sliding scale to indicate which state they believed was selected. After the task, participants estimated the percentage of White, Hispanic, Black, Asian, and Native American residents in each state and these estimates were incorporated into the cognitive models. Since participants relied on their background knowledge rather than explicit or artificial probabilities, we could develop cognitive models that account for realistic belief updating. We compared two types of models: a standard Bayesian model of belief updating and a state space model in which participants' beliefs were represented as trajectories though a state space of possible hypotheses. Although both models captured some of the variance in participants' beliefs (bayesian model: $R2=0.12$, $p<0.001$, state space model: $R2=0.13$, $p<0.001$), they both failed to account for the tremendous amount of individual differences in participants' belief updating behaviors. K-means clustering of participants' belief trajectories revealed that participants could be divided into subgroups with qualitatively different belief-updating behaviors, suggesting that multiple cognitive models may be needed to account for individuals' diverse belief updating strategies.

Topic Area: THINKING: Reasoning

Neural networks of logical reasoning and the influence of belief system

Poster C134, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Mohammadreza Bonyadi[1], Maryam Ziaei[1], David C. Reutens[1]; [1]Centre for Advanced Imaging, the University of Queensland, St. Lucia, Brisbane, Australia

Prior knowledge and beliefs influence our daily reasoning and may lead to drawing unwarranted conclusions and undesirable outcomes. Syllogistic arguments present a type of logical reasoning problems in which the decision maker is asked to determine whether a given conclusion follows a set of given assumptions (premises). While some studies have argued that the believability content of conclusion affects the way people reason, others support the importance of the believability of premises in the final decision. No experimental work to date, however, has investigated how believability of the premise may influence the reasoning. The primary aim of this study is thus to examine the underlying neural correlates involved in interaction between belief and logical systems in syllogistic reasoning. Thirty younger adults (18-25 years old) participated in an fMRI study and responded to a series of syllogistic arguments while the believability of the premises and conclusions was manipulated. Behaviourally, we found that people were faster and more accurate to respond to believable conclusions relative to unbelievable ones. Our fMRI data showed that regions such as inferior frontal gyrus, dorsal anterior cingulate, and parietal lobe were involved when believability of the conclusions and premises contradicts with each other. In other words, more cognitive effort was needed to ascertain logical validity of the statements when the conclusions' content was incongruent with the premises'. This study is the first to demonstrate the underlying neural correlates of the belief system during both premise and conclusion stages in a syllogistic reasoning task.

Topic Area: THINKING: Reasoning

Intelligence and modular brain networks: The TPJ's involvement in inter-modular communication is associated with general intelligence

Poster C135, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Kirsten Hilger[1,2], Matthias Ekman[3], Christian Fiebach[1,2], Ulrike Basten[1]; [1]Goethe University Frankfurt, Frankfurt am Main, Germany, [2]IDeA Center for Individual Development and Adaptive Education, Frankfurt am Main, Germany, [3]Donders Institute for Brain, Cognition, and Behaviour, Radboud University Nijmegen, The Netherlands

Individual differences in general intelligence have been linked to function, structure, and interaction of frontal and parietal brain regions (Jung & Haier, 2007; Basten et al., 2015). Recently, graph-theoretical analyses have been used to identify features of brain network topology associated with intelligence. Here, we investigate the role of the modularity structure of functional brain networks for intelligence, by examining inter- and intra-module communication in a large and representative sample of N = 309 adults (18-60 years; Nooner et al., 2012). Based on fMRI resting-state data, functional networks were modeled as graphs over a range of different sparsity thresholds. The network modularity structure was investigated with global graph metrics of modularity and two node-specific metrics of inter-module connectivity (participation coefficient) and intra-module connectivity (within-module degree centrality), respectively. Global modularity was not significantly associated with intelligence (Wechsler Abbreviated Scales of Intelligence). For participation coefficient and intelligence, we observed a positive association in the anterior insula (AI) and a negative association in the temporo-parietal junction area (TPJ). For within-module degree centrality, we observed opposite associations with intelligence in both regions, i.e., negative in AI and positive in TPJ. For left TPJ, these results could be replicated in an independent sample (N = 114). Given the TPJ's central role in bottom-up attention, we speculate that less functional connections between the TPJ and brain regions in other network modules reflect facilitated shielding of cognitive processing against irrelevant information in people with higher intelligence.

Topic Area: THINKING: Reasoning

Neural representations of numerosity support the acquisition of counting in preschool children

Poster C136, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Alyssa Kersey[1], Jessica Cantlon[1]; [1]University of Rochester

Prior to formal schooling, children's numerical reasoning undergoes a fundamental change that allows them to map numerical symbols (e.g., number words) onto their quantitative meanings. There are no neural data examining counting acquisition in human children. Some behavioral work suggests that the evolutionarily-primitive approximate number system may play a role in the acquisition of numerical symbols, but behavioral work testing for a relation between indices of the approximate number system and number word acquisition has been inconclusive. In the current study we used functional magnetic resonance imaging (fMRI) to identify evolutionarily-primitive numerosity processing regions in adults and 3- to 5-year-old children during a numerosity comparison task. A contrast of difficult versus easy numerosity ratio revealed bilateral intraparietal sulcus (IPS), bilateral inferior frontal cortex, and anterior cingulate cortex (ACC). To identify whether those regions are also involved in the acquisition of verbal counting in these children, we measured changes in BOLD signal while those same participants listened to the verbal count sequence and the alphabet. The same IPS regions recruited for numerosity processing showed preferential activation for counting sequences compared to alphabet sequences in these children. This is the first neural evidence that evolutionarily-primitive numerosity processing regions of the brain are functionally related to the acquisition of verbal counting over child development. Additional analyses will explore the relation between counting ability and neural maturity.

Topic Area: THINKING: Reasoning

Activation of Paired Associates Predicts Cue Revaluation in Causal Learning

Poster C137, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Sean O'Bryan[1], Evan Livesey[2], Tyler Davis[1]; [1]Texas Tech University, [2]University of Sydney

Instances of retrospective revaluation in human causal learning suggest that the predictive ratings of unpresented stimuli may be updated via associative retrieval (AR). In this experiment, we tested the predictions of the AR hypothesis using fMRI and a multi-stage allergy prediction task that encourages cue revaluation. Participants were first trained to predict whether an allergic reaction would occur in a hypothetical patient exposed to different animal-food stimulus pairs (e.g., Cat + Strawberry = Allergic Reaction). In a second learning stage, animals and foods from the initial stage were presented individually, with outcomes that either agreed or conflicted with previous learning (Strawberry = No Reaction). Revaluation was then assessed during a test phase where participants rated the likelihood of a reaction to the unpresented but associated stimuli from phase two (Cat). To measure the reactivation of associated cues, independent localizer scans were collected to distinguish between multi-voxel patterns associated with each object class. We found substantial individual differences in behavior, with half of participants showing classic revaluation effects. Consistent with the AR hypothesis, neural similarity to the unpresent, associated feature class during phase two was predictive of the degree to which participants modified their causal ratings at test. These results are the first to provide direct neural evidence for the long-held theory that associative memory retrieval is responsible for retrospective revaluation.

Topic Area: THINKING: Reasoning

Does the brain have a domain-general mechanism for representing mental models?

Poster C138, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Katherine L. Alfred[1], Andrew C. Connolly[1], Joshua S. Cetron[1], David J. M. Kraemer[1]; [1]Dartmouth College

Research on deductive reasoning has highlighted the usefulness of constructing mental models to represent knowledge about the world. Neuroimaging research has indicated the specific involvement of superior parietal cortex (SPC) during tasks that require deductive reasoning with mental models. These results are consistent with the notion of a domain-general deductive reasoning mechanism that relies on spatial computations in parietal cortex. However, this research has left open at least two key questions: 1) Does SPC activity reflect the mental model or deductive reasoning (or both)?, and 2) Is this parietal reasoning mechanism domain-general? A previous study from our lab used multivariate representational similarity analysis (RSA) to reveal the structure of neural patterns of activity in SPC with respect to a newly-learned mental model generated through linear syllogistic reasoning. These results indicated that RSA can be used to examine the structure of a newly-learned representational space and that SPC supports the representation of a mental model even outside of an explicit reasoning task. However, the content in this previous study, as in most deductive reasoning studies, was visuospatial in nature. Here we replicate and extend these findings using a task in which participants generate three distinct mental models (linear hierarchies) through a transitive reasoning task. The relationships within the three models range from being expressly visuospatial to entirely abstract. Whereas univariate fMRI results reveal that models generated from all three tasks elicit activity in SPC, RSA reveals more fine-grained similarities and differences in the neural representations of the models across different domains.

Topic Area: THINKING: Reasoning

The Role of the Prefrontal Cortex in Inductive Reasoning: An fNIRS Study

Poster C139, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Layla Unger[1], Jaeah Kim[1], Theodore J. Huppert[2], Julia Badger[3], Anna V. Fisher[1]; [1]Carnegie Mellon University, [2]University of Pittsburgh, [3]University of Oxford

This study examined neural activity associated with inductive inference using functional Near Infrared Spectroscopy (fNIRS). Induction is a powerful way of generating new knowledge by generalizing known information to novel items or contexts. Two key bases for identifying targets for induction are perceptual similarity, and rules that specify category-relevant features. Similarity- and rule-based induction have been argued to represent distinct mechanisms, such that only rule-based induction requires executive function processes associated with the prefrontal cortex (PFC), namely: active maintenance of representations and inhibition of salient but irrelevant features. Here, we address the lack of direct empirical evidence supporting this possibility by recording PFC activity using fNIRS while adult participants (n=24) performed an inductive inference task. We found that PFC activity during induction was greater when participants had been taught a category-inclusion rule versus when participants could only rely on overall similarity. These results provide evidence that rule- and similarity-based induction represent qualitatively distinct processes. Specifically, rule-based induction may uniquely require executive functions associated with PFC such as the active maintenance of rules in memory, and/or inhibition of rule-irrelevant input.

Topic Area: THINKING: Reasoning

Overlapping neural representations of magnitude support understanding nonsymbolic and symbolic fractions

Poster C140, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

John Binzak[1], Elizabeth Toomarian[1], Edward Hubbard[1]; [1]University of Wisconsin - Madison

A fundamental question in numerical cognition is how we retrieve the meaning of number symbols-the “symbol grounding problem”. To address the symbol grounding problem for fractions, we have recently argued that the brain contains a ratio processing system (RPS) adapted to perceiving nonsymbolic ratios (e.g. the ratio of two line lengths; Lewis, Matthews & Hubbard, 2015), and that the RPS provides an underappreciated neurocognitive startup tool upon which the meaning of symbolic fractions (e.g. ¾) can be built. Although previous studies have demonstrated that the intraparietal sulcus (IPS) and prefrontal cortex (PFC) are involved in processing nonsymbolic ratios and symbolic fractions, no experiment has directly compared activation for these two classes of stimuli in the same participants. We tested the hypothesis that processing of symbolic fractions builds on the RPS by having adults compare the magnitudes of two fractions in three conditions: pairs of symbolic fractions, line ratios, or mixed line-fraction. Distance effects were observed in all three conditions; participants were faster and more accurate as the numerical distance between pairs increased. Additionally, participants were faster and more accurate to compare line ratios than either condition containing symbolic fractions. Critically, activation of the bilateral IPS overlapped for all three conditions, with fMRI activation closely paralleling RT distance effects. We found greater activation when numerical distances were small compared to when they were close. These results suggest that the processing of symbolic fractions and nonsymbolic ratios rely on similar neural regions sensitive to ratio magnitudes, consistent with the RPS account.

Topic Area: THINKING: Reasoning

Training Spatial Thinking in the High School Classroom Impacts Cognitive and Neural Correlates of Verbal Relational Reasoning

Poster C141, Sunday, March 26, 5:00 – 7:00 pm, Pacific Concourse

Emily Peterson[1,2], Robert Kolvoord[1], David Kraemer[3], Adam Weinberger[2], David Uttal[4], Dan Goldman[2], Adam Green[2]; [1]James Madison University, [2]Georgetown University, [3]Dartmouth College, [4]Northwestern University

Mental modeling (i.e., using spatial cognitive resources to represent the relations between pieces of information) has been implicated as a thinking tool that supports relational reasoning. Mental models are hypothesized to support reasoning not only when relations are explicitly spatial (e.g., to the left of), but also for non-spatial relations (e.g., smarter than). The present study examined whether students who learn spatial thinking skills within a year-long high school course show improved performance and increased deployment of spatial brain resources during relational reasoning with spatial and non-spatial content. Participants (Ntotal=200, NMRI=34) completed a deductive relational reasoning task (linear syllogisms) in which they determined the validity of a conclusion based on a series of premise statements. Spatial ability was measured in fMRI and non-scanning cohorts using a Mental Rotation Task and an Embedded Figures Task before and after the school year. Analyses indicated that individual differences in spatial abilities predicted performance on spatial as well as non-spatial relational reasoning, even when controlling for general academic ability. Critically, relative to matched controls, students who received spatial education demonstrated greater change in recruitment of posterior parietal cortex, a brain region widely implicated in spatial thinking. Findings provide support for the mental models theory of relational reasoning, and suggest that individual differences in spatial ability are important for reasoning, even when reasoning involves non-spatial relations presented in a verbal modality. Moreover, results suggest that the benefits of training spatial thinking through classroom-based interventions may impact students’ ability to use mental models during relational reasoning.

Topic Area: THINKING: Reasoning

Large-scale network fMRI connectivity increases caused by autobiographical memory retrieval

Poster D1, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Kristen Warren[1], Sungshin Kim[1], Molly Hermiller[1], Aneesha Nilakantan[1], Jon O'Neil[1], Robert Palumbo[1], Joel Voss[1]; [1]Northwestern University

The Default Mode Network (DMN) can be reliably identified via resting-state fMRI and is thought to reflect self-generated memory retrieval. Indeed, the DMN significantly overlaps with regions involved in autobiographical memory retrieval (ABM), suggesting it supports the self-referential memory retrieval that occurs as subjects daydream during fMRI rest periods. However, there have been few direct comparisons between DMN and ABM networks within the same subjects and with similar fMRI parameters. Here we aimed to characterize fMRI connectivity differences between resting-state and ABM retrieval using a novel ABM task involving long periods of directed retrieval intended to mimic retrieval that would normally occur during resting-state fMRI. Whole-brain, global-connectedness analysis of data from 22 subjects was used to identify regions with significantly different global connectedness levels for resting-state versus ABM. This analysis identified a set of regions, including much of the DMN, with increased connectedness during the novel ABM task versus during resting state. These global connectedness differences were driven by a large, distributed network, involving DMN and ABM regions as well as a variety of others. All regions demonstrated higher fMRI connectivity during the ABM task than during rest. These results suggest that although the DMN is engaged during rest, it is far more robustly engaged during directed autobiographical retrieval, even when the ABM task is designed to mimic the daydreaming that would occur during resting-state. Further, ABM recruits large-scale distributed networks. Relevance to understanding the nature of the memory retrieval that occurs during the resting state will be discussed.

Topic Area: LONG-TERM MEMORY: Other

Structural and functional evidence for thalamic nucleus reuniens in the human brain

Poster D2, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Zachariah Reagh[1], Aaron Mattfeld[2], Timothy Allen[2], Maria Montchal[1], Michael Yassa[1]; [1]University of California, Irvine, [2]Florida International University

Recently, memory researchers have taken great interest in interactions among the hippocampus (HC) and association areas of the neocortex. A major area of interest is the relationship between HC and medial prefrontal cortex (mPFC). One hypothesis states that mPFC organizes HC-dependent memories into conceptual frameworks. Another hypothesis states that mPFC aids in directed recall by selecting 'appropriate' HC-dependent memories in a given context. There are a few distinct anatomical routes from mPFC to HC, most prominently through thalamic nucleus reuniens (NR). Recent studies in rodents have found that NR is crucial for HC-mPFC interactions, as well as aspects of memory and navigation. However, NR and its role in cognition remain unexplored in humans. Here, we present diffusion-weighted MRI data defining human NR, as well as resting state and task functional MRI data consistent with its functional role. First, a region corresponding to NR was derived from anatomical connectivity between HC and mPFC via diffusion-weighted imaging (Human Connectome Project data). Second, applying this NR mask as a seed in resting state functional connectivity analyses revealed robust correlations with mPFC and HC across ~1000 individuals (Human Connectome Project), another set of 17 individuals (experimenter-collected), and 88 scans of the same individual (MyConnectome). Finally, in an experimenter-collected dataset of 17 individuals performing a memory task, we found evidence for NR mediating correlations between mPFC and HC. Together, these findings convey strong evidence for NR in the human brain, which may be critical to network interactions between mPFC and HC and memory-guided behavior.

Topic Area: LONG-TERM MEMORY: Other

Is this my rubber ducky? Does sleep benefit memory specificity or memory generalization?

Poster D3, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Sarah Witkowski[1], Leonardo E. Dionisio[1], Jessica D. Creery[1], Ken A. Paller[1]; [1]Northwestern University

During sleep, memories can be strengthened through replay. Whereas replay may generally be engaged spontaneously, it can also be directed using sounds associated with learning. This process of cueing memories during sleep is called targeted memory reactivation (TMR). Sleep may be useful not only for strengthening memories during replay but also for an abstraction process whereby specific memories come to support generalized schemas or gist. In this study, we investigated the extent to which memory replay during sleep has consequences for whether memories retain details or become generalized, using a paradigm that puts these two forces into opposition. Participants learned the locations of 64 objects on a grid. Each object was associated with a semantically related sound. After a pre-nap test of this spatial knowledge, participants took a 90-minute nap during sounds were presented softly during slow-wave sleep (32 sounds presented at least once, mean 3.5 times). Upon waking, participants were given a surprise memory test in which they endorsed each of 96 displayed objects as either old (seen before), similar (same category as one seen before), or new. Afterwards, they re-took the spatial memory test with all old objects. Initial analyses focused on results from participants who achieved high levels of learning prior to sleep. TMR produced a relative benefit for spatial recall accuracy, whereas generalization, as indexed by mistaking similar objects for old objects, was not increased by TMR. Results thus supported the idea that reactivation during sleep in these circumstances enhanced specific memories, but didn't affect generalization.

Topic Area: LONG-TERM MEMORY: Other

Prevalence of mild cognitive impairment and dementia in a population of adults over 60 years old in El Salvador

Poster D4, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Jonathan V. Hernández[1]; [1]Universidad de El Salvador

Mild Cognitive Impairment and Dementia are forgotten morbidities in public health systems of developing countries, which generate large economic costs and also shortening the quality of life of individuals who have them. The prevalence of mild cognitive impairment and dementia remain unclear in the Salvadoran population Therefore, this study determined the prevalence of mild cognitive impairment and dementia in a population of adults over 60 years old in El Salvador. A transversal descriptive two phases study was conducted. In the first phase, four screening test were applied to 117 subjects. In the second one 60 patients with abnormal screening tests were evaluate by psychiatrist to confirm or rule out the diagnosis of mild cognitive impairment or dementia. The data obtained were analyzed by descriptive and inferential statistical methods and prevalence of both morbidities, demographic profile and other morbidities present were established . It was found that 54.7% of the total population obtained an abnormal screening tests. The prevalence of mild cognitive impairment was set at 17.09% and 10.25% for dementia. The prevalence of dementia projected by the Alzheimer Disease International for Latin America for 2015 was 8.4% of those over 60 years old. There were no statistically significant differences between the results of the screening test. In this study the prevalence of mild cognitive impairment and dementia were higher than those projected in other studies for the Latin American region. More multicentric studies are needed to confirm the findings

Topic Area: LONG-TERM MEMORY: Other

Chronic Treatment with Bean Phosphatidyl-Serine Ameliorates Learning and Memory in TMT-induced Cognitive Deficit rats

Poster D5, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Minsook Ye[1], dae-hyun hahm[1], hye-jung lee[1], insop shim[1]; [1]kyung hee university

Background: Phosphatidylserine (PS) is a member of the membrane phospholipids which is vital to the brain cells. The present study investigated the effects of bean phosphatidylserine (Bean-PS) on the learning and memory function and the neural activity in rats with trimethyltin (TMT)-induced memory deficits. Methods: The rats were treated saline or bean derived bean-PS (Bean-PS, 50mgkg-1, p.o.) daily for 21 days following single injection of TMT (8.0 mg/kg, i.p.). The cognitive function of Bean-PS on the amnesic rats was assessed using the Morris water maze test. The levels of acetylcholine trasferase (ChAT) and acetylcholinesterase (AcheE) in the hippocampus were evaluated by using immunohistochemistry. Results: The rats with TMT injection showed impairments of learning and memory in the Morris water maze test and reduction of ChAT and AcheE immunereactivity in the hippocampus. Bean-PS produced significant improvement in escape latency of acquisition as well as retention tests of the maze. Treatment with Bean-PS reduced the loss of ChAT-ir neurons in the hippocampus compared to that of the control group, consistent with the behavioral data. Conclusion: These results demonstrate that Bean-PS could be a promising treatment for neurodegenerative disorders such as Alzheimer disease via regulation of cholinergic marker enzyme activity and neural activity. Key words: Trimethyltin (TMT), Choline acetyltransferase (ChAT), Bean phosphatidylserine (Bean-PS), Morris water maze (MWM)

Topic Area: LONG-TERM MEMORY: Other

Functional and structural characteristics of attentional networks predict attention and consciousness interactions

Poster D6, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Ana B. Chica[1], Michel Thiebaut de Schotten[2], Paolo Bartolomeo[2], Pedro M. Paz-Alonso[3]; [1]University of Granada, [2]CNRS U7225, Inserm U1127, [3]BCBL, Basque Center on Cognition, Brain and Language

Attention is considered a necessary pre-requisite of conscious perception. Phasic alerting and exogenous spatial orienting improve conscious perception of near-threshold information, through fronto-striatal and fronto-parietal brain networks. In the present work, we combined data from fMRI and diffusion-weighted imaging (DWI) tractography, to explore the influence of long-range white matter tracts (Superior Longitudinal Fasciculi branches I, II, and III) in the behavioral and functional interactions previously demonstrated between attentional systems and conscious perception. Results revealed that: (1) structural and functional characteristics of a left lateralized network predicted a more efficient use of phasic alerting signals to improve consciousness, and (2) structural and functional characteristics of a right lateralized fronto-parietal network predicted a more efficient use of orienting signals to improve consciousness. These results demonstrate that structural properties of the white matter organization determine the interactions between attention and consciousness.

Topic Area: ATTENTION: Spatial

Flexible biasing of visuospatial attention works through both target facilitation and distractor suppression

Poster D7, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Kerstin Unger[1], Rebecca Waugh[1], Michael S. Worden[1]; [1]Brown University, Department of Neuroscience

Preparatory spatial attention may improve processing of stimuli in attended locations (target facilitation) while attenuating processing of stimuli in unattended locations (distractor suppression). Recent work suggests that different neural mechanisms underlie target facilitation and distractor suppression. Specifically, mechanisms of target facilitation may be flexible and goal-directed, while distractor suppression mechanisms are not. However, most previous studies did not account for feature-based attention in target selection, potentially underestimating the role of preparatory suppression of distractor locations. Here, we controlled for feature-based target selection using an explicit spatial cueing paradigm that systematically varied the degree of feature overlap between target and distractor stimuli. Cue types occurred in blocks and indicated either target location, distractor location, or were uninformative. Target and distractor locations varied randomly with each trial. Participants responded faster to target and distractor cues, compared to uninformative cues. However, we found lateralized alpha-band activity, a potential electrophysiological correlate of preparatory suppression of anticipated distractors, only in target cueing. Both target and distractor cueing were associated with an enhancement of P1 amplitude to the target stimuli. The N1 amplitude to distractor stimuli was enhanced following target cues, but reduced following distractor cues. The lack of lateralized alpha-band activity in the distractor condition suggests that it is difficult to deploy targeted suppression in response to an attention-directing cue. However, P1 and N1 amplitude changes following distractor cues may indicate that distractor suppression mechanisms operate in a reactive fashion and are more flexible and goal-directed than previously thought in facilitating spatially specific processing.

Topic Area: ATTENTION: Spatial

Somatic symptoms and exogenous attention: an ERP study investigating modality specificity

Poster D8, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Bettina Forster[1], Maayan Karlinski[1], Alexander Jones[2]; [1]City, University of London, [2]Middlesex University, London

Theoretical accounts of medically unexplained symptoms have suggested changes in tactile attentional mechanisms during orienting, information filtering or higher perceptual processing. We investigated attentional ERP correlates during orienting (cue-target interval) and stimulus selection (post-target interval) of a tactile and a visual exogenous attention task in a group that scored high compared to a group of participants that scored low on the somtoform disorder questionnaire (SDQ-20; Nijenhuis et al., 1996). Behavioural results showed participants responded faster on validly cued trials in the tactile attention task only, and no group differences in either task. Lateralized ERP components present during the cue-target interval showed no group differences in either task suggesting similar spatial, attentional orienting. Post-target processing showed earlier attentional modulations in the low compared to the high group. Importantly, we found evidence for delayed attentional selection in the high group in both the tactile and the visual tasks. This suggests that somatic symptoms are not based on changes to modality specific, tactile attentional mechanisms but rather on, in general, delayed attentional selection.

Topic Area: ATTENTION: Spatial

ERP evidence of increased distractor salience AND suppression in psychopathic personality (target detection is unimpaired)

Poster D9, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Patrick Carolan[1], John J. McDonald[1], Mario Liotti; [1]Simon Fraser University

The selective attention model of psychopathy attributes the condition's interpersonal and affective impairments to a general unresponsiveness to environmental information incongruent with attention-set. The current study used ERPs to examine whether attention abnormalities in psychopathic personality extend to goal directed deployment of spatial attention (target N2pc) and/or suppression of task-irrelevant information (distractor Ppc and Pd). 79 undergraduate students completed the Psychopathic Personality Inventory-Revised (PPI-R), and performed a cognitive task in which a search display containing a lateralized singleton was presented surrounding a fixation point that varied in luminance from trial-to-trial. During visual search for the singleton, reaction time and N2pc fractional-latency were strongly correlated ($r = .421$, $p < .001$), however neither measure correlated with scores on the PPI-R or its subscales. Furthermore, regression analyses indicated that psychopathy did not moderate the association between N2pc latency and reaction time ($\beta = .099$, $p = .413$), and was unassociated with N2pc amplitude ($r = -.086$, $p = .472$). In contrast, when attending to fixation point luminance and ignoring the search display, distractor singleton Ppc and Pd amplitudes both correlated positively with scores on the Self-centered Impulsivity subscale of the PPI-R ($r \geq .256$, $p \leq .024$). This pattern of findings suggests that psychopathy does not impair the ability to simply direct attention to salient objects (N2pc). However, during focused attention, psychopathic impulsivity is characterized by a widened "preattentive window," increasing initial salience calculations (Ppc) and subsequent suppression (Pd) of task-irrelevant items.

Topic Area: ATTENTION: Spatial

Brain Structures Modulating Alpha Oscillations in Anticipatory Spatial Visual Attention: A Simultaneous EEG-fMRI Study

Poster D10, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Mingzhou Ding[1], Yuelu Liu[2], Jesse Bengson[2], Haiqing Huang[1], George R Mangun[2]; [1]University of Florida, [2]University of California at Davis

It is well-established that EEG alpha oscillations (8 – 12 Hz) decrease in amplitude in the visual cortex contralateral to the direction of covert spatial visual attention. What is not well-understood is what brain areas contribute to the attentional modulation of alpha. We addressed this question by recording simultaneous EEG-fMRI in human subjects performing a cued visual-spatial attention task. Correlating post-cue alpha power with concurrently recorded blood-oxygen-level-dependent (BOLD) activity we obtained three main results. First, regions negatively correlated with alpha power mainly included bilateral visual cortex, bilateral intraparietal sulci (IPS), and left middle frontal gyrus (MFG), the latter two being part of the frontoparietal attention control network. Further, in IPS, stronger negative correlations were found for contralateral alpha than ipsilateral alpha, suggesting an enhancement of task-relevant areas via top-down modulation. Second, regions positively correlated with alpha power include the sensorimotor cortices and the default mode network, possibly reflecting a mechanism of active inhibition over task-irrelevant areas. Finally, the degree of alpha lateralization was positively correlated with BOLD in dorsal anterior cingulate cortex (dACC) in both attend-left and attend-right conditions, suggesting that the dACC's role in goal-oriented behavior is to facilitate attentional set via executive influences over attentional control systems. These results, besides revealing the neural substrates of alpha modulation by attention, also indicate that spatial visual attention involves both selective enhancement of task-relevant cortical areas, and active inhibition of task-irrelevant cortical areas.

Topic Area: ATTENTION: Spatial

Cortical thickness and global/local visual abilities in children

Poster D11, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Nicolas Poirel[1,2], Grégory Simon[1], Katell Mevel[1], François Orliac[1], Sonia Dollfus[3,4], Olivier Houdé[1,2], Carole Peyrin[5], Grégoire Borst[1]; [1]LaPsyDÉ, UMR 8240, CNRS, Université Paris Descartes, Université de Caen Normandie, France, [2]Institut Universitaire de France (IUF), Paris, [3]ISTS, UMR 6301, CNRS, CEA, Caen, France, [4]CHU de Caen, Service de Psychiatrie, Centre Esquirol, Caen, France, [5]LPNC, UMR 5105, CNRS, Université Pierre Mendès France, France

A visual scene consists of local elements (trees) that are arranged into a global configuration (a forest). Paradigms using large global forms composed of suitable arrangements of small local forms revealed a global precedence effect in adults, characterized by a global advantage (faster detection of global information than local parts) and an interference from global information during local processing. Even if behavioral studies evidenced a global precedence from 9 years of age, cortical structures underlying global precedence and global interference effects are still unknown in healthy children. In the present work, after a MRI session in a 3-Tesla MRI scanner, 10 years-old children were presented with a classic global/local selective attention task with congruent and incongruent conditions. Regression analyses ($p<.01$) between cortical thickness estimation (Destrieux Atlas) and responses times to global/local task showed thinner cortical thickness associated with a weaker global advantage in right frontal (middle, inferior and opercular parts) and in right temporal pole regions. A thinner cortical thickness was also associated with (1) increasing ability to deal with interference from local information in the right middle frontal cortex and (2) increasing ability to deal with interference from global information in right frontal middle, frontal inferior and orbital bi-lateral sulcus. The mainly right lateralized frontal network evidenced in the present work that allow children to efficiently deal with global/local visual information has potential implications for models of attentional selection and executive control.

Topic Area: ATTENTION: Spatial

Sensory Activation as A Common Mechanism of Perceptual Pseudoneglect: Establishing Convergent and Discriminant Validity of Measures of Attention and Awareness

Poster D12, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Jiaqing Chen[1], Matthias Niemeier[1,2]; [1]University of Toronto Scarborough, [2]Centre for Vision Research, York University

Present knowledge of attention and awareness centers on deficits in patients with right brain damage who show severe forms of inattention to the left, called spatial neglect. Yet the functions that are lost in neglect are poorly understood. In healthy people they might produce "pseudoneglect", subtle biases to the left found in various tests that could complement the leftward deficits in neglect. But pseudoneglect measures are poorly correlated. Thus, it is unclear whether they reflect anything but distinct surface features of the tests. To probe for a common mechanism, here we asked whether visual noise, known to increase leftward biases in the grating-scales task, has comparable effects in other forms of pseudoneglect. We measured biases using three perceptual tasks that require judgments about size, luminance and spatial frequency, as well as two visual search tasks that permitted serial and parallel search or parallel search alone. In each task we superimposed stimuli with different amounts of noisy pixels, much like a poor TV signal. We found that participants biased their perceptual judgments more to the left with increasing levels of noise, regardless of task. Also, noise amplified the cross-over effect in the landmark task. In contrast, biases during visual searches were not influenced by noise. Our data are the first to demonstrate that different measures of perceptual pseudoneglect share a common mechanism of sensory activation. We argue that this mechanism feeds into specific, right-dominant processes of global awareness involved in comparisons across a wider range of the visual field.

Topic Area: ATTENTION: Spatial

Dynamic coupling between the anterior cingulate and occipital alpha power during willed attentional control.

Poster D13, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Jesse Bengson[1,3], Xiaoke Zhang[2], George Mangun[3]; [1]Sonoma State University, [2]University of Delaware, [3]University of California-Davis

Little is known concerning the control of attention in response to internal decision making processes in the absence of clear informative external cues: a cognitive operation that we refer to as willed attentional control. Only recently has it been established that attention can be controlled by a purely voluntary decisional process and only a few studies have examined the neural processes that underpin willed attentional control. In the present study, we examined the electrophysiological and anatomical sites of willed attentional control using combined fMRI and EEG recordings. Our results indicate that willed attentional control evokes a momentary 400ms reduction in alpha power recorded over the occipital cortex just prior to the canonical deployment of attention-induced alpha lateralization. Furthermore, this alpha reduction specifically and significantly interacts with decision induced activation of the Anterior Cingulate. This pattern suggests that willed attentional control involves a dynamic interplay between the Anterior Cingulate activity and visual-cortical sensitivity, as indexed by a reduction in occipital alpha power.

Topic Area: ATTENTION: Spatial

Can orienting endogenous spatial attention impact subjective awareness more than objective performance?

Poster D14, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Marine Vernet[1], Savannah Lokey[1], Sara Ahmed[1], Shruti Japee[1], Valentinos Zachariou[1], Leslie Ungerleider[1]; [1]Laboratory of Brain and Cognition, NIMH/NIH

Visuospatial attention often improves objective visual performance by increasing the gain of the signal at the attended location and reducing noise at unattended locations. Attention is also believed to influence decision-making and thus subjective awareness: observers assign more weight to information extracted from the attended location. In this experiment, we assessed whether orienting endogenous visuospatial attention with a central visual cue differentially modulates objective performance and subjective awareness in the same discrimination task. Visual targets were laterally presented Gabor patches, either embedded in white noise (noise experiment) or presented at low contrast (contrast experiment). Participants reported the orientation of the target, either in a 3 alternative choice task allowing subjective reports (clockwise, counterclockwise or unknown) or in a 2 alternative forced-choice task for a strict objective performance evaluation (clockwise, counterclockwise). Fitting models from Signal Detection Theory showed that, for both noise and contrast experiments, attention reduced noise, but contrast gain and increased sensitivity (i.e., of objective performance) were observed only in the contrast experiment. Indeed, in the noise experiment, any signal enhancement at the target location would enhance both the target signal and the noise in which the target was embedded. Interestingly, for both experiments, more liberal decisions were taken, i.e., subjective awareness increased. The noise experiment is thus an experimental configuration where people think they see better, even if they do not. This could be explained by an internal representation of their attentional state that would influence awareness decision independent of visual signals.

Topic Area: ATTENTION: Spatial

Impact of acute lung injury on cognitive function in experimental mice

Poster D15, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Amarjit Naura[1], Bijayani Sahu[1], Rajat Sandhir[1]; [1]Department of Biochemistry, Panjab University, Chandigarh

Acute lung injury (ALI) is a life threatening disorder characterized by accumulation of large numbers of neutrophils in the lungs. Interestingly, ALI survivors frequently present some cognitive deterioration at discharge; such as impaired memory, attention, concentration and/or mental processing speed. However, the molecular mechanism behind ALI mediated cognitive function is not known. Accordingly the present work was designed to investigate potential impact of ALI on cognitive impairment in mice for its potential application as a model system to study cross talk between lung and brain at molecular level. ALI in male Balb/c mice was induced by intra-tracheal administration of either HCl or LPS as single hit or both agents were administered to mimic 'two hit' model of ALI. Administration of either LPS or HCl alone increased the neutrophils in lungs significantly but did not impair memory as assessed by Morris water maze test. Interestingly 'two hit' mediated injury resulted in more pronounced increase in neutrophils and pro-inflammatory factors in lungs which was found to be associated with persistent decline in memory. It appears that exaggerated lung injury through two hits disrupt the threshold barrier to cause cognitive dysfunction. Indeed further analysis revealed that two hit mediated injury lead to disruption of blood brain barrier potentially through elevated systemic inflammatory response. Overall, our findings show that two hit mediated ALI leads to cognitive impairment in mice and hence the model can be used to examine lung-brain cross talk at molecular level.

Topic Area: ATTENTION: Spatial

Subthalamic nucleus stimulation impairs emotional conflict monitoring in Parkinson's Disease

Poster D16, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Friederike Irmen[1,2], Julius Huebl[2], Henning Schroll[2,4], Gerd-Helge Schneider[3], Andrea Kühn[1,2,3]; [1]Berlin School of Mind and Brain, Humboldt Universität zu Berlin, Germany, [2]Department of Neurology, Charité University Medicine Berlin, Germany, [3]Department of Neurosurgery, Charité University Medicine Berlin, Germany, [4]Department of Computer Science, Chemnitz University of Technology, Chemnitz, Germany

The subthalamic nucleus (STN) occupies an important strategic position in the motor network, slowing down responses in situations with conflicting perceptual input. Recent evidence further suggests a role of the STN in emotion processing through its strong connections with emotion recognition structures. As deep brain stimulation (DBS) of the STN in patients with Parkinson's Disease (PD) inhibits monitoring of perceptual and value-based conflict, STN DBS may also interfere with processing of emotional conflict. Specifically, STN DBS may modulate either the detection (conflict monitoring) or the control (conflict adaptation) of conflicting information. To assess a possible interference of STN DBS in conflict monitoring and adaptation, we used an Emotional Stroop paradigm previously established by Etkin et al. (2006). Subjects had to categorize face stimuli according to their emotional expression (positive or negative) while ignoring emotionally congruent or incongruent superimposed word labels. Eleven PD patients ON and OFF STN DBS conducted the computerized task while taking their usual antiparkinsonian medication. Eleven age-matched healthy subjects participated as controls. We found conflict-induced response slowing in healthy controls and PD patients OFF DBS, but not ON DBS suggesting, STN DBS to induce a decrease in emotional conflict detection irrespective of valence. OFF DBS, patients slowed down more for negative conflict stimuli and this emotional bias was regulated by STN DBS. Computational modelling of STN influence on conflict monitoring disclosed DBS to interfere via increased baseline activity. STN DBS did not alter the capacity to adapt cognitive control to conflict demands on a trial-by-trial basis.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

Evidence for error feedback control during intrinsic neuromodulation of emotion.

Poster D17, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Keith Bush[1], Josh Cisler[2], Andrew James[1], Clint Kilts[1]; [1]University of Arkansas for Medical Sciences, [2]University of Wisconsin - Madison

Real-time functional magnetic resonance imaging (rtfMRI), when used to generate brain activation feedback to guide volitional control (rtfMRI-guided intrinsic neuromodulation), reflects a cognitive error feedback control system that is subject to the principles defined by engineering control theory. We conducted retrospective control theoretic analysis of data related to rtfMRI-guided neuromodulation of emotional response to traumatic/stressful memories to test this hypothesis. We identified neural structures related to core control components: error processing and control law (the mapping of error signals to error-minimizing control decisions). Independent components containing anterior cingulate cortex as well as lateral prefrontal cortex, anterior insula, and striatum were linked to the control system's internal and external (feedback) error processing units, respectively. Combined, internal and external error processing predicted 57% of group performance variance for the task. Control law analysis further implicated the frontoparietal network (FPN) in the translation of error signals to task-specific cognitive dynamic changes. Moreover, neural activation within the external error processing system, which is recruited exclusively by rtfMRI-guided neuromodulation, was shown to recruit FPN activation more strongly than internal error processing, suggesting a neural explanation for the efficacy of guided over unguided neuromodulation. Based on the neuroanatomical structures involved, rtfMRI-guided neuromodulation exhibits strong functional ties to cognitive control, which was recently posited as a mechanism explaining both the onset and successful treatment of psychiatric illness and cognitive deficit. Therefore, understanding how these mechanisms interact, as well as their potential manipulation via rtfMRI-based feedback, may have positive future implications for psychiatric and psychological therapeutics.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

Early and late inhibitory processes for emotional words: An ERP investigation

Poster D18, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Regard Booy[1], Mario Liotti[1]; [1]Simon Fraser University

Results from the Negative Affective Priming (NAP) task suggests inhibition of emotional material is dysregulated at both early and late stages of processing in depression. However, it is not yet clear if and how positive and negative material may be differentially affected. In the present study, 46 female undergraduates completed a modified version of the NAP task while continuous EEG was recorded. The NAP task requires subjects to indicate the valence of a target word, while simultaneously ignoring a distractor. At analysis, two trial types are identified; ignored repetition trials (IgnRep; the previous distractor and current target are valence congruent) and control trials (the previous distractor was neutral). Two ERP components were examined; the Early Anterior Positivity (EAP; 190-260ms) and the Late Posterior Potential (LPP; 500-700ms). The EAP is thought to index automatic, bottom-up attentional capture, while the LPP is indexes the amount of working memory resources allocated to later, top-down processing. IgnRep trials for negative words elicited a significantly larger EAP compared to control trials. Within the LPP epoch, mean amplitude to IgnRep trials was significantly larger compared to control trials for positive words. Interestingly, both IgnRep and control trials for negative words elicited a large LPP. This suggests that negative words capture attention more readily possibly as part of a threat detection system. As a result, working memory resources may be employed to maintain a balance between positive and negative material at later stages.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

Effects of interoceptive attention on emotional responses

Poster D19, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Kamryn Taub[1], Sean Fannon[1]; [1]Folsom Lake College

Influential theories of emotion posit that feedback from the body plays a key role in emotional experience. Consistent with this view, individual variation in awareness of interoceptive signals (those originating within the body) is associated with trait measures of emotionality, and functional imaging implicates common brain regions supporting both interoception and emotion perception. Attending to one's heartbeat has been shown to increase the the amplitude of heartbeat-evoked brain potentials, demonstrating that selective attention can boost the central representation of interoceptive signals. Taken together, these observations suggest that biasing attention toward interoceptive signals should enhance emotional responses, however, this has not yet been directly tested. We directed subjects' attention either to interoceptive signals (their own heartbeat) or exteroceptive signals (auditory tones) and assessed the effects on physiological and self-report measures of their emotional response to affective pictures. We failed to uncover any influence of interoceptive attention on emotional responding. The results suggest that increased awareness of bodily state does not directly influence emotional state. Trait interoceptive awareness and emotionality may instead be correlated due to shared association with other psychological traits.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

Neural basis of altruistic motivation towards ingroup soccer fans

Poster D20, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Tiago Bortolini[1,2], Patrícia Bado[1,2], Sebastian Hoefle[1], Annerose Engel[1], Roland Zahn[3], Jean-Claude Dreher[4], Jorge Moll[1]; [1]Cognitive and Behavioral Neuroscience Unit, D'Or Institute for Research and Education, Rio de Janeiro, [2]Graduate Program in Morphological Sciences, Federal University of Rio de Janeiro, [3]Institute of Psychiatry, Psychology & Neuroscience, Centre for Affective Disorders, King's College London, [4]Neuroeconomics, Reward and Decision-making Team, Institut des Sciences Cognitives Marc Jeannerod, Centre National de la Recherche Scientifique

Humans have a natural need to belong to social groups, showing intense ingroup prosocial behavior. Although the psychological mechanisms behind human prosociality have been extensively studied, the specific neural systems bridging group belongingness and prosocial motivation remain to be identified. Here, we used soccer fandom as an ecologically valid and naturalistic framing of group membership to investigate the neural mechanisms underlying ingroup altruistic behavior using event-related functional magnetic resonance (fMRI). We designed an effort-based measure using force on a handgrip tapping on the motivation to earn money for oneself or for others (ingroup fans or 'neutral' participants not affiliated to soccer). While overlapping valuation signals in the medial orbitofrontal cortex (mOFC) were observed for these three conditions, the subgenual cingulate cortex (SCC) showed more robust responses for ingroup altruistic versus non-ingroup altruistic decisions. The SCC, a region previously implicated in altruistic decisions and group affiliation, also displayed increased functional connectivity with the mOFC for ingroup compared to non-ingroup conditions. These findings indicate a key role for the SCC to dovetail altruistic motivations in the context of natural groups with generic neural valuation systems.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

Medial prefrontal activation and liking / wanting judgements: Near-Infrared Spectroscopy (NIRS) study.

Poster D21, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Eriko Matsumoto[1], Tomoya Kawashima[1,2], Masahiro Zaitsu[1], Mathieu Lajante[3], Tomoyuki Naito[4]; [1]Graduate School of Intercultural Studies, Kobe University, [2]Japan Society for the Promotion of Science, [3]Graduate School of Management (IGR – IAE), University of Rennes 1 & CREM (UMR 6211), [4]Graduate School of Medicine, Osaka University

The purpose of this study is to examine the neural mechanisms related to the two different judgement processes; one is visual novelty of package design on aesthetic preference (liking) and another one is "want to eat (wanting)" judgment for daily consumer products. In the previous studies showed MPFC (medial prefrontal cortex) activity associated with preference ranking for products (Levy et al., 2011), however, the activity difference between liking and wanting is still unclear. We chose 10 Japanese snack packages for experiment stimuli (Matsumoto et al., 2016). Two of them were presented simultaneously for 2AFC judgement. To measure the brain activation during the judgements, we use Near Infrared Spectroscopy (NIRS) which record the changes in the regional cerebral blood volume around prefrontal cortex. We used 3x5 probe holders (22-channels) on the prefrontal cortex. Participants were asked to conduct preference judgement task and "want to eat" choice task. Also, the recognition rate of each stimulus was measured. We employ blocked design; liking and wanting task appeared alternatively with 30 sec interval. The order of the tasks was counterbalanced. The results showed that Hb-oxy signal changes were increased "want to eat" judgment than preference judgment within the left hemisphere ROI. This result possibly suggests that the different neural process underlie between liking and wanting.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

The role of reward and punishment motivation in attention: an ERP investigation

Poster D22, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Arzu Ozkan Ceylan[1], Xiaoqian Yu[2], Justin Burgess[2], Geoffrey F. Potts[2]; [1]Hacettepe University Department of Psychology, [2]University of South Florida Department of Psychology

The aim of the current study was to examine the role of reward and punishment motivation on attention assessed using ERN and Pe components. In the first phase of the study, data were collected from undergraduates (n = 663) using Adult Attention Deficit Hyperactivity Disorder (ADHD) Self-Report Scale (ASRS). Of these participants, 61 volunteered to participate in the second phase of the study in which we used a modified version of the Eriksen Flanker Task to assess attention, the effects of reward, and punishment motivation. Results of the study showed that the relationships between inattention scores of the participants with the Pe component when the response was error for reward motivated trials (r = -.28), and with loss aversion score (r = -.35) were significant. This second result indicated that the higher the inattention score, the smaller the difference between the punishment and reward for Pe. Furthermore, we divided participants into high and low inattention groups based on the median value of the ASRS inattention subscale. 2 (Group) x 2 (Motivation) ANOVAs on Error Pe and Error-Correct difference Pe showed that the interaction effect was significant on both analyses. Contrary to our expectations, the findings demonstrated the importance of Pe rather than ERN. This research was supported by The Scientific and Technological Research Council of Turkey (TUBITAK).

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

Modulating network dynamics using Theta Burst Stimulation to vlPFC

Poster D23, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Cammie Rolle[1], Hersh Trivedi[1], Karen Monuszko[1], Andrew Yee[1], Amit Etkin[1]; [1]Stanford University

The ventrolateral prefrontal cortex (vlPFC) has been largely implicated as a critical neural marker of attentional bias, and a key regulator of amygdala activity. But, our mechanistic understanding of the vlPFCs circuit-specific role remains largely unknown. In the current study, we used Theta Burst Stimulation (TBS) with Transcranial Magnetic Stimulation (TMS) to elucidate vlPFC's network dynamics and the resultant downstream behavior through the modulation of vlPFC cortical activity. Participants were randomized to receive three treatments across three sessions: continuous TBS (cTBS) to dampen vlPFC activation, intermittent TBS (iTBS) to excite vlPFC, and a sham TBS control group (mimicking the sensation of TBS). Within a given session, subjects participated in three tasks accompanying simultaneous Electroencephalogram (EEG) recordings prior to and following treatment: Resting state and single pulse Transcranial Magnetic Stimulation (spTMS) to examine changes in network connectivity, and the Attentional Bias Dot Probe task, to examine effects on behavior previously linked to the vlPFC. Analyses for resting state focused on key metrics of network connectivity and frequency-time series transforms, while the primary measure of interest for spTMS was pulse-onset Transcranial Evoked Potential (TEP). Interestingly, the effect of TBS on both behavior (Dot Probe) and network connectivity (Resting State, spTMS) was dependent upon the pre-intervention state of the participant. Participants who were initially captured by threatening stimuli differed in TBS-related measures of connectivity than those avoidant of threatening stimuli. This study is moving us closer to a more comprehensive understanding of the role of vlPFC as it relates to our affective experiences.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

Emotion regulation constructs associated with variance of fear learning in Post-Traumatic Stress Disorder

Poster D24, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Emily M. Hahn[1], Josh M. Cisler[2], G. Andrew James[1], Anthony A. Privratsky[1], Clinton D. Kilts[1]; [1]Brain Imaging Research Center, Psychiatric Research Institute, University of Arkansas for Medical Sciences, [2]Department of Psychiatry, University of Wisconsin- Madison

Post-Traumatic Stress Disorder (PTSD) is associated with both emotional dysregulation and impaired fear extinction. Fear extinction consists of repeated exposure to a conditioned stimulus (i.e. fear-inducing stimulus), which elicits new learning of a 'safe' memory that competes with retrieval of the initial fear memory, thereby reducing fear responding. Twelve adult women with PTSD [mean(sd) sage = 38(8) years] underwent functional neuroimaging during fear extinction learning. The Difficulty in Emotion Regulation Scale (DERS) measured emotion regulation (ER), defined as the ability to inhibit or regulate one's emotional state through six factors: Non-acceptance, Goals, Impulse, Awareness, Strategies, and Clarity. DERS factor-structures were correlated against differences in skin-conductance response (SCR) between CS+ and CS- during the fear extinction phase (CS+(E) , CS-(E)). Interestingly, the DERS Awareness subscale was significantly negatively correlated with SCR difference between CS+(E) and CS-(E) (r = -.53), suggesting that participants with more limited awareness about their feelings had less variance in their SCR responses to the fear-conditioned or neutral stimuli. Future studies may examine the overlapping neurocircuitry of fear extinction and emotion regulation in order to better understand brain mechanisms underlying impairment in both domains.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

Neural Processing of Gender Stereotypes Separate Liberals and Conservatives

Poster D25, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Adam Baker[1], Travis Baker[2], Genevieve Fuji Johnson[3], Mario Liotti[4]; [1]Simon Fraser University, [2]Rutgers University

Abstract: Recent research has begun to utilize event-related potentials (ERPs) to investigate social phenomena, such as social norm violations. Here, we continue this work by using electrophysiological and behavioral assays of pragmatic rule violations to identify neurocognitive differences between individuals identified through survey measures as conservative (n=15) or liberal (n=15). To assess the influence of automatic vs. controlled processing of stereotype violations between groups, a short (150ms) and long (700ms) stimulus-onset asynchrony (SOA) was utilized. Behaviorally, RT was longer for Incongruent trials in the Conservative group only at 700 ms compared to 150 ms. ERP results confirmed that participants as a whole (n=30) produced greater N400 activity to gender stereotype word-pair incongruities (Female + Mechanic), compared to congruities (Male + Beer). However, while in the short SOA condition, N400 voltage to incongruent word pairs was significantly larger then to congruent word pairs in both groups, in the long SOA condition, the N400 amplitude was significantly larger for Incongruent than Congruent word pairs for the Conservatives only, while it was much smaller and non-significant among Liberals (Congruency*SOA*Group: $F(1, 28) = 4.55$, $p < .05$, $\eta 2 = .14$.). In addition, scores in the self-identity questionnaire in the conservative group correlated significantly with the RT interference effect, but only for the short SOA, where the stereotype response is more prepotent. We suggest that in the Long SOA conservatives use deliberate processing of the Incongruent words through conflict monitoring mechanisms resulting in longer RT and smaller N400 difference with Congruent words.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

Deriving a neural representation of interpersonal guilt from multivariate brain patterns

Poster D26, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Hongbo Yu[1,6], Leonie Koban[2,3], Luke Chang[2,4], Ullrich Wagner[5], Patrik Vuilleumier[3], Xiaolin Zhou[1], Tor Wager[2]; [1]Peking University, [2]University of Colorado Boulder, [3]University of Geneva, [4]Dartmouth College, [5]University of Münster, [6]University of Oxford

Interpersonal guilt is a negative feeling arises from the awareness of one's own moral transgression. Neuroimaging studies have identified a number of neural substrates of guilt but have not yet derived a neural representation of guilt that is sensitive and specific for guilt processing and generalizable in predicting guilt states in new observations. We used machine learning to derive a neural representation of guilt on the basis of two existing neuroimaging datasets of interpersonal guilt. This pattern discriminated different states of interpersonal guilt in cross-validation (n = 24; Chinese population) and independent test (n = 19; Swiss population) samples. Moreover, it performed at chance level when applied to discriminate different levels of thermal pain or different types of recalled emotions (including guilt), indicating that it is specific to direct experience of interpersonal guilt and not to arousal or salience itself. Within the multivariate pattern, the voxels in the anterior middle cingulate cortex and anterior insula contribute most significantly. Overall, this work highlights an alternative approach for investigating the neural representation of complex social emotion and has implications for theory and measurement of social emotion.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

Sex Differences in Cooperation Decisions Following Observed Affective Non-Verbal Social Interactions: An ERP Investigation

Poster D27, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Matthew Moore[1], Illia Kuznietsov[2], Yuta Katsumi[1], Stephanie Kern[1], Qingying Zheng[1], Sanda Dolcos[1], Florin Dolcos[1]; [1]University of Illinois at Urbana-Champaign, [2]Eastern European National University

Cooperation behaviors in social dilemmas have been shown to be sensitive to manipulations of context, and evidence suggests that females are more sensitive to contextual aspects than males. However, it is not clear how aspects of social decision context, such as observed affective non-verbal behaviors in social interactions, may influence cooperation decisions and the underlying neuro-behavioral mechanisms. In the present study, the influence of observed social interactions was examined with respect to decisions to accept or reject monetary offers in a Ultimatum game. A total of 48 participants completed the task. Participants responded to offers following proposer's dynamic Approach (friendly) or Avoidance (non-friendly) behaviors. Behavioral results showed that female participants tended to reject more unfair offers than males did. However, both females and males rejected fewer offers from female proposers following approach behaviors, and female participants showed overall greater sensitivity to proposers' sex and behavior compared to males. Consistent with the behavioral findings, preliminary analyses of event-related potentials (ERPs) in females showed greater N2 following the onset of social interaction conditions with male proposers, compared to social interaction conditions with female proposers. This suggests possibly increased monitoring in earlier stages of social interaction with male proposers, which resulted in increased rate of rejected offers. The mechanisms of these differences were further investigated with additional manipulations involving comparisons of Community/pro-social and Individualistic/pro-self game framings. The results will be discussed in the context of sex differences in behavioral and ERP findings, related to the effect of non-verbal affective behaviors and framing manipulations.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

Contributions of physiological arousal levels to performance under pressure: an fMRI study.

Poster D28, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Noriya Watanabe[1,2,3,4], Mauricio R. Delgado[1]; [1]Rutgers University, [2]Japan Society for Promotion of Science, [3]Nagoya University, [4]National Institute of Information and Communications Technology

Success or failure of a motivated behavior can be determined by various factors. One such factor is the ability to keep calm and carry on while under pressure to perform. We investigated how an individual's level of arousal, characterized by pupil dilation, influences the probability of being successful during a simple motor-perception task. Specifically, we measured pupil dilation during a 5.5 second anticipatory phase prior to motor execution of a stop-watch task - a period where participants (N=22) were presented with an incentive associated with successful in the trial ($0.50-$40.00). Pressing the button within the designated time-window resulted in a successful outcome (M=39.9%). We separated pupil dynamics for trials resulting in success or failure in performance and regressed each one separately by incentive size during the 5.5 second period, showing that failure trials represented the incentive size later on during the anticipatory period - an effect not seen in successful trials. Using fMRI, we also observed that presentation of the incentive value of a trial recruited activation in the caudate nucleus, which was enhanced for trials that resulted in failure and suppressed for trials resulting in success. Interestingly, using pupil amplitude as a regressor in the fMRI analysis independent from incentive yielded activity in the amygdala, where a greater response to failure compared to success trials was observed. Taken together, the results suggest that arousal levels prior to execution of a behavior can modulate neural activity in the caudate and amygdala, contributing to one's ability to successfully perform under pressure.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

I Like the Way You Move: Increased Value of Biological Motion in Individuals with Few Autistic Traits

Poster D29, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Elin Williams[1], Emily S Cross[1]; [1]Bangor University

Individuals with a diagnosis of Autism Spectrum Disorder (ASD) characteristically demonstrate impaired eye-contact during social interactions and look less towards faces than typically developing (TD) individuals. The Social Motivation Theory of Autism posits that this is due to a reduced sensitivity to the value of social stimuli, specifically faces, in ASD. Research has also demonstrated that TD individuals preferentially orient towards another type of salient social stimulus, namely biological motion. Individuals with ASD, however, do not show the aforementioned behaviours. Although the reward value of faces to TD and ASD individuals has been investigated, it remains unknown how rewarding both populations find biological motion. The present study investigated the value assigned to biological and non-biological motion by TD participants, and further examined whether reward values differed in individuals with more autistic traits. Videos of a human performing smooth, natural movements were used as a proxy for biological motion, and videos of a human performing rigid, robotic movements were used as a proxy for non-biological motion. Autistic traits were measured in TD adults who then completed an innovative behavioural paradigm that measures stimuli preference. The results suggest that TD participants prefer biological, or human-like, motion, in comparison to non-human-like motion. However, this preference appears to be weaker in individuals with more autistic traits. This study helps us to begin to understand whether individuals with ASD assign a reduced reward value to faces alone, or whether these individuals find a broader conceptualisation of social stimuli less rewarding compared to TD individuals.

Topic Area: EMOTION & SOCIAL: Other

Mirroring multiple agents at the same time: An fMRI study

Poster D30, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Emiel Cracco[1], Christian Keysers[2], Amanda Clauwaert[1], Marcel Brass[1]; [1]Ghent University, [2]Netherlands Institute for Neuroscience

There is now converging neural evidence that observed actions are mirrored in the sensorimotor system of the observer. However, this research has mainly focused on situations where the observer views a single agent. We were interested in how the mirror neuron system (MNS) responds to seeing multiple agents. To this end, participants observed two right hands that independently performed either one of three gestures (A, B, or C) or no gesture (N). A univariate analysis of the data indicated stronger activation in the MNS when seeing two simultaneous gestures compared with seeing a single gesture. In addition, a representational similarity analysis showed that both gestures were represented at the same time in the MNS. Specifically, this analysis revealed a stronger correlation between the activation patterns corresponding to seeing two different gestures and to seeing a single gesture when there was overlap between the gestures (e.g. A+B and A+N) compared with when there was no overlap (e.g. A+B and C+N). Based on these findings, it was reasoned that the simultaneous representation of two different gestures in the MNS should trigger activation in brain regions related to response conflict because these gestures cannot be executed at the same time. In support of this idea, increased activation in the anterior cingulate cortex was found in the A+B condition compared with the A+A condition. Together, these findings support the hypothesis that the human MNS is able to incorporate multiple observed actions at the same time.

Topic Area: EMOTION & SOCIAL: Other

Trait impulsivity is associated with functional connectivity of striatal-frontal circuits differentially in smokers and nonsmokers

Poster D31, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Sufang Li[1], Xiaochu Zhang[1], Betty Jo Salmeron[1], Hong Gu[1], Elliot Stein[1], Yihong Yang[1]; [1]Neuroimaging Research Branch, National Institute on Drug Abuse, NIH

Ventral striatum (VS) is a key structure implicated in impulsivity. Impulsivity is a multi-facet trait and it must interact with other brain regions to modulate impulsive behaviors. However, little is known about how it interacts with other brain regions underlies impulsivity in addiction. Resting state functional connectivity (rsFC) provided us a novel method to explore the association between impulsivity and intrinsic functional connectivity of VS circuits, and the potential alterations in smokers. 60 smokers and 60 nonsmokers participated in the rs-fMRI scan and their impulsivity was assessed. Voxel-wise rsFC between VS and all other brain regions were computed. ANOVA was then conducted to identify the effect of smoking, trait impulsivity and their interactions. Significant interactions were found in the dorsal anterior cingulate cortex (dACC) and bilateral amygdala. Specifically, positive correlation between impulsivity and rsFC of VS-amygdala circuit was found in smokers while not in nonsmokers; positive correlation between impulsivity and rsFC of VS-dACC circuit was found in nonsmokers but not in smokers. To further explore the role of these rsFC in impulsivity, subjects performed two tasks: Go/NoGo task and emotional task. rsFC of VS positively correlated with the activation in the amygdala (negative - positive); and also positively correlated with the activation in the dACC during failed inhibition. Additionally, VS-dACC rsFC negatively predict nicotine dependence severity and VS-amygdala rsFC positively predict anxiety in smokers. These results provide new evidence for the theory that the role of frontal-striatal circuit involved in impulse control, and striatal-limbic circuit involved in impulse drive.

Topic Area: EMOTION & SOCIAL: Other

Embodied empathy when judging crimes: Interindividual differences predict responses in somatosensory brain areas

Poster D32, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Claudia Denke[1], Claudia Spies[1], Andreas Heinz[2], Andreas Ströhle[2], Michael Schaefer[3]; [1]Department of Anesthesiology and Intensive Care Medicine,Charité – Universitätsmedizin Berlin, [2]Department of Psychiatry and Psychotherapy, Charité – Universitätsmedizin Berlin, [3]Medical School Berlin

An increasing body of evidence suggests a role for somatosensation in perceiving and understanding social interactions. Numerous studies reported vicarious responses in the primary somatosensory cortex (SI) merely when seeing others being touched, which may be linked to a putative mirror neuron system. For example, watching video clips showing simply non-painful touch to a hand by a paintbrush resulted in vicarious somatosensory activation in SI. Recent research links this vicarious activation in the somatosensory cortices with empathic personality traits. Hence, the more empathic the observer is, the more the somatosensory cortices are vicariously activated when observing touch. While previous studies revealed this association when looking at simple touch to a hand, the current study aimed to examine the roles for empathy and somatosensory cortices in a more complex social scenario. We conducted a study with functional magnetic resonance imaging (fMRI), in which we asked participants (N=17) to read ambivalent scenarios in a tactile priming paradigm. In these scenarios the protagonists explain their reason for having done crimes. Subsequently, the participants had to recommend sentences for the protagonists. Results revealed activation in somatosensory brain areas (SI) when judging the delinquents depending on the priming. This brain activation and the behavioral data were associated with trait differences in empathy. We conclude that these results provide further support for a role of the somatosensory cortices in empathic situations.

Topic Area: EMOTION & SOCIAL: Other

Neurocomputational model of decision-making under social influence in cocaine addicts

Poster D33, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Dongil Chung[1], Brooks King-Casas[1,2,3], George Christopoulos[1,4,5], Thomas Newton[6], Richard De La Garza[6], Pearl Chiu[1,2,3]; [1]Virginia Tech Carilion Research Institute, [2]Salem Veteran Affairs Medical Center, [3]Virginia Tech, [4]Nanyang Technological University, [5]Culture Science Institute, [6]Baylor College of Medicine & Michael E. DeBakey VA Medical Center

Previous studies have highlighted the impact of social influence on preferences, especially under conditions of uncertainty. Social influence is of particular interest for substance-abusing individuals, since the social element of addiction is a prominent factor influencing first use and relapse. The aim of the current study is to examine mechanisms of decision-making among social others, with a focus on how cocaine addicts integrate social and non-social information. Thirty-two male cocaine dependent individuals and thirty healthy male matched controls participated in the current study. The participants made a series of forced choices between two gambles (one “risky” and one “safe”). We measured their choice patterns as they made decisions alone and after viewing other players’ decisions. Blood-oxygen-level-dependent (BOLD) responses during the presentation of others’ choices were measured and analyzed. Using model-based fMRI analyses, this work shows that biased perceptions

of risk probability contribute to cocaine addicts' decisions under social influence. This bias was observed only among individuals with cocaine use disorder, and the bias adjusted subjective value was parametrically correlated with vmPFC activity. These data together provide a neuromechanistic account of how social and non-social information are integrated and how substance use disorders may affect this process.

Topic Area: EMOTION & SOCIAL: Other

Variations in alpha oscillatory power during rule switching

Poster D34, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Paolo Medrano[1], Robert Ross[1]; [1]University of New Hampshire

Cognitive control allows for goal-directed selection of the appropriate action within a given context. Rule-switching is a cognitive control process related to flexibly switching tasks, a process which may require the retrieval of information from long-term memory. Previous research utilizing EEG has associated oscillatory activity in the alpha (8-12 Hz) and beta (13-30 Hz) frequencies with cognitive processes. In particular, suppression of alpha oscillatory activity has been linked with better task switching performance, as well as long-term memory retrieval. This study aims to further the current literature by investigating differences in oscillatory power during a rule-switching task. EEG and behavioral data were collected from 73 healthy young adult participants. Participants were asked to differentiate stimuli based on two rules: color (red or green) or shape (square or circle). Cues presented prior to stimulus presentation determined what rule the participant followed, and changed every few trials. Trials where cues changed were labeled switch trials, while trials that repeated the previous cue were labeled maintain trials. Behavioral analyses revealed significantly greater accuracy and faster reaction times for maintain trials compared to switch trials. Oscillatory analyses revealed a large decrease in alpha oscillatory power in a right lateral inferior region for switch trials, with the significant decrease sustained from 500-2500 ms post-cue presentation. This sustained decrease in alpha power occurring may be linked to memory retrieval processes that aid the reinstatement of a previous rule.

Topic Area: EXECUTIVE PROCESSES: Goal maintenance & switching

Towards Optimal Competitive Behavior: Wins versus Losses Determine Model-based versus Random Choices in Competitive Task Switching

Poster D35, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Atsushi Kikumoto[1], Caitlin Corona[1], Joshua Karpf[1], Ulrich Mayr[1]; [1]University of Oregon

In mixed strategy games, probability for equal-utility options should converge towards maximally unpredictable choices. Moving towards such optimal competitive behavior requires negotiating two conflicting goals: (1) being unpredictable for the opponent and (2) exploiting the opponent's deviations from randomness by relying on a model of the opponent. We investigated how this balance is achieved using a voluntary task-switching paradigm, where typically (i.e., in a non-competitive context) strong deviations from randomness in form of a task-perseveration bias is observed. Across several experiments, participants played a task-switching version of the matching pennies task against human or computerized opponents that varied—either naturally or experimenter controlled—in switch probability. Generally, we found that task choices were much less predicable than in a non-competitive context and in particular showed only very small perseveratory tendencies. More importantly, after win trials participants exhibited task choices that indicated model-based adaptations to the opponents' local and overall switch rate. In contrast, after loss trials choice behavior was close to random. In a final experiment, we probed the representations about the opponent using EEG. In multi-level analyses of the single-trial EEG signal, we found that after win feedback, signals at mid-central electrodes robustly represented information about the local and global strategy of the opponent. After losses, this information was nearly absent. Overall, these results suggest that win versus loss feedback triggers model-based or "randomizing" behavior, providing a process-level explanation to the question how people move towards optimal competitive behavior.

Topic Area: EXECUTIVE PROCESSES: Goal maintenance & switching

Different Levels of Intrinsic Reward Modulate Cognitive Control Allocation While Performing a Naturalistic Behavioral Task

Poster D36, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Richard Huskey[1], Britney Craighead[2], Michael Miller[2], Rene Weber[2]; [1]The Ohio State University, [2]University of California Santa Barbara

Cognitive control (Miller & Cohen, 2001) is an important framework for understanding the neuropsychological processes that underlie the successful completion of everyday tasks. Only recently has research in this area investigated motivational contributions to control allocation (Botvinick & Braver, 2014). An important gap in our understanding is the way in which intrinsic rewards associated with a task motivate the sustained allocation of control (Braver et al., 2014). In three behavioral (n = 122, 110, 87) and one functional magnetic resonance imaging (n = 18) studies, we use a naturalistic and open-sourced simulator to show that changes in the balance between task difficulty and an individual's ability to perform the task result in different levels of attentional engagement and intrinsic reward which motivates dynamic shifts between networked brain states. Brain-mapping and psychophysiological interaction analyses show that high levels of intrinsic reward associated with a balance between task difficulty and individual ability correspond with increased connectivity between cognitive control and reward networks. By comparison, a mismatch between

task difficulty and individual ability is associated with lower levels of intrinsic reward and corresponds to increased activity within the default mode network. Insular activation suggests that motivational salience, as defined by the level of intrinsic reward, drives shifts between networked brain states associated with task engagement or disengagement. These results underscore recent theorizing suggesting that higher order cognitions and their resulting behaviors are not easily reducible to their lower-level constitute parts, especially when considering the relationship between cognition and motivation (Pessoa, 2008).

Topic Area: EXECUTIVE PROCESSES: Goal maintenance & switching

Preparatory brain activity in dual-tasking

Poster D37, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Marco Steinhauser[1], Robert Steinhauser[1]; [1]Catholic University of Eichstätt-Ingolstadt

When the execution of two tasks overlaps in time, dual-task costs emerge in response times and error rates. While research has primarily focused on the source of these costs, less is known about how the execution of dual-tasks is prepared in advance. In the present study, we used event-related potentials to investigate preparatory brain activity related to Task 1 and Task 2 during a dual-task paradigm. Participants performed two tasks in close succession, while the order of tasks was indicated by a cue and varied across trials. Our approach was to isolate preparatory activity predictive for Task 1 and Task 2 errors during the cue-stimulus interval. In this way, we aimed to distinguish between three hypotheses concerning the scheduling of task preparation: Either only Task 1 is prepared in advance, or both tasks are prepared simultaneously, or each task is prepared at different time points. We found an early anterior positivity related to Task 1 preparation and a late anterior negativity related to Task 2 preparation. Whereas this pattern suggests that both tasks are prepared at different time points, the nature of these effects implies that the underlying preparation processes differ.

Topic Area: EXECUTIVE PROCESSES: Goal maintenance & switching

Individual differences in mixing costs relate to general executive function

Poster D38, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Louisa L. Smith[1], Naomi P. Friedman[1,2], Marie T. Banich[1]; [1]Department of Psychology and Neuroscience, University of Colorado Boulder, [2]Institute for Behavioral Genetics, University of Colorado Boulder

Task switching paradigms are used to assess individuals' ability to enact cognitive control under changing environmental demands. Current accounts of the cognitive processes underlying these tasks focus heavily on active shifting between task sets, i.e. switch costs. However, during trials not requiring a shift, participants must exert sustained control to maintain task goals and overcome interference from competing task sets. The difference in performance between repeat trials within mixed blocks and trials within single-task blocks, i.e. mixing cost, is thought to reflect this additional control demand, but the nature of its processes remain subject to debate. We take a latent variable approach in a large sample (n=749) to investigate mixing costs within an established framework of EFs that captures executive processes common across tasks as well as those unique to specific EFs (Unity/Diversity framework). We first assessed the degree to which individual differences in mixing costs across three different task switching paradigms shared common variance. Each loaded onto a single latent mixing factor (ps<.001) indicating shared underlying processes. Through confirmatory factor analysis, we next investigated the extent to which this latent mixing factor relates to established abilities within the Unity/Diversity framework (Common EF, Updating-Specific, Shifting-Specific). The mixing cost latent variable showed a moderate correlation with the Common EF factor (r=.59, p<.05) and nonsignificant correlations with Updating-Specific and Shifting-Specific (both rs=.11, ps>.10). Results indicate that the additional cognitive control required during mixed block repeat trials relies on common executive processes, as well as unique abilities distinct from both shifting and updating.

Topic Area: EXECUTIVE PROCESSES: Goal maintenance & switching

Causal evidence for learning-dependent frontal lobe contributions to cognitive control

Poster D39, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Paul Muhle-Karbe[1], Jiefeng Jiang[1,2], Tobias Egner[1]; [1]Duke University, [2]Stanford University

The prefrontal cortex (PFC) is essential for controlling attention to amplify processing of task-relevant information. Although such control is of fundamental importance in pursuing goals, it can also be costly when deployed excessively. Efficient behavior therefore requires a careful regulation of PFC-based cognitive control to align it with changing external demands. This regulation can be observed in the Stroop task, where participants typically adapt their attentional selectivity based on the recent (trial-wise adaptation) or frequent (block-wise adaptation) experience of conflict. We have recently shown that both effects are captured by a volatility-driven reinforcement-learning model that learns to predict forthcoming control demand. Moreover, activity in the lateral PFC tracked learning-based adjustments in behavior (Jiang et al., 2015, Nat Comm). Here, we present a follow-up transcranial magnetic stimulation (TMS) study that probed the causal relevance of this region in learning-based engagement of control. Participants completed a Stroop task with dynamically changing conflict probabilities, and TMS was given on each trial just prior to stimulus onset (5 pulses, 10 Hz, 60% of stimulator output), either over the lateral PFC or over a control site. Results show that, in the control condition, participants adapted their performance to changing demands, as reflected by adaptation effects at both time scales. In contrast, no evidence for behavioral adaptation was found at either time scale during the PFC session. These preliminary results suggest a causal role for the PFC in implementing learning-dependent changes in cognitive control over stimulus processing. Additional, model-based analyses will be presented at the meeting.

Topic Area: EXECUTIVE PROCESSES: Goal maintenance & switching

Dynamics of hippocampal-prefrontal cortex interactions supporting event segmentation

Poster D40, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Anna Jafarpour[1], Sandon Griffin[1], Jack J. Lin[2], Robert T. Knight[1]; [1]University of California, Berkeley, California, [2]University of California, Irvine, California

Event-segmentation is a process applied to the stream of perception that identifies the temporal-context of an episode. The stream of events is segmented based on their temporal relevance that starts with perception of a salient change. The intensity of changes in the stream of perception depends on the level of the new event saliency or novelty. The human prefrontal (PFC) and the medial temporal cortices (MTL) are critical for detecting salient events and establishing their temporal-context. We recorded intracranial-electroencephalography from the PFC and MTL of epilepsy patients (n=6) with electrodes implanted for clinical purposes. The patients watched movies and the degree of event saliency for every movie frame was established by an independent behavioral analysis. We used this behavioral regressor to examine the relationship between event saliency and neural activities. The results revealed that the power of low gamma band activity (30-70Hz) and high-gamma band (70-150Hz) activity in the hippocampus, PFC and OFC predicted the intensity of event saliency (corrected $P<0.05$). Moreover, the functional connectivity between the medial PFC and the MTL in the theta band changed according to the saliency of events. Our findings provide evidence for the dynamics of PFC-MTL interactions coordinating event segmentation in the stream of perception.

Topic Area: EXECUTIVE PROCESSES: Goal maintenance & switching

Correlations between Gray-White Matter Blurring in Prefrontal Lobe Regions and Cognitive Set-Shifting in Healthy Adults

Poster D41, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Carl Kim[1], Joehyun Kim[2], Sanford Kim[3]; [1]St. Paul's School, [2]Academy for Medical Science Technology, [3]Horace Mann School

Humans have a unique capacity for higher-order cognition such as planning and multitasking. These abilities are collectively referred to as “executive functions.” This study investigates cognitive set-shifting, a type of executive function that involves shifting from one task to another. Advances in neuroimaging have allowed for the structural integrity of specific frontal-lobe subregions to be probed with greater resolution. One such measure is the intensity contrast between cortical gray and white matter (GWC), with greater contrast indicating better development (Blackmon et al., 2011). This study tested whether GWC in 8 subregions of the Prefrontal Cortex (PFC) was associated with set-shifting abilities in 61 healthy controls. Set-shifting abilities were measured using two neuropsychology tests: Trail Making Test B (TMT-B) and Wisconsin Card Sorting Test-Perseverative Errors (WCST-PE), with a third test, the Boston Naming Test (BNT), used to determine the discriminant validity of set-shifting findings. Cognitive set-shifting was significantly correlated with GWC in the left ventrolateral PFC (Broca’s area), the left and right middle frontal gyri (dorsolateral PFC), and the left and right superior frontal gyri. These findings indicate that successful set-shifting relies on the structural integrity of ventrolateral and dorsolateral PFC but not the basal orbitofrontal regions.

Topic Area: EXECUTIVE PROCESSES: Goal maintenance & switching

Acute stress alters specific elements of cognitive flexibility in chronic cannabis users

Poster D42, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Amy T Nusbaum[1], Paul Whitney[1], Carrie Cuttler[1], Alexander Spradlin[1], Ryan J McLaughlin[1], John Hinson[1]; [1]Washington State University

As recreational use of marijuana becomes increasingly common, there is an urgent need to better understand the long-term consequences of its use. In terms of effects on cognition, the current literature on chronic marijuana use is equivocal. Here we contrast chronic marijuana users and control subjects on multiple measures of cognitive flexibility (CF), the ability to adjust cognitive and behavioral strategies to changing environmental circumstances. We also manipulated acute stress using the Maastricht Acute Stress Test to determine if chronic cannabis use is associated with different physiological and cognitive stress reactions. Self-reported chronic users (N=40) and non-users (N=43) were randomly assigned to stress and control conditions, and then performed two different tasks measuring CF: (a) a well-established task switching measure, which also included assessment of the ability to overcome response competition, and (b) a novel measure of the ability to adjust top-down control of attention with shifts in the validity of cues that predicted the identity of target stimuli. The acute stress manipulation was effective, leading to increased cortisol levels and subjective stress ratings. Chronic cannabis users generally performed well on the CF measures, but when they were under acute stress they showed a larger effect of task switching on trials that required both inhibition of a dominant response and a switch from a previous rule. Our results suggest that investigations of the effects of chronic marijuana use on cognition should consider whether the effects vary depending on the degree to which situational challenges are also present.

Topic Area: EXECUTIVE PROCESSES: Goal maintenance & switching

Effect of a dopaminergic antagonist on the drives to perform extraordinary roles

Poster D43, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Tim Hadjis[1,3], Gifty Asare[1,3], Ana Fernandez-Cruz[4], Ola Mohamed Ali[1,3], Ishan Walpolla[1,3], Julia Segal[1,3], Bruno Debruille[1,2,3]; [1]Department of Psychiatry, McGill University, Montreal, QC, Canada, [2]Department of Neurology and Neurosurgery, McGill University, Montreal, QC, Canada, [3]Douglas Mental Health University Institute, Montreal, QC, Canada, [4]McGill University Integrated Program in Neuroscience, Montréal, QC, Canada

The will to play extraordinary social roles in healthy participants could be a factor of the symptoms measured in the continuum existing from normality to schizophrenia. In a previous study, healthy participants who accepted a greater percentage of the extraordinary roles did it faster compared to those who accepted a lower percentage of such roles and had higher schizotypal personality (SPQ) scores. Here, we tested if dopaminergic antagonists act by changing the will to play extraordinary roles. Healthy volunteers were recruited to fill out questionnaires assessing schizotypal traits and were either given one minimal dose (i.e., 1 mg) of risperidone (N=45) or a placebo (N=37). They were then presented with hundreds of names of social roles and asked, for each of them, to decide whether or not they could consider playing it at any moment in their lives. Using a median split, participants were then divided into a group of high- and a group of low-accepters of extraordinary roles. In contrast to predictions, relative to placebo, risperdal increased the percentages of extraordinary roles accepted in the high- and not in the low-accepter group ($F(1,70)=8.012$, $p=0.006$). Risperidone also increased the percentages of favorable roles accepted in the high- but not in the low-accepter group ($F(1,70)=4.919$, $p=0.03$). Nevertheless, risperidone delayed acceptance and rejections in high- and not in low-accepters for all types of social roles ($F(1,76)=5.03$, $p=0.028$). The results found here suggest that dopaminergic antagonists may change the drives to play social roles in high-accepters of extraordinary roles.

Topic Area: EXECUTIVE PROCESSES: Goal maintenance & switching

The Neural Correlates of Proactive and Reactive Control in Bilingual Word Production

Poster D44, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Junjie Wu[1], Yongben Fu[1], Chunyan Kang[1], Shuhua Li[1], Taomei Guo[1]; [1]Beijing Normal University

Bilingual speakers can use two languages with one brain. Thus, they engage more cognitive control to select the correct intended language. The present study examined the neural activity of proactive control and reactive control during bilingual word production. Chinese-English bilinguals were instructed to name pictures in their native language or second language. Compared to naming pictures in single language blocks, bilinguals need more proactive control to predict and resolve conflicts in the mixed naming blocks. In the mixed naming context, compared to non-switch trials, bilinguals need more reactive control to inhibit the parallel activated non-target language in the switch trials. We found that naming latencies for mixed language blocks were significantly longer than those for single-language trials, and that naming latencies for switch trials were significantly longer than those for non-switch trials. The fMRI results showed that the proactive control involved bilateral middle frontal gyrus, left inferior parietal lobule, left superior parietal and right frontal operculum; whereas the reactive control engaged left supplementary motor area, right putamen, right inferior temporal gyrus, and bilateral cerebellum. This results indicate a separate brain network of proactive control and reactive control in bilingual production. Specifically, proactive control depends on the frontal-parietal network, and reactive control depends on frontal-subcortical network and cerebellum.

Topic Area: EXECUTIVE PROCESSES: Goal maintenance & switching

Investigation of the changes in oscillatory power during rule switching after mild traumatic brain injury

Poster D45, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Stephanie Barlow[1], Paolo Medrano[1], Daniel Seichepine[2], Robert Ross[1]; [1]University of New Hampshire, [2]University of New Hampshire-Manchester

Mild traumatic brain injury (mTBI) can cause persistent cognitive changes years after the injury. These cognitive changes may be due to changes in neural communication. Rule-switching is a cognitive control operation susceptible to mTBI and is associated with oscillations in the alpha frequency range (8-12 Hz). This study aimed to investigate oscillatory power during rule switching after mTBI. EEG and behavioral data was collected from eleven participants with a history of two or more concussions (mTBI) and twelve age- and sex-matched controls as they performed a rule-switching task. The participants were asked to differentiate whether visual stimuli were red or green, or circles or squares, depending on a presented cue. The cue changed every few trials and the first trial after a rule-change was termed a switch trial. During switch trials, a right posterior inferior region showed a significant difference in alpha oscillatory power between mTBI and matched controls. The control group showed greater alpha power around 1000ms post-cue, though alpha was present in the mTBI group. Though the mTBI group showed lower alpha power, that power was sustained between 1000-1400ms post cue and was greater around 1400ms post cue. There were no differences in response time or accuracy during switch trials, which may be attributed to the sustained duration of alpha seen in the mTBI group. The sustained alpha power seen in mTBI participants may be a compensatory mechanism to maintain rule-switching ability despite the initial lessened alpha power seen during switch trials.

Topic Area: EXECUTIVE PROCESSES: Goal maintenance & switching

Decoding rule modality in the human left inferior frontal gyrus

Poster D46, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Michele Furlan[1], Laura Babcock[2], Antonino Vallesi[1]; [1]Department of Neuroscience, University of Padua, Padua, Italy, [2]Department of Neuroscience, Karolinska Institutet, Stockholm, Sweden

Many daily activities require us to integrate information and extrapolate unknown rules, a process known as inductive reasoning. Until recently the left prefrontal cortex (PFC) was thought to integrate information across verbal patterns, but recent evidence showed that the left inferior frontal gyrus (IFG) is able to apply inductive reasoning to both verbal and spatial information. Here we used multivariate pattern classification of fMRI data to decode the representation of rule modality during different types of rule search. Thirteen participants were asked to extract the rule underlying streams of letters presented in different spatial locations. The rule was either verbal (letters forming words pertaining to a single semantic category) or spatial (letters forming geometric figures). The rule search was carried out either serially (i.e. the modality to attend was known by participants) or in parallel (i.e. the modality to attend was unknown). Our results show that information about rule modality is reliably represented in the left IFG but not in the right one, and that this representation was stronger when the modality to attend to was known in advance. These results were replicated in a second confirmation analysis run on the same participants who completed the same experiment two years after the acquisition of the first one. These findings extend our knowledge of the neural mechanisms of inductive reasoning and how relevant information is mapped on the prefrontal cortex [This project was funded by the FP7 European Research Council Starting Grant LEX-MEA (GA #313692) awarded to AV].

Topic Area: EXECUTIVE PROCESSES: Goal maintenance & switching

Visual field maps limit working memory precision

Poster D47, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Xingyu Ding[1,2], Wayne E. Mackey[1], Clayton E. Curtis[1], Xiao-Jing Wang[1,2], Jonathan Winawer[1]; [1]NYU, [2]NYU Shanghai

The storage capacity of working memory (WM) is severely limited, and this limitation varies greatly both between individuals and across the lifespan. Currently, the neurobiological basis of this limitation is unknown. Here, we show that the sizes of select visual field maps in early visual cortex and frontoparietal cortex limit the precision of WM representations. First, we used a recurrent (attractor) network model of spatial working memory to investigate how the size of the neural population affected the fidelity of the WM representation. Results show that with a larger population size, the precision of the decoded WM representation is enhanced. Second, we carried out nonlinear population receptive field mapping to identify visual field maps in early visual and frontoparietal cortex of human subjects. This allowed us to quantify the size of specific populations in individual subjects. We then correlated the size of visual field maps with individual performance during a spatial working memory task and found that the size of select visual field maps predicted WM precision. Finally, using our measurements of visual field maps for each individual subject, we simulated population level activity in each visual field map with our neural network model. This simulation demonstrates that the precision of the WM representation in the population activity correlates with WM accuracy. Together, these results support the hypothesis that WM resources are limited by neural architecture in visual and frontoparietal cortex known to be critical for WM performance.

Topic Area: EXECUTIVE PROCESSES: Working memory

Dynamic coding in PFC, FEF and LIP during a change localization working memory task

Poster D48, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Dante Wasmuht[1], Eelke Spaak[1], Timothy J. Buschman[2], Earl K. Miller[3], Mark Stokes[1]; [1]Oxford University, [2]Princeton University, [3]Massachusetts Institute of Technology

Maintenance of task relevant information during working memory has been a matter of debate. Recent advances in population-level analysis reveal complex dynamics during working memory encoding. Here, we explore these dynamics using multi-electrode electrophysiological data recorded from non- human primates (macaca mulatta), performing a delayed change localization task. Neuronal activity from three different brain regions, lateral-prefrontal cortex (PFC), frontal eye-fields (FEF), intraparietal cortex (LIP), was recorded simultaneously. Using multivariate pattern analysis, we found that all task relevant features were decodable from each of the three brain regions even though mean activity declined to baseline levels during the memory delay. Moreover, we found that in all three brain areas, decoding was time-specific, the hallmark signature of dynamic coding. Applying a general linear model based approach to explore the temporal dynamics of single cells, we identified a large proportion of neurons with a dynamic selectivity i.e. neurons were selective to different features of the item to be remembered at different time points. Using simulations of artificial neuronal populations generated from the observed data we suggest that most of the observed dynamic coding might be explained by the dynamic selectivity of individual neurons. We also find a relationship between these dynamics and the intrinsic time-scales for individual neurons.

Topic Area: EXECUTIVE PROCESSES: Working memory

Electrophysiological Correlates of Time-Based Prospective Memory in Individuals Across the Lifespan

Poster D49, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Erin E. Aisenberg[1], Christy C. Chan[1], Sarah A. Raskin, Ph.D.[1]; [1]Trinity College

This study investigated the relationship between a clinical measure of time-based prospective memory (PM) and a computerized paradigm (Cona et al., 2012) that examined time-based PM in individuals in different age groups. PM involves the ability to form and realize intentions after a time delay (Einstein & McDaniel, 1990). The Memory for Intentions Screening Test (MIST) was used to clinically assessed both time- and event-related PM, which were compared with the electrophysiological and behavioral data collected as participants completed a computer-based PM task that assessed time-based PM. Older adults performed significantly worse on MIST tasks with a 15-minute time delay, event-based cues, action-based responses, and their total MIST scores were also significantly lower than that of younger adults. On the computerized-PM tasks, older adults performed significantly worse on PM tasks with a 5-minite time delay. ERP data was significantly different between groups only on realized 5-minute PM blocks. In the 275-325 ms post-stimulus time window, older adults had significantly higher amplitudes in left frontal electrodes and significantly reduced amplitudes in right parietal and occipital electrodes indicating their frontal lobes work harder in maintaining the intention. The reduction in the occipital electrode was the only ERP difference that extended into the 550-600 ms post-stimulus time window, a period critical for cue detection. Previously Cona et al. (2012) found a similar pattern in event-based PM, possibly indicating the presence of a separate clock altered the nature of the time-based cue into more of an event-based cue.

Topic Area: EXECUTIVE PROCESSES: Working memory

sFROST: a Spiking Model of Working Memory Maintenance

Poster D50, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Zachary Hutchinson[1], Sebastien Helie[2], Shawn W. Ell[1]; [1]University of Maine, [2]Purdue University

Neurocomputational modeling is a powerful tool for grounding explanations of cognitive processes within neuroanatomical and neurophysiological constraints. The FROST (FROntal-Striatal-Thalamic) model of working memory maintenance proposes that to-be-remembered items are encoded in the lateral prefrontal cortex and maintenance depends upon reverberant activity in a network of cortical and subcortical structures (i.e., basal ganglia, thalamus). The original version of FROST predicted continuous membrane potentials. In the present work, we develop a spiking version of FROST (sFROST) that offers an increase in neurobiological realism. Benchmark simulations demonstrate that sFROST successfully accounts for single-cell recording data and human behavioral data. The impact of scaling the model (i.e., increasing number and connectivity of neurons) and adding a more detailed basal ganglia network will be investigated.

Topic Area: EXECUTIVE PROCESSES: Working memory

Retroactive attention can protect multiple working memory contents from perceptual interference. Evidence by event-related EEG parameters in a retro-cuing paradigm

Poster D51, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Anna Magdalena Barth[1], Edmund Wascher[2], Daniel Schneider[3]; [1]Leibniz Research Centre for Working Environment and Human Factors #1, 2, 3

To enable goal-directed behavior in changing environmental conditions it is important to keep working memory updated and to avoid distraction by irrelevant information. Focusing attention within mnemonic representations is typically studied using retroactive cues (retro-cues). So far, neither the neural correlates of protection from interference nor the amount of information that can be protected by selective attention are well understood. We addressed this issue by running EEG during a visual working memory task based on retro-cues. Participants had to memorize the angle of three differently colored bars followed by one of four retro-cue types. Two selective retro-cues indicated a subset of the memory array as being relevant for report (one or two of three bars). Additionally, two types of neutral cues were used: one cue repeated the color and position of all three bars; the other one was completely non-informative. A distractor display was presented during the retention interval in half of the experimental blocks. A distractor-induced performance decrease was only observed in neutral retro-cue trials whereas the presentation of selective retro-cues attenuated the distractor effects. Event-related potentials revealed a negative slow wave component over posterior electrodes reflecting the amount of items held in working memory after the retro-cue presentation. Moreover, a P3-like component after distractor onset in neutral retro-cue conditions indicated interference with the information held in working memory. This leads to the conclusion that selective retro-cues facilitate to an optimization of cognitive resources for preventing visual distractors from getting access to working memory.

Topic Area: EXECUTIVE PROCESSES: Working memory

The effects of individual variations in Contrast Sensitivity on Working Memory: An ERP study.

Poster D52, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Cristina Filannino[1], Elliot Freeman[1], Andrew Parton[2], Corinna Haenschel[1]; [1]City, University of London, [2]Brunel University London

Few studies have examined the basic visual processes underlying encoding into working memory (WM). Here we investigate how individual variations in sensitivity to contrast affect WM. More specifically, we utilised stimuli for which the perceived contrast depends on the strength of lateral inhibitory activity in early visual areas as indexed by both behaviour and ERP responses. In an initial contrast matching task (CM), twenty participants confirmed that a central target grating appeared to have less contrast in the context of a co-oriented surround compared to an orthogonally-oriented surround. A further contrast detection task was then used to set individual supra-threshold contrast levels in the main WM match-to-sample task. On each trial of that task, participants viewed one to three sequentially presented oriented gratings surrounded by either orthogonal or parallel band-pass filtered noise. They then judged whether a subsequent probe (without a surround) matched any of the targets. Performance on CM and WM tasks correlated significantly: greater co-oriented surround suppression of perceived contrast predicted better match-to-sample accuracy. WM performance based on simple visibility of the target would have predicted the opposite relationship. During WM encoding, the P2 ERP component was significantly higher in the orthogonal condition. Furthermore, during retrieval P1 component and slow-wave activity were modulated by WM load. This slow-wave activity correlated with the CM surround-orientation effect on perceived contrast, even though the evoking probe stimulus had no surround. In summary, fundamental contrast processing mechanisms affect WM processing. This is reflected in both visual and higher cognitive ERP components.

Topic Area: EXECUTIVE PROCESSES: Working memory

rTMS stimulation on right frontal and parietal reduces the impairment of object location changes on object identity change detection

Poster D53, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

PING YANG[1,2,3,4], LING LI[1,2,3,4]; [1]Key Laboratory for NeuroInformation of Ministry of Education, [2]High-Field Magnetic Resonance Brain Imaging Key Laboratory of Sichuan Province, [3]Center for Information in Medicine, [4]University of Electronic Science and Technology of China

In visual working memory (VWM) task, object location plays a crucial role in object identity change detection, since it indicates the spatial coordinates of the object and the focus of attention allocation. In our previous fMRI study, subjects responded faster in the object color change detection when the probe array share the same spatial location as the memory array compared to when it was changed. Subjects responded more accurately in location match compared to location no-match conditions, when a higher VWM load was utilized. Our fMRI results indicate right supramarginal gyrus (SMG) (MNI = 57, -48, 33) and right inferior frontal gyrus (IFG) (MNI = 54, 15, 6) were responsible for the object location discrimination. To confirm the specialized role of these two regions, we applied a 10 Hz with 5 pulses repetitive transcranial magnetic stimulation (rTMS) over right SMG and right IFG, as well as an additional control site (CZ) when the probe array onset. In the CZ stimulation, subjects responded more accurately during the match versus on-match object location condition only for higher VWM load of 4, consistent with previous fMRI study. However, in the SMG and IFG stimulation, the location match advantage effect disappeared. For the reaction time (RT), all of three regions stimulation showed the location match advantage, which is shorter RT for the location match compared to no-match condition. Overall, our results support the specialized role of right SMG and right IFG in the object location discrimination implicated in the object color change detection.

Topic Area: EXECUTIVE PROCESSES: Working memory

Variability in attentional control explains working memory impairments in ADHD

Poster D54, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Sarah L. Karalunas[1], Brittany Alperin[1], Christiana Smith[1]; [1]Oregon Health & Science University

Decreased working memory capacity and increased performance variability are two of the most commonly observed cognitive impairments in Attention-deficit/hyperactivity disorder (ADHD), but it is fundamentally unclear whether they should be viewed as two distinct deficits or as manifestations of the same underlying problem. Put another way, differences in working memory may arise not from consistently low memory capacity per se, but from variability in engaging that capacity. Here, we propose that working memory impairments and increased performance variability in ADHD both reflect limitations on attentional control. Using a novel adaptation of the well-validated change detection task, we examine fluctuations in working memory performance in a sample of 111 adolescents (50 with ADHD) and directly compare neurophysiological responses on trials with and without lapses of attention. Lower working memory capacity in children with ADHD fit with a graded attentional control model. Within the ADHD group, lapse trials were associated with smaller amplitude P1/N1 responses to stimuli than non-lapse trials. Greater alpha suppression in the pre-stimulus fixation period predicted higher average working memory performance. Results add parsimony to cognitive theories of ADHD and suggest that variability in engaging attentional control can account for working memory impairments in the disorder. Identifying mechanisms of cognitive impairments and neurophysiological predictors of performance in ADHD will be critical for developing novel treatments for the disorder.

Topic Area: EXECUTIVE PROCESSES: Working memory

The N170 ERP component differs in laterality, distribution, and association with continuous reading measures for deaf and hearing readers

Poster D55, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Karen Emmorey[1], Katherine J. Midgley[1], Phillip J. Holcomb[1]; [1]San Diego State University

The N170 ERP component is hypothesized to reflect print-tuning in skilled readers. This study investigated whether deaf and hearing readers (matched on reading ability) exhibit similar N170 patterns, given their distinct experiences learning to read. Thirty-two deaf and 32 hearing adults were presented with 60 words (e.g., TABLE) and 60 symbol strings (e.g., %$#@+) in a familiarity judgment task. We measured the amplitude of an early (130-180ms) and late (180-230ms) N170 epoch over left (LH) and right hemisphere (RH) posterior electrode sites. For the early N170 epoch, hearing readers produced substantially larger activity at temporal than occipital sites while deaf readers produced slightly larger activity at occipital sites. For the late N170 epoch, hearing readers produced larger activity for words than symbols in the LH, while deaf readers did not show an asymmetry. Linear mixed effects regression was used to examine the influence of continuous measures of reading, spelling and phonological skills on the N170 (130-230ms). For deaf readers, better reading ability was associated with a larger N170 over the RH, but for hearing readers better reading ability was associated with a smaller RH N170. Better spelling ability was strongly related to larger occipital N170s in deaf readers, but this relationship was weak in hearing readers. Better phonological awareness was associated with smaller N170s in the LH for hearing readers, but this association was weaker and in the RH for deaf readers. The results indicate that print-tuning differs for deaf and hearing readers and may be linked to different skills.

Topic Area: LANGUAGE: Lexicon

When Script met Sally: An ERP study on the impact of lexical processing during the early encoding of handwritten words

Poster D56, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Marta Vergara-Martinez[1], Manuel Carreiras[2], Eva Gutierrez-Sigut[1], Cristina Gil[2], Manuel Perea[1,2]; [1]Universitat de Valencia, [2]Basque Center on Cognition, Brain and Language (BCBL)

The legibility of the script has a strong impact in the recognition of handwritten words. Behaviorally, the word-frequency (WF) effect is greater for difficult-to-read handwritten words than for typewritten (printed) words. This effect may reflect the influence of top-down mechanisms in disambiguating noisy and ambiguous forms during visual-word recognition. In a lexical decision ERP experiment, we aimed to track the stages at which top-down processing meets early perceptual encoding. Participants were presented with high- and low-frequency words that varied in the legibility of the script (printed, easy-to-read handwritten, difficult-to-read handwritten). Behaviorally, the WF effect was larger for difficult-to-read than for easy-to-read handwritten words or printed words. The ERP data showed a large effect of script in early (perceptual) stages of processing: we found larger N170 amplitudes for handwritten than for printed words. More important, we found an interaction between Script and WF in the N170 amplitude (WF effects were already present in the two types of handwritten words, but not in the printed words). These results suggest that the "normalization process" (at a feature-to-letter level) entails an extra cost when encoding noisy and ambiguous letter forms (i.e., handwritten words), possibly reflecting an early effect of top-down feedback on the N170. This pattern of results is consistent with fully interactive models of visual-word recognition.

Topic Area: LANGUAGE: Lexicon

An ERP Investigation of Repetition Priming Effects in American Sign Language: Time-locking to Dynamic Stimuli

Poster D57, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Katherine J. Midgley[1], Phillip J. Holcomb[1], Karen Emmorey[1]; [1]San Diego State University

In a previous study we reported that ERPs recorded to ASL signs in a repetition priming paradigm produced a similar pattern of effects as has been found for written and spoken words: larger N400s for unrepeated compared to repeated signs. However, the time course of this effect was substantially delayed and longer in duration than generally observed for written word repetition. Previous spoken word repetition effects show a prolonged N400 duration, but the N400 onset is generally early (~300 ms). For speech, acoustic information arrives dynamically, while for written words all of the visual information is available for processing simultaneously. Signs share attributes of both modalities, being dynamic in nature but delivering some phonological information simultaneously rather than sequentially. We tested the hypothesis that our original results were due to the dynamic and overlapping nature of information available in the signed signal. Specifically, we edited the 200 ASL videoclips from the previous ERP repetition experiment so that videoclips began two frames before the onset of the sign (as determined by native ASL signers), rather than from a rest position with the model's hands in her lap. Nineteen deaf signers performed a go/no-go semantic categorization task, and forty items were repeated. As expected, the N400 repetition effect began substantially earlier than in the original study and in fact had a time course much like that seen in previous written word studies. Thus, the timing of the N400 effect for sign language crucially depends upon whether ERPs are time-locked to sign onset.

Topic Area: LANGUAGE: Lexicon

Word Frequency Effects During Ambient Language Processing

Poster D58, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Laurel Lawyer[1], Andrew Kessler[1], Lee Miller[1], David Corina[1]; [1]University of California, Davis

Language processing is typically characterized as an obligatory and automatic process. However, whether language mechanisms are fully engaged when we encounter ambient speech is less well understood. In this study we examined whether word frequency effects are detectable during ambient language processing. Methods: 32-channel EEG was acquired while subjects (N=25) passively viewed a 12 minute silent cartoon flanked by concentric flashing checkerboard patterns (visual data not discussed) and heard ambient free-field speech. Speech stimuli consisted of 49 sentences, grouped into three repeated two-minute blocks. Subjects were given no overt task. Results: Responses to open-class words were split into high and low frequency quartiles. Difference waves were analyzed between 0 and 600 msec. using the Mass Univariate Toolbox (Groppe et al. 2011). Cluster mass permutation testing showed significantly larger amplitude responses for low frequency words than high frequency words ($p < .01$) in bilateral frontal sites, beginning at 140 msec. and persisting through 220 msec. Conclusions: The time course and distribution of these effects is in alignment with previous studies showing early frequency effects using single-word presentation in reading (eg. Penolazzi et al. 2007) and passive auditory oddball paradigms (eg. Shtyrov et al. 2011). The present data illustrates that these effects are not limited to single-word processing and may be evoked in response to ambient speech. This suggests early frequency effects are robust in speech perception and provides further support that lexical processing circuits are engaged automatically, outside of task demands.

Topic Area: LANGUAGE: Lexicon

Orthographic and phonological sensitivity in the reading network in skilled deaf readers.

Poster D59, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Laurie S. Glezer[1], Jill Weisberg[1], Cindy O'Grady[1], Stephen McCullough[1], Katherine J. Midgley[1], Phillip J. Holcomb[1], Karen Emmorey[1]; [1]San Diego State University

People who are born deaf frequently have difficulty learning to read. Numerous studies have examined reading in people who are deaf, yet to date there is no clear understanding of what contributes to these reading difficulties or why some deaf people are good readers and others are not. Previous studies in typical hearing readers show that within the reading network there are regions that specialize in processing orthography and others that specialize in processing phonology during reading (Glezer et al., 2016). We used fMRI rapid adaptation in deaf adults who were skilled readers. We presented pairs of words that differed in orthographic and phonological similarity to examine neural selectivity in three functional ROIs in the left hemisphere: temporoparietal cortex (TPC), inferior frontal cortex (IFC), and the visual word form area (VWFA). Our results showed that in skilled deaf readers, there was no adaptation within the VWFA for homophones or words that were 1-letter different, suggesting neurons in this region are finely tuned to whole words at the orthographic level. In contrast, in the TPC, there was adaptation for homophone pairs, suggesting sensitivity to phonological codes in this region. Finally, in the IFC there was sensitivity to orthographic overlap but no sensitivity to phonological overlap. These results parallel the results of Glezer et al. for hearing readers, suggesting that skilled deaf readers engage the reading network in the same manner as hearing readers, despite poorer speech-based phonological skills.

Topic Area: LANGUAGE: Lexicon

Bilingual lexical access is triggered by the intention to speak: behavioral and ERP/EEG evidence.

Poster D60, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Francesca Martina Branzi[1], Emmanuel Biau[2], Clara Martin[3], Albert Costa[4]; [1]University of Manchester, [2]Maastricht University, [3]Basque Center on Cognition, Brain and Language (BCBL), [4]Pompeu Fabra University; ICREA, Institució Catalana de Recerca i Estudis Avançats

When bilinguals plan to speak even one word, lexical entries in the two languages get concurrently activated. However, whether this may happen even without the intention to speak has not been explored yet. In the present study, we tested bilinguals in a task where participants had naming intention (i.e., naming task) and a task where there was no naming intention (i.e., semantic classification task), using the same picture stimuli. In order to assess the presence of languages' co-activation, we manipulated the cognate status of the pictures and we recorded the EEG signal to differentiate the time-course of the cognate effect (non-cognates vs. cognates) on the ERPs depending on the task (naming vs. semantic). We also performed mean amplitude analysis (power) in the theta (6-7Hz) and alpha (9-10Hz) frequencies, which have been related to semantic-lexical retrieval processes and top-down control respectively. Reaction times were significantly increased by non-cognates stimuli in the naming task only. This modulation was reflected at neural levels by a negative ongoing shift in the non-cognate evoked ERPs. Power analysis revealed an increase of alpha activity for non-cognate stimuli in the naming task but not in the semantic task. Finally, we found an increase of theta activity significantly greater in the naming task as compared to the semantic one. Taken together, these findings seem to suggest that activated concepts do not automatically trigger bilingual lexical access. Rather, only when bilinguals have conscious intention to name an object their brain engages lexical access in the two languages.

Topic Area: LANGUAGE: Lexicon

Investigating the Temporal Dynamics of Word Processing Using Multiband fMRI

Poster D61, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Stephen Bailey[1], Laurie Cutting[1,2]; [1]Vanderbilt Brain Institute, Vanderbilt University, [2]Vanderbilt Kennedy Center, Vanderbilt University

Reading requires distant areas of the brain to rapidly coordinate, passing along information from visual regions to language processing regions. Research using MEG and EEG suggest that this process occurs in less than half a second, with an initial sweep of visual information, followed by feedback from various other cortical areas (Carreiras et al, 2014). Recent advances in parallel slice acquisition with fMRI enable sub-second temporal resolution, opening up the possibility of studying network dynamics in tasks such as reading. Here, we determined whether the BOLD response, measured at a 600ms sampling rate, could detect temporal differences in the hemodynamic responses of regions involved in word recognition. We acquired 3-4 eight-minute runs of fMRI data from 12 subjects while they completed a word recognition task using sparse event-related presentation. Analysis of the BOLD signal showed, on average, a canonical hemodynamic response among nodes in the language network, with the left inferior frontal gyrus emerging as the key phonological processing region. This contrasted with uniform deactivation among default mode network ROIs across conditions. Across individuals, the hemodynamic response showed the canonical shape; however, there was individual variability in both the mean amplitude and width of the response. Results suggest that multiband fMRI can capture variability in its shape across individuals and trials. Future investigations will address how response properties are related to behavioral indices, such as reading skill, and explore more complex reading tasks such as discourse processing.

Topic Area: LANGUAGE: Lexicon

Primary motor cortex is involved in online word learning: A combined TMS-MRI study

Poster D62, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Nikola Vukovic[1], Yury Shtyrov[1]; [1]Center of Functionally Integrative Neuroscience, Institute for Clinical Medicine, Aarhus University, Denmark

Language processing recruits a fronto-temporal cortical network, which is complemented by a distributed network of modal areas, such as the motor cortex, that encode modality-specific referential aspects of meaning. Since most studies typically focus on already fully-formed adult vocabulary, it remains unclear how and when exactly modality-specific areas become involved in language processing. Here, we addressed this using a 3D virtual reality-based learning game to teach adult participants new action verbs and object nouns, such that their meaning was learned in a contextually relevant and immersive fashion. We used offline continuous theta-burst stimulation over primary motor cortex (M1, defined using individual MRI images and fMRI localiser task) to test the hypothesis that this area selectively encodes aspects of action verb meaning early on in the process of word acquisition. Our results indicate that TMS of M1 (as opposed to a control site in a different participant group) interferes with the learning process, as revealed by a significantly increased number of errors during training. This variable encoding accuracy between the motor and control TMS groups was further corroborated in a post-learning lexical decision task, which showed that significant between-group RT differences were only pronounced for newly learned action verbs, but not for new nouns or real native words. These behavioural results are further accompanied by MRI measures of structural reorganisation within motor, inferior frontal and temporal regions of interest. Overall, our study highlights rapid brain plasticity during word learning, and the motor cortex's functional involvement in its earliest phases.

Topic Area: LANGUAGE: Lexicon

No escape from morphological parsing in Semitic languages: The case of proper nouns in Arabic

Poster D63, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Sami Boudelaa[1]; [1]Department of Linguistics, United Arab Emirates University

Previous studies suggest that the neural and functional mechanisms involved in the analysis of Arabic words require processes of morpho-phonological assembly and disassembly, systematically analysing words in this language into a root plus an word pattern (e.g., [katama] 'conceal' = {ktm} + {-a-a-}) (Boudelaa, Bozic & Marslen-Wilson, 2010; Boudelaa & Marslen-Wilson, 2015). On this account, any input string that shows the critical diagnostic properties of a complex word –presence of two or three consonants– will automatically trigger an attempt at segmentation to identify the underlying component morphemes. Here I report a masked lexical decision experiment which explored the contribution of this critical morphological property to the processing of Arabic proper nouns such as [baliig] 'eloquent' in the context of the full name [baliig Anajjaar]. The results show that an Arabic proper noun effectively primes not only a target with which it shares a root and a transparent semantic relationship (e.g., [baliig Anajjaar]-[balaagah] 'eloquent'-'eloquence'), but also a target with which it shares a root and an opaque semantic relationship (e.g., [baliig Anajjaar]-[buluug] 'eloquent'-'puberty'). Matched semantic and phonological controls showed no evidence of such facilitation. These findings clearly show that there is no escape from morphological parsing processes in Arabic so long as the input item comprises the criterial structural properties. At the representational level, these finding suggest that damage to the anterior temporal lobe, standardly thought to house proper nouns, should not affect proper noun processing any more (or any less) than it does common noun processing in Arabic.

Topic Area: LANGUAGE: Lexicon

Decoding phonology and lexicality from MEG data

Poster D64, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Keith Doelling[1], Bijan Pesaran[1], David Poeppel[2]; [1]New York University, New York, NY, [2]Max Planck Institute for Empirical Aesthetics, Frankfurt, Germany

There exists a large body of research on effects of lexical status on speech recognition, including in the neuroimaging literature. Often, these studies have used pseudowords (i.e. items that conform to the phonological rules of a language but have no meaning) as a control to isolate semantic processing from acoustic and phonological analysis. Is this comparison accomplishing what it promises, i.e. does the brain process pseudowords just as it would words except for semantic analysis? Or is more processing required to deal with items that are not stored in our lexicon and could potentially be incorporated as a new word? Here we apply multivariate decoding techniques to MEG data in order to investigate the time course of semantic and phonological pathways when listening to words and pseudowords. We were able successfully to decode lexicality directly after item offset, suggesting a divergence of semantic pathways and functions for words and pseudowords at this timepoint. We then decoded a phonological feature (i.e. voicing of the first phoneme) as a marker of phonological processing. While classification accuracy is significantly above chance for both words and nonwords during the word, only the pseudowords show a resurgence of phonologically related activity after word offset. This re-activation coincides temporally with the onset of the lexicality effect. These results suggest that at least part of the divergence between word and pseudoword processing lies not only in the addition of semantic pathways for words but also in additional phonological (and potentially other) forms of processing of pseudowords.

Topic Area: LANGUAGE: Lexicon

Electrophysiological evidence of lexical competition from masked neighbor priming

Poster D65, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Gabriela Meade[1,2], Katherine J. Midgley[1], Jonathan Grainger[3], Phillip J. Holcomb[1], Karen Emmorey[1]; [1]San Diego State University, [2]University of California, San Diego, [3]Aix-Marseille University & CNRS

Lexical competition among form-similar words is central to many models of visual word recognition, including the Bimodal Interactive Activation Model (BIAM). According to these models, prime words (e.g., time) should facilitate processing of neighboring target words (e.g., TAME) at a sublexical level, but interfere with processing at a lexical level due to competition. Behavioral masked priming studies have indexed the end result of these counteracting effects, reporting interference (slower RTs) for target words preceded by neighboring word primes compared to those preceded by orthographically unrelated primes. However, a technique with higher temporal precision is needed to capture the sublexical facilitation hypothesized to occur earlier in the processing stream. In an ERP masked priming lexical decision study, we presented word pairs that were orthographically related (i.e., neighbors) or unrelated. Relative to the unrelated control condition, targets preceded by neighboring primes elicited smaller amplitude N250s, but larger amplitude N400s. The early attenuated negativity supports the hypothesis that letter overlap between neighbors facilitates sublexical processing. The larger amplitude N400 is reminiscent of the behavioral interference effects observed for neighboring word pairs and provides complementary evidence of lexicosemantic competition among form-similar words. Finally, the size of this N400 effect correlated with a behavioral measure of spelling ability, suggesting that neighboring word primes induced greater interference in participants who had more precise lexical representations. Overall, this study provides novel evidence for a transition from early sublexical facilitation to later lexical competition when two subsequently presented words overlap in form, as predicted by the BIAM.

Topic Area: LANGUAGE: Lexicon

High Definition-transcranial Direct Current Stimulation Enhances Statistical Learning

Poster D66, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Julie Fratantoni[1], John Hart[1,2], Julia Evans[1]; [1]The University of Texas at Dallas, [2]The University of Texas Southwestern Medical Center

Statistical learning, or pattern extraction, is one of the fundamental processes that enable humans to learn language. Deficits in statistical learning have been found to be an important contributor to language disorders such as specific language impairment, which affects roughly 7% of the general population, but is estimated to effect up to 58%-84% of juvenile prison populations. Clearly, a better understanding of the deficient neural mechanisms underlying language impairment and a better means to remediate those deficiencies could have major individual and societal impacts. As a first step in investigating methods to enhance statistical learning we used High Definition-transcranial Direct Current Stimulation (HD-tDCS) to modulate the left inferior frontal gyrus (LIFG) during an auditory statistical learning task. Imaging data has shown the LIFG is significantly involved in auditory statistical learning. We used the same artificial language stimuli as Evans and colleagues (2009). Participants listened to the artificial language for 21 minutes during stimulation/no-stimulation. Next, participants were tested using a forced-choice paradigm to identify which set of sounds was most like the artificial language they were listening to. A total of 20 healthy adults participated in the study (10/10, stimulation/control). There was a significant difference in accuracy between the stimulation group (M = 78.7%, SD = 11.2) and the control group (M = 62.3%, SD = 10.0). These findings suggest the LIFG is engaged in statistical learning for the auditory modality during a syllable segmentation task, and that this process can be enhanced using brain stimulation.

Topic Area: LANGUAGE: Lexicon

Phonological rules affect natural speech processing

Poster D67, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Miriam Munoz[1], Michael Key[2], Ahren B. Fitzroy[1], Lisa D. Sanders[1]; [1]University of Massachusetts, [2]University of Maryland

There is ample evidence that listeners have knowledge of phonological rules. However, the extent to which these rules affect typical language processing is unknown. Event-related potentials (ERPs) have been pivotal in investigating the distinct neural systems supporting the use of syntactic (LAN and P600) and lexical/semantic

(N400) knowledge during natural speech processing. To date, there is no such tool to investigate the use of phonological rules during natural language processing. In this study, we measured behavioral (experiment 1) and ERP (experiment 2) responses to phonological violations in stories presented as connected, natural speech. The phonological violations were incorrect allomorphs (e.g., dog-/s/ and walk-/d/) included in a small proportion of sentences. Canonical (e.g., dog-/z/ and walk-/t/) and violation versions were constructed by splicing single phonemes from permissible contexts. When asked to press a button in response to "anything abnormal" about the stories, adults (N=20) failed to report the phonological violations, even though they detected missing phonemes that resulted in syntactic violations (e.g., She call every morning). In the ERP experiment, adults (N=20) listening to the stories for comprehension showed an early, central positivity in response to the phonological violations. Specifically, cluster-based permutation analysis, a data-driven approach designed to correct for multiple comparisons, revealed a significant cluster 112-130 ms after the onset of an incorrect allomorph over central, right and medial regions. This early phonological positivity (EPP) is entirely different from ERPs elicited by violations of syntax (LAN and P600) and lexical/semantics (N400). Phonological rules influence natural speech processing early and automatically.

Topic Area: LANGUAGE: Other

Electrophysiological effects of orthographic neighborhood in a letter detection task

Poster D68, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Stephanie Osmond[1], Phillip J. Holcomb[1], Gabriela Meade[1,2]; [1]San Diego State University, [2]University of California, San Diego

A large literature now examines how a variety of lexical factors modulate N400 amplitude, but almost exclusively in tasks that require lexical processing. In these lexically-oriented tasks, words (e.g., drug) with more neighbors (e.g., drag, drum, rug) elicit larger amplitude N400s than words (e.g., tofu) with fewer neighbors. The present study examines whether or not this evidence of co-activated neighbors can also be found in the context of a superficial form-level task. ERPs were recorded as participants decided whether or not a target letter was present in words from high- and low-density orthographic neighborhoods. Behavioral responses were faster overall for target-present stimuli, but were not affected by neighborhood density. N400 amplitude was also sensitive to target presence such that target-absent trials elicited larger amplitude N400s than target-present trials. Interestingly, the presence of the target letter appeared to determine whether or not neighbors were co-activated. When the letter was absent, the classic N400 orthographic neighborhood effect was observed. However, when the letter was present, there was no effect of neighborhood on N400 amplitude. Together, these data suggest that neighbors can be activated in a form-level task, but that early identification of the target letter terminates lexical processing prematurely, thereby minimizing spreading of activation to neighboring lexical nodes.

Topic Area: LANGUAGE: Other

Action representations depicted in gesture are modulated by motion-content in Parkinson's disease.

Poster D69, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Stacey Humphries[1,2], Judith Holler[3], Trevor Crawford[4], Ellen Poliakoff[2]; [1]University of Pennsylvania, [2]University of Manchester, [3]Max Planck Institute for Psycholinguistics, [4]University of Lancaster

In communication, speech is often accompanied by co-speech gestures, which embody a link between language and action. Language impairments in Parkinson's disease (PD) are particularly pronounced for action-related words in comparison to nouns. In addition, patients with PD produce fewer gestures from a first-person perspective when they describe others' actions (Humphries et al., 2016), which may reflect a difficulty in simulation. We extended this to investigate the gestural depiction of other types of action information such as "manner" (how an action is performed) and "path" (the trajectory of a moving figure in space). We also explored whether the level of motion required to perform an action influences the way that PD patients use gestures to depict those actions. 37 PD patients and 35 age-matched controls viewed a cartoon which included low motion actions (e.g. hiding, knocking) and high motion actions (e.g. running, climbing), and narrated it to an addressee. We analysed the co-speech gestures they spontaneously produced while doing so. Overall gesture rate was similar in both groups, but PD patients produced action-gestures at a significantly lower rate than controls in both motion conditions. PD patients also produced significantly fewer manner and first-person action gestures than controls in the high motion condition, but not the low motion condition. Our findings suggest that motor-cognitive impairments in PD contribute to the way actions, especially high motion actions, are depicted gesturally. PD patients may have particular difficulty cognitively representing high motion actions, which affects the way they communicate about them.

Topic Area: LANGUAGE: Other

Categorization of Mandarin lexical tones in native and naïve non-native listeners: ERP evidence

Poster D70, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Yang Gao[1], Darren Tanner[1], Jerome Packard[1], Chilin Shih[1]; [1]University of Illinois at Urbana-Champaign

Native speakers of tonal languages have been shown to perceive lexical tone continua in a more categorical manner than speakers of non-tonal languages. A previous ERP study using an oddball paradigm showed that native Mandarin speakers exhibit different sensitivity to deviant tones that cross category boundaries compared to deviants that belong to the same category as the standard (Zhang et al., 2012), suggesting categorical perception. Other recent ERP findings examining consonant voicing categories question whether perception is truly categorical (Toscano et al., 2010). The current study investigated these discrepant findings by replicating and extending the Zhang et al. study. Native Mandarin speakers and naïve English speakers performed an auditory oddball detection test while EEG was recorded. Naïve English speakers were included to test for language experience effects associated with phonological learning. Stimuli were those from Zhang et al. (2012): one across-category deviant, one within-category deviant, and one standard were chosen from a 10-interval Chinese lexical tonal continuum, where the two deviants were acoustically equidistant from the standard. We found that Mandarin speakers and English speakers demonstrated similar N2/P3 responses. In both groups, the deviants elicited greater N2/P3 responses than the standard. However, there was no difference in the N2 (reflecting attention) or the P3 (reflecting categorization) between two deviants. The N2/P3 pattern also did not differ in scalp topography for the within- versus across-category deviants. Thus, in contrast to Zhang et al., the current electrophysiological results do not support categorical perception of Mandarin tone.

Topic Area: LANGUAGE: Other

Asymmetric associations between GABA and intrinsic auditory network activity

Poster D71, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Samika Kumar[1], Srikantan Nagarajan[1], Fumiko Hoeft[1], Roeland Hancock[1]; [1]University of California, San Francisco

Gamma-aminobutyric acid (GABA) regulates excitation-inhibition balance critical for sustaining local cortical oscillations, particularly in the gamma (>40 Hz) range, and long-range oscillatory synchrony between regions, which are reflected in resting-state functional connectivity (RSFC). The resting-state auditory network reflects asymmetries in connectivity that may reflect the asymmetric specialization of auditory regions in processing high- and low-frequency components of the speech signal. This study examined how GABA, measured using magnetic resonance spectroscopy (MRS), moderates RSFC within the auditory network. GABA was measured bilaterally from voxels in the superior temporal gyri (STG) in 18 healthy adults. Seed-to-voxel RSFC was calculated from bilateral seeds in the primary auditory cortex and planum temporale. GABA in the left STG was associated with decreased RSFC between left hemisphere ROIs and the left precentral gyrus and premotor cortex, as well as the right STG. Right hemisphere GABA was positively correlated with RSFC between left auditory cortex ROIs and the right prefrontal cortex and negatively correlated with RSFC between left auditory cortex ROIs and the left PFC, as well as right language regions. As hypothesized, left hemisphere GABA seems to more strongly modulate RSFC in temporal and language-related regions. However, right hemisphere GABA reveals a more complex relationship with RSFC extending beyond the language network, and it may be shown to contribute to the atypical language network, in abnormally increased strength, with further investigation.

Topic Area: LANGUAGE: Other

Individual Differences in Language Processing: A Hybrid ERP/SPR Investigation

Poster D72, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Amalia Reyes[1], Darren S. Tanner[1]; [1]University of Illinois at Urbana-Champaign

It has been traditionally held that morphosyntactic manipulations elicit P600 ERP effects while semantic manipulations tend to elicit N400 effects. Some recent evidence has challenged this traditional dichotomy by finding that literate, monolingual English speakers varied considerably in the nature of their ERP responses to morphosyntactic violations in that they varied along a continuum between N400- and P600- dominant effects (Tanner & van Hell, 2014.) The causes of this variation are as of yet unknown. In eye tracking studies, however, reading speed has been shown to predict individual variation in the processing of syntactically complex sentences (Traxler et al., 2012.) Given that most ERP studies have used RSVP, it is plausible that individual ERP variation reflects the interaction between the presentation speed and individual reading speed. This study therefore investigates reading speed and reading environment as predictive factors of this individual variation. Using a concurrent ERP/self-paced reading methodology, we gathered EEG and reading speed data simultaneously in order to analyze the effect of reading speed on individual variation. Furthermore, by allowing participants to control their reading speed, we investigated whether this individual variation is affected by reading environment. Monolingual English speakers were presented with morphosyntactic agreement violations and were instructed to press a button to advance the sentence while EEG was being recorded. Results show similar patterns of individual differences observed with RSVP studies, suggesting that this individual variation reflects processing variation and is not a result of an artificial reading environment.

Topic Area: LANGUAGE: Other

The Ad hoc Perceptual Grouping of Speech Sounds in the Varying Standards Oddball Paradigm

Poster D73, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Chao Han[1], Ryan Rhodes[1], Arild Hestvik[1]; [1]University of Delaware

Phillips et al. (2000) assumed that varying the standards along acoustic parameters of speech sounds in an oddball paradigm causes auditory cortex to recruit phoneme category information, driving a pure phoneme-based Mismatch Negativity (MMN) response. We put this assumption to the test. Using [d] as the oddball (with 15ms VOT), we created two standard conditions: a "low" condition (with [t]s varying among VOTs of 60, 65, 70ms) and a "high" condition (among VOTs of 75, 80, 85ms). According to Phillips et al., both the high and the low conditions should equally invoke the same abstract phoneme category, hence no difference in MMN should be observed. On the other hand, if auditory cortex can track acoustic statistics and form "ad hoc" groupings (e.g., based on the standard deviation of VOTs within the standards), then we would expect to observe the general distance effect on the amplitude of the MMN (Näätänen et al., 2007), with greater MMN for the "high" condition. The latter prediction was borne out: The MMN for the high condition was significant ($p < .025$, one-tailed), but the MMN in the low condition was not ($p < .2$). Although the "ad hoc" grouping predicts an MMN for both conditions, and an additive interaction based on the perceptual distance from the oddball, the results still support a different MMN effect based on perceptual distance, and is unexpected under the varying standards assumption. The results raise questions about whether varying the standards suffices to isolate a phoneme category representation.

Topic Area: LANGUAGE: Other

Development of Language and Social Behaviors in School-Age Children with Autism

Poster D74, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Nicholas Woo-VonHoogenstyn[1,2], Philip Lai[3]; [1]Salk Institute, [2]UC San Diego, [3]Wisconsin-Madison

Three school-age groups, High Functioning Autism (HFA) group (9-13), a Young Typically Developing (TD) group (6-8), and age-matched Typically Developing (TD) group (9-13), were compared to assess three language measures and two behavioral scores. A one-way ANOVA compared the three IQ scores (full-scale, performance, verbal). Significant differences for FSIQ ($p=.003$) and VIQ ($p<.001$) were observed with the HFA group scoring lower than both the TD groups. As expected, the two TD groups showed no differences. Next, we analyzed the language measures and the groups did not show a significant difference when using complex syntax or evaluative devices. A difference was observed for morphological errors, the HFA group produced more errors than the age-matched TD group ($p=.03$). For the behavioral measures, the HFA group produced fewer positive-facial-expressions than the age-matched TD group ($p<.001$). In this study, the HFA group and the younger TD group exhibit similar aspects of language and affective social interaction output. Although there are differences in IQ between the three groups, the HFA group scored within the normal IQ range; therefore, the differences in behaviors are not attributable to IQ. These findings suggest that the HFA group experience a developmental delay when compared to age-matched TDs. Future studies should identify the age range at which HFA children match their age-matched peers. By studying the differences in these developmental age groups, we can better understand the developmental trajectory within the HFA group.

Topic Area: LANGUAGE: Other

Neural changes following short-term visual word recognition training

Poster D75, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Sophia van Hees[1,2], Penny M Pexman[1,2], Sage Brown[1], Andrea B Protzner[1,2]; [1]University of Calgary, Department of Psychology, [2]Hotchkiss Brain Institute, University of Calgary

Introduction: Previous behavioural studies suggest that the efficiency of the visual word recognition system can be improved with short-term training. The current study examined the neural changes underlying such enhancements in visual word processing. Methods: 20 healthy young adults (20-28yrs; 11 males) completed approximately 16 hours of training over 7-10 days. The training involved a visual lexical decision task (LDT) using words and pronounceable nonwords. We recorded EEGs at the beginning, middle, and end of training. Behaviourally, we analysed training-induced changes in reaction times using repeated measures ANOVAs. To examine neural changes, we performed Partial Least Squares (PLS) analysis on the ERP data. Results: Behaviourally, participants were significantly faster at correctly responding to both words and nonwords following training. Analysis of the ERP waveforms revealed greater N170 amplitudes in bilateral posterior electrodes following training, as well as reduced P600 amplitudes in centro-parietal electrodes. Discussion: The behavioural results replicate previous studies showing that short-term training improves the efficiency of visual word recognition. Greater amplitudes in the N170 component suggest that training enhanced early visual-orthographic processing, in line with previous studies examining reading skill. In contrast, decreased amplitudes in the P600 component suggest reduced access to stored representations of words. Taken together, the results suggest that, following training, participants relied more on perceptual processing of the stimuli, and less upon the language network.

Topic Area: LANGUAGE: Other

Audiovisual speech intelligibility decays under adverse listening conditions

Poster D76, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Jess R. Kerlin[1], Antoine J. Shahin; [1]UC Davis, Center for Mind and Brain

For billions of people worldwide, daily communication is primarily conducted through a face-to-face natural conversation. However, little is known of how speech intelligibility changes over the course of a naturally spoken sentence, nor how visual speech is utilized as a sentence progresses. In the current study, we sought to characterize how audiovisual speech understanding evolves over the course of a sentence under adverse listening conditions. We presented individuals with sentences

selected from over 1000 unique audiovisual English sentences contained in the TCD-TIMIT audiovisual corpus. Sentences were presented in silence or with background babble, with or without matching video of the speaker's lip-movement and participants were asked to report all of the words of the sentence they heard. We expected that transcription accuracy under noisy listening conditions would increase over the course of the sentence due to improved speaker segregation and enhanced contextual predictability. Instead, we participant's transcription accuracy substantially decreased with increasing word position when presented with background babble noise. This decrease in intelligibility could not be attributed to informational masking by the content of the background babble, and is not fully accounted for by reductions in talker volume over the course of a natural sentence. The availability of lip movement information substantially increased intelligibility across the entire sentence, particularly for frontally articulated phonemes, however, it did not alter the rate of decline over word position. These results suggest that while lip reading improves phonetic representations, it does not prevent a bottleneck that degrades retention of later information in memory.

Topic Area: LANGUAGE: Other

Double dissociation of structure-function relationships between memory and fluid intelligence using magnetic resonance elastography

Poster D77, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Hillary Schwarb[1], Curtis L. Johnson[2], Charles H. Hillman[3], Arthur F. Kramer[3], Neal J. Cohen[1], Aron K. Barbey[1]; [1]Beckman Institute, University of Illinois, [2]University of Delaware, [3]Northeastern University

Magnetic resonance elastography (MRE) is an emerging technique for probing neural tissue architecture through its mechanical properties by measuring tissue viscoelasticity that reflects the underlying microstructural integrity of the neuronal-glial matrix. Our recent work has suggested that MRE may provide a novel biomarker of tissue integrity that is related to cognitive function; however, only the relationship between hippocampal viscoelasticity and memory performance has been investigated to date. Considering that among healthy young adults, viscoelasticity measures across cortical and subcortical regions are highly correlated, the structure-function specificity of this technique remains an empirical question. In this study (N=52), we investigated the relationship between both hippocampal and prefrontal viscoelasticity and performance on measures of relational memory and fluid intelligence. Despite the observation that cortical and subcortical viscoelasticity is correlated, as is memory and fluid intelligence task performance, we observed a double dissociation suggesting that MRE measures of tissue integrity are indeed functionally separable. Data revealed that hippocampal viscoelasticity significantly correlated with relational memory performance, but not measures of fluid intelligence. Conversely, orbital frontal cortex viscoelasticity significantly correlated with fluid intelligence measures, but not relational memory. These data provide the first evidence that MRE measures of microstructural variability in specific regions of interest may contribute to distinct cognitive processes. This finding enhances our previous observations of the high sensitivity of MRE measures to functional performance, even in the absence of volumetric effects, and further points to the potential for MRE to provide a novel tool for investigating functionally-relevant neural tissue microstructure.

Topic Area: LONG-TERM MEMORY: Episodic

The neural correlates of successful source encoding and recognition

Poster D78, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Louis Renoult[1], Carolin Sievers[1], Matthew Spriggs[1], Andrew P. Bayliss[1]; [1]University of East Anglia, UK

Few studies using the recognition-source paradigm have compared the neural correlates of correct (hits+), incorrect source (hits-) and forgotten trials (misses) at study and test. In the present event-related potential (ERP) study, twenty participants completed four blocks of an indoors/outdoors categorization task in which stimuli were presented as words, pictures or in both modalities in alternation (multi-modal condition). In a subsequent surprise recognition test, participants performed an old-new recognition task followed by a source judgment. Overall, results showed that source memory effects were much more robust at test than at study (respective max effect sizes of 1.5 versus 0.2). At study, two putative familiarity effects were identified, whereby hits- differed from misses at fronto-central sites bilaterally and later on at right centro-parietal sites. In addition, a linear increase in amplitude across repeated stimulus encoding predicted subsequent recollection at frontal and centro-parietal sites. At test, putative recollection effects were observed mainly at centro-parietal sites, where hits+ systematically differed from both hits- and misses. These effects peaked around 600ms after stimulus onset, typical of the LPC component associated with recollection. Interestingly, the amplitude of a late posterior negativity was found to predict subsequent memory performance for the multi-modal source (pictures & words) at study and to show maximal amplitudes for correct recollection of this modality at test. Further studies using the recognition-source paradigm will be useful to investigate whether the neural correlates of familiarity and recollection can be more robustly differentiated at study when using a voluntary encoding task.

Topic Area: LONG-TERM MEMORY: Episodic

Memory consolidation reconfigures neural pathways involved in the suppression of emotional memories

Poster D79, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Peter Bayley[1,2], Yunzhe Liu[3], Wanjun Lin[3], Chao Liu[3], Yuejia Luo[4], Jianhui Wu[5], Shaozheng Qin[2]; [1]Department of Veterans Affairs, [2]Stanford University, [3]McGovern institute for Brian Research, Beijing Normal University, [4]Shenzhen University, [5]Chinese Academy of Sciences

The ability to suppress unwanted emotional memories is crucial for human mental health. Through consolidation over time, emotional memories often become resistant to change. However, how consolidation impacts the effectiveness of emotional memory suppression is still unknown. Using event-related fMRI while concurrently recording skin conductance, we investigated the neurobiological processes underlying the suppression of aversive memories before and after overnight consolidation. Here we report that consolidated aversive memories retain their emotional reactivity and become more resistant to suppression. Suppression of consolidated memories involves higher prefrontal engagement, and less concomitant hippocampal and amygdala disengagement. In parallel, we show a shift away from hippocampal-dependent representational patterns to distributed neocortical representational patterns in the suppression of aversive memories after overnight consolidation. These findings demonstrate rapid changes in emotional memory organization with overnight consolidation, and suggest possible neurobiological bases underlying the resistance to suppression of emotional memories in affective disorders.

Topic Area: LONG-TERM MEMORY: Episodic

Investigating semantic and episodic representations for concepts

Poster D80, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Wei-Chun Wang[1], Simon W Davis[1], Roberto Cabeza[1]; [1]Duke University

Functional neuroimaging studies suggest that similar regions are activated during both semantic memory and episodic memory retrieval. The current study sought to extend these findings by investigating semantic memory and episodic memory representations of object concepts as measured by functional MRI. To this end, we scanned participants as they covertly named a series of object pictures. Following this incidental encoding task, they were then presented with a series of object names and instructed to covertly recall the object pictures that they previously saw. Using representational similarity analysis, we identified regions exhibiting greater encoding-retrieval similarity (ERS) to object information irrespective of retrieval success (i.e., semantic memory) and regions exhibiting greater ERS to memory success (i.e., episodic memory). Posterior cingulate/retrosplenial cortex and left parahippocampal cortex showed ERS between the initial object picture and subsequent object name presentations for both remembered and forgotten individual objects, suggesting that semantic memory representations are stored in these regions. On the other hand, left inferior frontal and fusiform gyri showed ERS between the initial object picture and subsequent object name presentations for hits but not misses, suggesting that episodic memory representations are stored in these regions. Additionally, left parahippocampal cortex and inferior frontal gyrus were more functionally connected for hits than misses, suggesting an interaction between these regions.

Topic Area: LONG-TERM MEMORY: Episodic

Modulation of regional activity and inter-regional connectivity during recollection of visual and auditory information

Poster D81, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Danielle King[1], MIchael Rugg[1]; [1]University of Texas at Dallas

Successful recollection involves enhanced activity (as assessed with fMRI) in both content-general brain regions (the 'core recollection network') and in content-specific regions that were also active during encoding. Recent studies have demonstrated that in addition to enhanced activity, core recollection regions also exhibit recollection-related increases in connectivity with a broadly distributed set of brain regions that include both content-general regions (other members of the core network and regions implicated in cognitive control) and content-specific regions such as visual cortex. We hypothesize that the enhanced connectivity observed with content-selective regions reflects their role in 'reinstating' encoded information. The goal of the current study is to examine an implication of this hypothesis, namely, that recollection-related enhancement of connectivity between core regions and content-specific areas should vary depending on whether recollected information depends on those areas for its representation. This hypothesis will be examined with psychophysiological interaction (PPI) analyses. Participants were scanned during both encoding and retrieval phases of a source memory task. At study, pictures of objects were presented with either written or spoken words. At test, participants were shown old and new pictures and made old/new recognition judgments and for items judged old they then made source memory judgments (written/spoken). Robust material-selective effects (spoken vs. written) were evident at encoding, along with material-selective 'subsequent memory' effects. Similarly robust retrieval success effects were identified at test, along with evidence of content-selective reinstatement. Results from the PPI analyses will be presented.

Topic Area: LONG-TERM MEMORY: Episodic

Multivoxel pattern analysis reveals task-general representation of decision criterion

Poster D82, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Benjamin Turner[1], Evan Layher[1], Nicole Marinsek[1], Puneeth Chakravarthula[1], Anjali Dixit[1], Amir Meghdadi[1], Barry Giesbrecht[1], Miguel Eckstein[1], Michael Miller[1]; [1]University of California, Santa Barbara

A common model of recognition memory holds that when humans make “old”/“new” judgments, they compare the item’s mnemonic signal against a criterion before deciding whether to endorse the item as “old.” In the fMRI literature, a standard contrast -- between studied items correctly identified as “old” versus unstudied items correctly identified as “new” -- is commonly understood to reflect mnemonic processes. However, our lab has shown that in a widespread frontoparietal network, criterion placement plays a major role (Aminoff et al., 2015). In a new study, we scanned 30 participants while they performed memory and perception tasks. Participants were induced to shift their criteria across blocks of trials with a payoff manipulation, while deciding on each trial whether the item had been studied (memory task) or contained a human (perception task). We carried out two classification analyses in each of two a priori-defined frontal and parietal ROIs. First, separately for each trial type and task, we classified items according to which criterion condition (liberal or conservative) each item appeared in. Second, separately for each trial type, we classified across tasks by training the criterion discrimination using only memory data and testing using only perception data. We highlight two results: 1) within-task classification successfully predicts a conservative or liberal trial regardless of the item type, including old or new items; and 2) surprisingly, memory data accurately predicts perception data. These results extend our previous results, suggesting that these ROIs are agnostic to the type of evidence and instead represent decision-making processes.

Topic Area: LONG-TERM MEMORY: Episodic

MDMA diminishes the recollection of emotional information.

Poster D83, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Manoj Doss[1], Jessica Weafer[1], David Gallo[1], Harriet de Wit[1]; [1]University of Chicago

±3,4-Methylenedioxymethamphetamine (MDMA) has shown promise as an adjunct to psychotherapy for the treatment of posttraumatic stress disorder. One mechanism for this may be by modifying emotional memory. We tested the effects of MDMA on the encoding and retrieval of emotional memories. Healthy participants came in for an encoding and retrieval session, separated by 48 hours. The encoding and retrieval groups received MDMA at the first and second session, respectively, and placebo on their non-MDMA session. A placebo group received placebo at both sessions. During encoding, participants viewed labels describing negative, neutral, and positive pictures, sometimes followed by the corresponding picture. During retrieval, participants performed two memory tests: a picture recollection test with confidence ratings and a picture recognition test with remember/know judgments. On the picture recollection test, all groups exhibited a typical memory advantage for negative items over neutral and positive items. However, recollection estimates from a receiver operator characteristic analysis and the remember/know procedure found that MDMA differentially affected emotional memory. MDMA at encoding diminished recollection of negative and positive material. There was also evidence for modulation of emotional recollection in the retrieval group. These findings suggest that MDMA affects qualitative aspects of emotional memories, such as the subjective vividness of recollected details. They also suggest that the potential therapeutic value of MDMA may partly come from a re-encoding of an event such that emotional details are weakened in memory.

Topic Area: LONG-TERM MEMORY: Episodic

Interactions between parietal and striatal systems contribute to subjective recollection and decision-making

Poster D84, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Yana Fandakova[1], Elliott Johnson[1], Simona Ghetti[1]; [1]University of California Davis

Vivid recollections may provide a stronger basis for action than weaker memories, but they also tend to be more accurate, making it difficult to establish if the experience of recollection in itself guides decision-making. We experimentally dissociated subjective recollection from accuracy to characterize their unique neural underpinnings and implications for decision-making. During scanning, participants (N = 29) performed two-alternative forced-choice recognition across two conditions: in the Target-Match condition, the distracter was a novel exemplar of a studied item (e.g., studied vs. unstudied chair); in the Other-Match condition, the distracter was a novel exemplar of a different studied, but untested item (i.e., studied chair vs. unstudied version of a toaster). While memory accuracy was higher in the Target-Match condition, $t(28)=5.64$, $p<.05$, subjective recollection reports were higher in the Other-Match condition, $t(28)=8.04$, $p<.05$, demonstrating a dissociation between accuracy and subjective recollection. Notably, on indepedent trials, participants bet on the accuracy of their memory more frequently for Other-Match trials, $t(28)=6.47$, $p<.05$. Hippocampal activity was higher for correctly than incorrectly remembered trials irrespective of condition, whereas Other-Match trials showed enhanced activity in the precuneus and the retrosplenial cortex compared to Target-Match trials. Decisions to bet on memory were associated with increased activity in the dorsal striatum. Increased connectivity of precuneus and retrosplenial cortex with striatum during Other-Match trials predicted greater subjective recollection, $r=.50$, $p<.05$ and higher betting frequency, $r=.48$, $p<.05$ in this condition. These results suggest that these parietal regions support subjective recollection and, together with the striatum, contribute to decision-making and memory regulation.

Topic Area: LONG-TERM MEMORY: Episodic

Effects of Depression in Episodic Memory Updating

Poster D85, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Bhaktee Dongaonkar[1], Sumantra Chattarji[1]; [1]National Center for Biological Sciences, Tata Institute of Fundamental Research, Bangalore, India

When a consolidated episodic memory is reactivated, it becomes modifiable and can be updated or integrated with new learning. Acute psychosocial stress effects on episodic memory updating (EMU) have shown impairments in updating. We decided to explore effects of prolonged stress which typically gives rise to depressive symptoms. We, therefore, planned to study EMU in depression. Individuals undergoing treatment for unipolar depression or bipolar depression at the National Institute of Mental Health and Neurosciences (NIMHANS), Bangalore, India, were included. Age and education matched individuals meeting requisite criteria formed the control group. Participants learned a set of 20 objects (list 1) on Day 1. On Day 3, half the participants were reminded of list 1 before learning a different set of 20 objects (list 2). The unipolar, bipolar, and control groups were therefore randomly split into 'reminder' or 'no-reminder' conditions. List 1 is considered updated when list 2 items are incorporated into list 1 items, contingent upon reactivation of list 1 memory. In Exp1, recall of List 1 was tested on Day 5 in all groups. Despite impaired List 1 recall in all patient groups, the ability to update in unipolar and bipolar reminder groups was proportional to the control reminder group. Unexpectedly, bipolar no-reminder group also showed updating. In Exp2, recall of List 2 was tested on Day 5 in all groups. Only bipolar reminder and no-reminder groups updated List 2. Our results suggest differential EMU in depression – unidirectional updating in unipolar depression and bidirectional updating in bipolar depression.

Topic Area: LONG-TERM MEMORY: Episodic

Neurocognitive mechanisms of functional and dysfunctional socio-emotional prospection

Poster D86, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Jessica Andrews-Hanna[1,2], Emily Lane[1], Lindsay Ives[1], Aylah Sroloff[1], Leonie Koban[1], Michelle Ferris[1], Jessica Green[1], Donna Rose Addis[3], Joanna Arch[1]; [1]University of Colorado Boulder, [2]University of Arizona, [3]University of Auckland

A growing consensus across psychology, neuroscience, and evolution research is that prospection – the ability to mentally construct hypothetical futures – is a key function of human memory. This capacity to build on past knowledge by imagining what may lie ahead is thought to have remarkable benefits, ranging from goal attainment to successful navigation of the social world. Despite its adaptive potential, however, little is known about the neurocognitive mechanisms of dysfunctional forms of prospection, such as chronic worry over what the future might hold. To differentiate functional from dysfunctional prospection across levels of brain and behavior, we compared self-reported phenomenological experiences and patterns of fMRI brain activity while 24 healthy adults and 23 adults with Social Anxiety Disorder (SAD) imagined positive and negative hypothetical social future scenarios. Both groups reported that their positive imagined scenarios were more vivid, more personally-significant, more similar to previous experiences, less intense, and less upsetting than their negative imagined scenarios; no significant group differences emerged. Despite these similarities, SAD participants engaged regions within the default network linked to mentalizing, aspects of the salience network linked to salient emotional experience, and aspects of the ventral striatum linked to reward and aversion to a greater degree than controls, particularly when imagining negative social outcomes. In contrast, healthy controls engaged lateral prefrontal regions associated with cognitive control to a greater degree than SAD participants. These findings suggest that SAD is linked to brain network alterations that may manifest as anxious/socially-evaluative and less constructive forms of prospection.

Topic Area: LONG-TERM MEMORY: Episodic

Exemplar repetition at encoding alters the specificity of retrieval-related mnemonic information

Poster D87, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Erik Wing[1], Wei-Chun Wang[1], Mark Hatcher[1], Roberto Cabeza[1]; [1]Duke University

Episodic memories may vary along many dimensions, including the degree of detail or specificity pertaining to an initially experienced event. Previous work has shown that encoding a number of related or overlapping concepts can produce an overall conceptual gist, even as individual items become harder to distinguish in memory. The present study examined how the repetition of similar items during initial encoding might lead to a loss of specificity in mnemonic representations when the corresponding concepts were later retrieved. Subjects initially viewed a series of object pictures in an incidental categorization task. While some object concepts appeared only once, for others, six similar exemplar pictures were shown in separate runs across the encoding session. Unsurprisingly, a word memory test administered one day later showed better memory for concepts in the exemplar repeat condition. While successful retrieval of previously repeated vs. single concepts was associated with increased activity in left ventrolateral prefrontal cortex (VLPFC), measures of encoding-retrieval similarity (ERS) showed a different effect. In both frontal and occipitotemporal cortex, correspondence with encoding patterns was higher during the retrieval of words that had been initially shown in picture form only once vs. those associated with multiple picture exemplars. This dissociation suggests a reduction in representational specificity of gist-based memories that may be characterized by the reinstatement of primarily conceptual vs. exemplar-specific information.

Topic Area: LONG-TERM MEMORY: Episodic

Lateral occipital complex activation associated with response confidence during forced-choice recognition of novel abstract kaleidoscope images

Poster D88, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Michael S. Cohen[1], Larry Y. Cheng[1], Ken A. Paller[1], Paul J. Reber[1]; [1]Northwestern University

Memory studies using stimuli low in conceptual meaning can shed light on fundamental memory mechanisms. We used fMRI to examine brain activity associated with encoding, retrieval, and confidence for novel abstract kaleidoscope images. During study, two images were presented simultaneously in different visual quadrants, following a cue indicating each item's value. A key brain region during encoding, predicting later recall regardless of value, was lateral occipital complex (LOC). Study runs alternated with yes-no recognition tests for each set of items, with the yes-no test additionally assessing participants' memory for the quadrant in which the image appeared, and also confidence. Following 6 study/test run pairs, participants completed an unexpected forced-choice test for all stimuli, which also included confidence judgments. High-confidence responses on the forced-choice test, and hits on the yes-no tests, activated a network of frontal and parietal regions typically associated with successful memory retrieval. In addition, confident responses during the forced-choice test were associated with increased LOC activity, relative to novel foil item pairs. While activity was somewhat higher for accurate responses, the increase in LOC activity was apparent even for incorrect high confidence responses, but not for accurate or inaccurate guesses. LOC has previously been associated with object and shape perception, and with successful memory for shapes (e.g., Karanian & Slotnick, 2015). Thus LOC activity may contribute to a subjective feeling of familiarity, which has previously been shown to play a key role in forced-choice tests. Here, familiarity appears to drive confidence as well as accuracy during forced-choice recognition.

Topic Area: LONG-TERM MEMORY: Episodic

THETA OSCILLATORY ACTIVITY IN SENSORY CORTEX IS ASSOCIATED WITH REACTIVATION AND ACCURACY AT SUBSEQUENT TEST

Poster D89, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

John Walker[1], Kathy Low[1], Neal Cohen[1], Gabriele Gratton[1], Monica Fabiani[1]; [1]University of Illinois at Urbana-Champaign

Multiple theories have suggested that one possible form of communication between the hippocampus and cortical memory stores is through synchronizing oscillatory activity between the hippocampus and the cortex. We sought to demonstrate this oscillatory power increase in cortical memory stores during retrieval of information. We utilized a paradigm in which participants studied faces and scenes and were re-presented with the scenes prior to the test trials to elicit retrieval and reactivation of the associated face. The data were from two previous studies, Walker et al. (2014, 2015), that have shown that the superior temporal sulcus (STS), a known part of the face processing network, is reactivated to the presence of the scenes in college-aged and older adults, respectively. Here we show that oscillatory power in the theta band (4-8 Hz) and in the band just above theta (8-10 Hz) in the STS is associated with later memory performance across all participants. Furthermore, we show that power in the 8-10 Hz band in the STS, immediately prior to the reactivation, is associated with the magnitude of that reactivation in college-aged adults. These findings provide evidence that oscillatory activity is associated with memory retrieval and reactivation in the cortex and is a possible source through which information from the cortex can be retrieved. We also show that there is a different pattern in aging in that older adults show lower oscillatory power in the theta band in the STS and also do not show a link between oscillatory power and reactivation.

Topic Area: LONG-TERM MEMORY: Episodic

How does pre-existing person knowledge affect source memory? Event-Related Potentials dissociate effects of person knowledge and recollection.

Poster D90, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Graham MacKenzie[1], Peter J.B. Hancock[1], David I. Donaldson[1]; [1]University of Stirling

Recognition memory is better for faces of people we know than for unfamiliar faces, and this benefit presumably arises from a greater facility to recollect information associated with semantic knowledge. To assess whether and how person knowledge affects recollection, a face-colour source memory task was performed for famous and unfamiliar faces. To ensure that task performance reflected face rather than picture recognition, different photos of studied faces were used as test items before source colour judgments were made for recognised faces. A familiarity check was performed to exclude famous identities unknown to participants from analysis. Both item recognition and source memory were better for famous than unfamiliar faces. Event-Related Potential (ERP) old/new effects from 300-500msec displayed frontal versus parietal maxima for famous and unfamiliar faces, respectively. From 500-700msec, the famous effect was larger than the unfamiliar effect. We additionally examined ERP effects of person knowledge by contrasting famous and unfamiliar waveforms directly for source correct and correct rejection conditions. In both cases, person knowledge was linked with frontal effects from 300-700msec – although with a more widespread distribution from 500-700msec for source memory. The difference between these source correct and correct rejection person knowledge effects revealed a pattern of left parietal activity (500-700msec), which suggests that neural activity linked with person knowledge is dissociable from the left parietal signature of recollection. Person knowledge clearly enhances source memory; in the absence of pre-experimental person knowledge recollection for unfamiliar faces is difficult and additional cognitive operations linked to semantic processing are recruited.

Topic Area: LONG-TERM MEMORY: Episodic

Mechanisms of targeted memory reactivation during sleep

Poster D91, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

James Antony[1], Luis Piloto[1], Margaret Wang[1], Ken Norman[1], Ken Paller[2]; [1]Princeton University, [2]Northwestern University

Newly formed hippocampal memory traces become reactivated during sleep, suggesting sleep may play an active role in long-term memory stability. Memory reactivation can be induced during post-learning sleep by presenting stimuli that had previously been associated with learning. This method, termed targeted memory reactivation (TMR), offers a unique opportunity to study the physiological conditions underlying memory reactivation with high temporal precision. In two experiments, participants learned specific sound-picture pairs followed by spatial locations for those pictures against a background grid. Next, they took a pre-nap location test and napped in the lab. During online indications of slow-wave sleep, half of the sounds were softly and repeatedly presented. At a post-nap test, cueing benefited memory. Moreover, we found that sleep spindles — bursts of 11-16 Hz electroencephalographic activity thought to contribute to memory processing — increase shortly after presenting TMR sound cues and predict later memory retention. However, spindles have a refractory period with a median of about 6 seconds, suggesting cues may not always be able to induce spindles. Indeed, we found spindles occurring shortly before (< 2.5 s) TMR cues prevent the TMR-related spindle increase and negatively predict later memory retention. To test causality of this later finding, we will discuss results from a study that tracks spindles in real time and delivers TMR cues either shortly after or long after spindles. These findings significantly contribute to understanding the efficacy of TMR and memory reactivation more generally.

Topic Area: LONG-TERM MEMORY: Episodic

Organization of object representations across different medial temporal lobe structures

Poster D92, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Anna Blumenthal[1], Bobby Stojanoski[1], Chris Martin[1,2], Rhodri Cusack[1], Stefan Köhler[1,2,3]; [1]University of Western Ontario, [2]University of Toronto, [3]Rotman Research Institute

Functional neuroimaging research has established that perceptual representations of objects in the ventral visual stream are broadly organized by animacy and, for inanimate objects, by real-world size. While this organization has been well characterized in posterior occipito-temporal structures, it remains unclear whether it also captures the organization of object representations in the medial temporal lobe (MTL), specifically during memory decisions. In the current fMRI study we examined representational similarities in patterns of activity in the MTL during memory judgements for images of real-world objects, focusing on perirhinal cortex, parahippocampal cortex, and the hippocampus. Participants performed a continuous recognition-memory task on objects from 12 different categories, which were matched for accuracy across domains. Stimuli included multiple exemplars from each category, and participants were required to judge prior occurrence at the exemplar level. Multivariate representational similarity analyses revealed that, as in more posterior ventral visual pathway regions, animacy and real-world size shape the organization of object representations in the MTL. However, the precise organization of object representations differed across structures. Animacy was reflected in similarities of representations in parahippocampal and perirhinal cortex, but not in the hippocampus. Real-world size for inanimate objects, by contrast, was reflected in representational similarities in parahippocampal cortex and the hippocampus, but not in perirhinal cortex. These findings add to a growing body of evidence that highlights representational differences not only between the hippocampus and neocortical MTL structures, but also between perirhinal and parahippocampal cortex.

Topic Area: LONG-TERM MEMORY: Other

A novel account of developmental math disability: The procedural deficit hypothesis

Poster D93, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Michael Ullman[1], Tanya Evans[2]; [1]Georgetown University, [2]Stanford University

Mathematical disability (MD), which includes developmental dyscalculia, is a neurodevelopmental disorder affecting math abilities. We propose a new explanatory account of MD, the procedural deficit hypothesis (PDH), which may further our understanding of the disorder. According to the PDH of MD, abnormalities of brain structures subserving the procedural memory system can lead to difficulties with math skills learned in this system, as well as problems with other functions that depend on these brain structures. This brain-based account is motivated in part by the high comorbidity between MD and language disorders such as dyslexia that may be explained by the PDH, and in part by the likelihood that learning automatized math skills should depend on procedural memory. Here, we first lay out the PDH of MD, and present specific predictions. We then examine the existing literature for each prediction, while pointing out weaknesses and gaps to be addressed by future research. Although we do not claim that the PDH is likely to fully explain MD, we do suggest that the hypothesis may have substantial explanatory power, and that it provides a useful theoretical framework that is likely to advance our understanding of the disorder.

Topic Area: LONG-TERM MEMORY: Skill learning

The role of DLPFC in statistical learning: Evidence from Bilateral Transcranial Magnetic Stimulation

Poster D94, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Dezso Nemeth[1,2], Geza Ambrus[3], Karolina Janacsek[1,2], Anna Triborn[3], Gyula Kovacs[3]; [1]Eötvös Loránd University, Budapest, Hungary, [2]Hungarian Academy of Sciences, Budapest, Hungary, [3]Friedrich Schiller University, Jena, Germany

Human learning depends on multiple cognitive systems related to dissociable brain structures. These systems interact not only in cooperative but sometimes competitive ways in optimizing performance. Previous studies showed that manipulations reducing the engagement of frontal lobe-mediated explicit, attentional processes can lead to improved performance in striatum-related procedural learning. The aim of the present study was to investigate the role of the prefrontal cortex (PFC) in implicit statistical learning and its consolidation and to explore the competitive relationship between implicit statistical learning and frontal lobe functions. Healthy, young adults (n=22) were trained on a probabilistic sequence learning task. 1 Hz transcranial magnetic stimulation (TMS) or sham stimulation of both the left and right dorsolateral PFC (DLPFC) was applied right before the learning session and 4x during the learning session in order to disrupt frontal lobe functions. To assess the lasting effects of TMS on learning and consolidation, statistical learning performance (expressed as the faster reaction times for sequences with high as compared to low probabilities) was tested ten minutes, two hours, and 24 hours later. We found lower level of learning in the bilateral DLPFC as compared to the sham stimulation group ten minutes after learning. However, the DLPFC stimulation group showed significantly better performance compared to the sham group after the 24-hour consolidation period. Our results support a dynamic antagonist relationship between the brain networks of automatic and controlled processes.

Topic Area: LONG-TERM MEMORY: Skill learning

Resting state connectivity before and after visuo-motor skill learning

Poster D95, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Aurélie L Manuel[1], Adrian G Guggisberg[1,2], Francesco Turri[2], Armin Schnider[1,2]; [1]Laboratory of Cognitive Neurorehabilitation, University of Geneva and University Hospital of Geneva , Switzerland, [2]Division of Neurorehabilitation, University Hospital of Geneva, Switzerland

Procedural learning, including learning of a new visuo-motor skill, is subject to fast training-induced plasticity and to offline consolidation. The present study investigates how brain functional connectivity (FC) relates to and predicts plastic changes during visuo-motor skill learning and offline consolidation. Twenty-four healthy participants were assigned to one of two groups: The experimental group (Exp) performed a computerized mirror-tracing task, in which right-left movements with the mouse were reversed on the screen. The control group (Ctrl) performed a similar task but with concordant direction of cursor movements. Both groups performed the task for 15 minutes on Day 1. High-density 156-channel EEG was recorded at rest before and immediately after training. Subjects were again tested for offline consolidation 24h later. The Exp group, but not the Ctrl group, showed behavioral improvements during training ($p<0.01$) and offline consolidation ($p<0.01$). FC analyses in the alpha frequency band (8-12Hz) revealed that node centrality (a measure of global FC to the entire cortex) of the left superior and inferior parietal cortex before training correlated positively with the learning gain in the Exp group. Furthermore, parietal node centrality decreased during training in the Exp group but not the Ctrl group and this correlated with improved learning. These findings demonstrate that visuo-motor skill learning - but not simple motor execution – modulates left parietal connectivity possibly due to enhanced visuo-spatial processing necessary for perform the mirror-tracing task.

Topic Area: LONG-TERM MEMORY: Skill learning

Post-practice resting-state functional connectivity predicts the benefit of contextual interference on motor learning

Poster D96, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Chien-Ho Lin[1], Ho-Ching Yang[1], Barbara Knowlton[2], Shin-Leh Huang[1], Ming-Chang Chiang[1]; [1]1National Yang-Ming University, Taiwan, [2]UCLA

Interleaved practice (IP) of motor sequences generally leads to better learning than repetitive practice (RP). Moreover, IP was found to be associated with greater fMRI blood-oxygen-level dependent (BOLD) signals in the sensorimotor areas during practice, but lower BOLD signals during retention. Here we investigated whether post-practice resting-state functional connectivity predicts the learning benefit of IP. 26 healthy adults (11M/15F, age = 23.3±1.3 years) practiced two sets of three sequences arranged in a Repetitive or an Interleaved order over 2 days, followed by a retention test on Day 5 to evaluate learning. On each practice day, fMRI data were acquired in a resting state after practice. The resting-state fMRI data was decomposed using a group-level spatial independent component analysis (ICA), yielding 9 independent components (IC) matched to the ventral and dorsal default-mode networks (DFN), primary visual (2 ICs), sensorimotor, left and right executive-control, posterior salience, and the language networks. The functional connectivity strength between a voxel and an IC was gauged by a z-score. Greater RP-minus-IP difference in connectivity strength was found on Day 1 in the left posterior inferior temporal gyrus belonging to the ventral DFN, while the IP-minus-RP difference in connectivity strength in the left premotor cortex (Brodmann area 6; the sensorimotor network) on Day 1 was positively correlated with the RP-minus-IP difference in the response time on Day 5. Our findings suggest that resting brain networks in the early phase of consolidation may be a biomarker of enhanced learning following interleaved practice.

Topic Area: LONG-TERM MEMORY: Skill learning

Age-related differences in implicit skill consolidation across the human lifespan: Dissociation between general skill and sequence-specific knowledge

Poster D97, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Karolina Janacsek[1,2], Dora Juhasz[3], Dezso Nemeth[1,2]; [1]Hungarian Academy of Sciences, [2]Eotvos Lorand University, [3]University of Szeged

Recognizing sequential regularities of the environment underlies motor, cognitive and social skill acquisition, and is essential for predictive behavior and decision making in day-to-day activities. Therefore it is crucial to understand how sequence learning occurs and how the acquired information consolidates and stabilizes over time. The ontogenetic changes of these processes, however, are still poorly understood. Here we aimed to characterize age-related differences in the consolidation of sequential memories between 7 and 85 years of age. Participants were clustered into nine age groups. The Alternating Serial Reaction Time (ASRT) task was used to measure implicit sequence learning. Participants were retested 24 hours after the learning phase. Two aspects of learning were analyzed, namely general skill and sequence-specific learning. We found offline improvement in general skills across the lifespan, with greater improvement in childhood. In contrast, sequence-specific knowledge did not change in the offline period in either age group, indicating efficient retention of the acquired knowledge irrespective of age. These results remained stable even after controlling for age-related differences in overall accuracy and reaction time. Our findings suggest that the fronto-striatal circuits mediating general skill vs. sequential memory consolidation are differentially affected across the human lifespan: while general skill consolidation undergoes age-related changes, sequential memory consolidation shows developmental invariance. Our results highlight the importance of separate analysis of the subprocesses underlying skill learning.

Topic Area: LONG-TERM MEMORY: Skill learning

Neuroimaging context-dependent perceptual classification

Poster D98, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Matthew Crossley[1], Jessica Roeder[2], Lauren Vucovich[2], F. Gregory Ashby[2]; [1]SRI International, [2]UC Santa Barbara

Context-dependent learning (CDL) allows an agent to learn and engage different response policies given identical stimuli in different contexts. CDL is essential for survival, and many neurological disorders and maladaptive behaviors can be traced to dysfunction within CDL systems. Here we aim to understand how neural circuits drive CDL. Towards this goal, we measured fMRI BOLD signal in participants as they performed a context-dependent perceptual classification task thought to rely on procedural learning and memory systems. Throughout the entire experiment, participants used correct / incorrect feedback provided after every response to learn to classify circular sine wave gratings through trial-and-error. During the first two scanning blocks, participants first learned one category (i.e., stimuli-response mappings), and during the final four blocks of scanning 50% of these mappings were reversed. No warning was given prior to this change. A GLM analysis identified a single cluster spanning parts of posterior parietal and inferotemporal cortex that was significantly more active during blocks 3 and 4 than it was during blocks 1 and 2, and 5 and 6. Thus, this area may be important for recognition of the context change that happened between blocks 2 and 3. We will also report a variety of other analyses that investigate the functional connectivity of this area with whole brain networks, and attempt to link activity in this area to the behavioral profile of individual participants.

Topic Area: LONG-TERM MEMORY: Skill learning

Lateral Occipital and Prefrontal Activation Reflect Distinct Cognitive Mechanisms Involved in Classification of Real-World Stimuli

Poster D99, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Kyle Morgan[1,2], Dagmar Zeithamova[1]; [1]University of Oregon, [2]Electrical Geodesics, Inc.

Categorization is a basic cognitive process necessary for the development of concepts. Studies utilizing novel artificial stimuli demonstrated that categorization may involve distinct cognitive and neural mechanisms depending on how categories are constructed and participants are trained. The goal of our study was to determine if such recruitment of dissociable categorization systems can also be evoked within a single task with real-world stimuli. Through corrective feedback, participants learned to categorize realistic images of football formations into three categories that were originally unknown to them. The formation categories were three of the most widely used defensive formation types in college and professional football. Formations from one category were visibly distinct and were quickly learned; the remaining two categories were highly similar and required the discovery of a rule to distinguish between them across training. Following training, participants classified the training formations and novel formations from the same categories during a functional MRI scan. Classification of formations from the visually distinct category preferentially recruited posterior visual cortex. Classification of formations that required subtle rule application recruited a network of regions across the prefrontal cortex and striatum. The results demonstrate that categorization is a complex cognitive process that relies on multiple learning and memory systems, and that these systems can be flexibly deployed on a case-by-case basis within the context of a single real-world categorization task.

Topic Area: LONG-TERM MEMORY: Skill learning

Investigating Individual Differences in Implicit Sequence Learning

Poster D100, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Kelsey R. Thompson[1], Paul J. Reber[1]; [1]Northwestern University

Implicit learning researchers commonly assume that individual differences in implicit learning are small or nonexistent due to its relatively automatic nature and the hypothesis that it depends on evolutionarily older neural mechanisms. In contrast, research on the type of real-world skill learning that implicit learning tasks aim to measure often assumes the opposite—individual differences in innate talent do influence learning (Campitelli & Gobet, 2011). This suggests that implicit learning may vary across individuals in a similar way to measures like fluid intelligence or working memory capacity. Recent findings of state effects on implicit learning (e.g., mood, depletion, motivation) challenge strong forms of the idea that implicit learning is fully automatic. Here, two experiments are reported that investigate whether implicit learning ability acts like a trait measure across individuals by examining test-retest reliability with an implicit learning task. The SISL (Serial Interception Sequence Learning) task measures implicit learning of perceptual-motor sequences that can be repeatedly assessed within individuals and is highly resistant to explicit discovery of the sequence. Across both experiments, the intercorrelations of the sequence-specific learning measure across repeated assessments was very low (mean $r < .1$), suggesting little evidence for trait-like differences in implicit learning ability. By contrast, general task performance measures (overall speed/accuracy) were highly correlated (mean $r > .9$). Thus, although individuals did reliably differ on their general ability to perform the task, sequence-specific learning did not appear to be a reliable trait difference, implying that low levels of individual differences are present in implicit learning ability.

Topic Area: LONG-TERM MEMORY: Skill learning

Associations between neurochemistry and oscillatory speech coding

Poster D101, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Roeland Hancock[1], Srikantan Nagarajan[1], Fumiko Hoeft[1]; [1]University of California, San Francisco

A hierarchy of oscillatory neural processing can provide a mechanism for de-multiplexing and coding auditory signals. In particular, gamma band oscillations, nested within theta oscillations, may provide a basis for discretizing the speech signal. These oscillations are dependent on cortical excitation-inhibition balance, partially regulated by gamma aminobutyric acid (GABA). The present study examined how neural synchronization to the speech signal is modulated by resting GABA levels. We hypothesized that higher levels of GABA, reflecting greater cortical inhibition, would be associated with greater information processing at higher gamma band (>40 Hz) frequencies. Magnetoencephalographic recordings were obtained from 28 healthy right-handed adults while they listened to conversational speech and GABA was measured from the left superior temporal gyrus (STG) using magnetic resonance spectroscopy (MRS). Mutual information analyses revealed coupling between the phase of theta (4-7 Hz) oscillations in left primary auditory cortex (PAC) and the speech envelope. Consistent with previous research, the amplitude of gamma oscillations in left PAC provided additional, synergistic information about speech theta phase. This effect was examined in two low-gamma frequency bands, 25-35 Hz and 35-45Hz. As predicted, the amount of information synergy provided by gamma amplitude at 35-45Hz relative to 25-35Hz was positively correlated with GABA concentration ($r=.58$, $p<.005$). Synergy at 35-45Hz was also positively correlated with Word Attack scores, a measure of phonological processing ($r=.51$, $p < .01$). These results suggest that levels of cortical inhibition in the STG, as measured by MRS, are associated with the frequency at which the speech signal is encoded.

Topic Area: PERCEPTION & ACTION: Audition

Categorical perception of Mandarin lexical tone at age 8 can predict children's reading ability at age 10 in Chinese children: a longitudinal auditory ERP investigation.

Poster D102, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Han Wu[1], Pengfei Qu[2], Linjun Zhang[3], Hua Shu[4], Bruce McCandliss[5], Jingming Liu[1]; [1]Tsinghua University, [2]Chinese Academy of Governance, [3]Beijing Language and Culture University, [4]Beijing Normal University, [5]Standford University

Background: Auditory processing of speech sounds is influenced by one's native language experiences. Studying speech perception in childhood can improve the understanding of how people become culture-bounded and attend to the specific sounds in their native languages. This two-year longitudinal ERP study investigates changes in pre-attentive auditory processing that underlies Categorical perception of Mandarin lexical tones during the years children learn to read fluently. The main purpose of the present study was to explore the development of lexical tone categorical perception to see if it can predict children's reading ability. Methods: Both behavioral and electrophysiological measures were taken in this study. Auditory event-related potentials were collected with a passive listening oddball paradigm. Using a stimulus continuum spanning from one lexical tone category exemplar to another, we identified a between-category and a within-category tone deviant that were acoustically equidistant from a standard stimulus. 8-year-old Mandarin speakers participated in both an initial ERP oddball paradigm and returned for a two-year follow up. Results: The between-category MMN and within-category MMN significantly correlate with each other at age 8 but not at age 10. The between-category MMN at age 8 can predict children's ability at age 10 but the within-category MMN cannot. Conclusion: The behavioral and electrophysiological results demonstrate that categorical perception of lexical tone at age 8 can predict children's reading ability at age 10.

Topic Area: PERCEPTION & ACTION: Audition

Effects of a tinnitus percept on tone discrimination learning in Mongolian Gerbils

Poster D103, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Achim Schilling[1], Patrick Krauss[1], Konstantin Tziridis[1], Ilona Strohmeyer[1], Holger Schulze[1]; [1]University of Erlangen-Nuremberg

The mechanisms of the chronic manifestation of central tinnitus are still not completely understood, but do involve plastic changes of the functional organization of the auditory cortex (AC). Here we investigate possible interferences of tinnitus related maladaptive plastic AC changes with tone discrimination learning plasticity in Mongolian gerbils. 12 animals (trauma group) were treated with a mild acoustic trauma (2kHz, 115 dB SPL, 75 min), 6 animals (control group) received sham trauma (2 kHz, 65 dB SPL, 75 min). Starting two days after the acoustic event, the animals were trained over 10 days with a pure tone discrimination learning paradigm (2 vs. 5 kHz aversive GO-NOGO shuttle-box paradigm). Approximately 60% of the trauma group animals developed a tinnitus percept (T) while in the remaining 40% no tinnitus percept was detectable (NT) (behaviorally tested: gap/nogap startle-paradigm). A group comparison between control and the T group showed no significant differences in the learning performance, but the learning performance of the NT group turned out to be significantly impaired. On the other hand, an individual analysis of learning performance revealed that T animals with tinnitus frequencies at or above the training frequency used in the range learning paradigm also showed a significantly impaired learning performance. This observation is an indication of an interferences of the plastic changes induced by tinnitus and learning, respectively. The impaired learning performance of the NT animals might either be an effect of the trauma induced hearing loss or an effect of the trauma induced reduction of cortical activity.

Topic Area: PERCEPTION & ACTION: Audition

Altered speech production in response to transient mid-utterance formant perturbation

Poster D104, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Inez Raharjo[1,2], Hardik Kothare[1], John F. Houde[1], Srikantan S. Nagarajan[1]; [1]University of California, San Francisco, [2]University of California, Berkeley

Listeners distinguish vowels by their formant frequencies, so speaking requires precise control of formants. To understand how this control works, and what the role of auditory feedback is in the process, previous studies have looked at the behavioral responses to an altered formant feedback. These studies show that people adapt when a consistent formant shift is applied during repeated productions of an entire word utterance. However, speakers' responses to unexpected formant perturbations transiently applied at mid-utterance is not yet known, and may be relevant to understand online control of formants. To investigate this, we applied a real-time shift of the first formant frequency (F1) in the middle of participants' utterance. We shifted F1 for only 400 ms after a jittered delay while participants phonated the word 'head' (vowel /ɛ/) for an entire 1.5 seconds. We found that participants immediately altered their F1 production at the onset of the perturbation. The magnitude of these responses were much smaller than the magnitude of the perturbation, and were smaller than responses seen in formant adaptation studies. Moreover, participants did not return to their baseline frequency at the end of the perturbation. The results of this study indicate that online feedback alteration may utilize a feedback error correction mechanism that is similar to what drives formant adaptation. Moreover, this suggests a time-dependence for the activation of speech error correction.

Topic Area: PERCEPTION & ACTION: Audition

Brain structural changes in chronic bilateral tinnitus: subtypes and effects of co-morbidity

Poster D105, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Bianca Besteher[1], Daniela Ivansic[1], Christian Gaser[1], Igor Nenadic[1,2], Orlando Guntinas-Lichius[1], Christian Dobel[1]; [1]Jena University Hospital, Jena, Germany, [2]Philipps-University Marburg / Marburg University Hospital - UKGM, Marburg, Germany

Chronic tinnitus is associated with brain structural changes in both the auditory system and limbic brain areas (Mühlau et al., 2006; Leaver et al., 2011). The latter might be linked to emotional aspects or distress, which is very common in these patients. In an ongoing project, we investigated this relationship using magnetic resonance imaging (MRI) morphometry comparing to subgroups of patients with chronic bilateral tinnitus (either with or without significant emotional distress) and control groups (healthy subjects or patients with psychiatric disorders). We analysed 24 patients with tinnitus (13 low-distress and 11 high-distress, subtyped according to the tinnitus questionnaire by Goebel and Hiller) and 20 healthy controls. All subjects underwent high-resolution MRI (3 Tesla, 1mm slice thickness), and we analysed data using voxel-based morphometry (VBM) with the CAT12 toolbox. We found a significant grey matter reduction in high-distress tinnitus patients (compared to low-distress patients) in the right inferior occipital gyrus. Furthermore, we found grey matter reductions in the pallidum comparing non-distressed tinnitus with healthy controls, as well as increases in right inferior temporal gyrus, left posterior cingulate cortex, and left parahippocampal gyrus comparing tinnitus patients and healthy controls. This preliminary analysis shows brain structural deficits in tinnitus, diverging between low-distress vs. high-distress subtypes. This divergence might account for the emotional symptoms and the difference in co-morbidity with psychiatric conditions like depression or anxiety disorders. We are currently expanding the study to include more tinnitus patients as well as a psychiatric control group (major depression without hearing loss).

Topic Area: PERCEPTION & ACTION: Audition

Increased Structural and Functional Connectivity in Jazz Improvising Musicians

Poster D106, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Tima Zeng[1], Emily Przysinda[1], Psyche Loui[1]; [1]Wesleyan University

The process of creativity entails the production of novel and original work appropriate in certain domains. One specific domain of creativity is jazz improvisation, which requires musicians to produce original and novel music in real time. Previous studies have found positive associations between behavioral performance on creativity tasks and white matter integrity in mesial structures such as corpus callosum, and lateral structures such as superior longitudinal fasciculus. We hypothesize that the ability to improvise is facilitated by increased structural and functional connectivity between mesial and lateral structures. We test this hypothesis by comparing diffusion tensor imaging and resting state fMRI of jazz improvising musicians to musician and non-musician control groups. DTI analyses include TBSS and probabilistic tractography of specific white matter pathways of interest. Compared to control group, jazz musicians have significantly higher FA in the anterior cingulate and corpus callosum (TBSS, $p < .05$ TFCE-corrected), and significantly higher volume and mean FA of arcuate fasciculus and pathways between left inferior frontal gyrus and corpus callosum (probabilistic tractography, $p < .05$). Resting state fMRI data show significantly more overlap among jazz musicians between regions that are functionally correlated with default mode network and language network areas ($p < .05$, voxel-corrected). Results support our hypothesis by showing enhanced structural and functional connectivity between mesial default mode areas and lateral language areas in jazz improvising musicians. This interplay may enable spontaneous creative behavior, such as in conversation.

Topic Area: PERCEPTION & ACTION: Audition

Structural Brain Differences in Jazz Improvising Musicians

Poster D107, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Cameron Arkin[1], Charles Pfeifer[1], Emily Przysinda[1], Psyche Loui[1]; [1]1Department of Psychology and Program in Neuroscience and Behavior, Wesleyan University, Middletown, CT, USA

Jazz improvisation requires execution of creative musical ideas in real time. Here we investigate structural differences between the brains of improvising jazz musicians, musicians, and nonmusicians. We hypothesize that regions important for auditory-motor and cognitive control functions will show structural differences in jazz musicians compared to non-improvising musicians and nonmusicians. T1 images were acquired from nonmusicians (n=12), musicians (n=12), and jazz musicians (n=12) and run through the Freesurfer pipeline to identify surface area, volume, and cortical thickness values for each region. Our hypothesized regions of interest included the superior temporal gyrus, cingulate, and precentral gyrus, corresponding to auditory, cognitive control, and motor processes respectively. Results showed that Jazz musicians had significantly larger surface area and volume in the superior temporal gyrus, precentral gyrus, and rostral anterior cingulate in the left hemisphere (main effect of group, $p<0.0167$). In the right hemisphere a main effect of group was seen in surface area for the posterior cingulate cortex and superior temporal gyrus ($p<0.05$). Additional whole-brain analyses revealed differences in entorhinal cortex, inferior parietal lobule, and insula in the right hemisphere, and the fusiform gyrus, inferior temporal gyrus, and lateral occipital gyrus in the left hemisphere ($p<0.05$). However, these additional regions did not survive Bonferroni correction for multiple comparisons ($p<0.0015$). Results show that regions associated with auditory and motor processes as well as integration processes are significantly larger in jazz musicians, suggesting that these two networks are involved together in executing auditory-motor ideas into improvisational pieces of music.

Topic Area: PERCEPTION & ACTION: Audition

Post-Stimulus Target Detection Modulation as Evidence for the Oscillatory Entrainment Model

Poster D108, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Moran Aharoni[1], Matthias M. Müller[1], Erich Schröger[1]; [1]Leipzig University, Germany

The importance of beat entrainment, i.e., the ability to perceive and synchronize to a regular beat, extends beyond musical context, hinting at general deductive and predictive mechanisms. The oscillatory model is commonly used to represent the mechanism behind beat entrainment. Supporting evidence for the model was found in many behavioural and neuroimaging studies. However, as most previous studies focused on the stimulation period, it is hard to disentangle their periodic results from evoked responses to the beat. It is, therefore, not yet clear whether oscillatory sources play a role in beat entrainment. Large's non-linear oscillator model (2008) suggests an ongoing oscillatory activity following the beat's end. Such activity, manifest in either brain signal or behavioural response, would be crucial evidence for the model. Recently, Hickok et al (2015) found periodic modulation of target detection following 3 Hz modulated noise. To find whether such response modulation is stimulus independent, we used a similar target detection task. Participants listened to a discrete, varying-length sequence of drum sounds at 3 Hz, accompanied by background noise. A target tone followed half the sequences, appearing at one of four temporal positions by equally dividing the presentation frequency period. We ran the experiment in 3 variations (four target positions, six positions and target positions shifted forward by 25%). Using a repeated-measures analysis, we found a robust, harmonic modulation (6 Hz) of the target detection rate. That is, target detection was dependent on the period of the preceding drum sequence, hinting at an ongoing oscillatory activity.

Topic Area: PERCEPTION & ACTION: Audition

Improving visuo-spatial abilities in blind youngsters using programmable tactile displays

Poster D109, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Fabrizio Leo[1], Carla Tinti[2], Silvia Chiesa[2], Roberta Cavaglià[2], Susanna Schmidt[2], Luca Brayda[1]; [1]Istituto Italiano di Tecnologia, [2]Università di Torino

The ability to memorize and integrate spatial images is crucial to build cognitive maps at the developmental age and to properly navigate in unknown environments. Blind people are known to have issues in building spatial information as compared to sighted individuals. In our work, we aimed at investigating whether a training with tactile matrices displayed with a programmable tactile display is able to improve recalling performance of spatial images in three groups of blind, low vision and sighted youngsters between 6 and 18 years old. The training consisted in 4 sessions with a weekly schedule in which participants were asked to memorize single or double spatial layouts, featured as two-dimensional matrices. Results showed that all groups of participants significantly improved their recalling performance compared to the first session baseline in the single-matrix task. We did not observe any statistical difference in performance between groups. On the contrary, blind and low vision participants did not show a learning effect in the double-matrix task whereas blindfolded sighted controls did. We also coded tactile exploration strategies in both tests and their correlation with performance. Sighted youngsters, in particular, were in favour of a proprioceptive exploration strategy. Finally, performance in the double-matrix task negatively correlated with the use of one hand and positively correlated with a proprioceptive strategy. Our study confirms that blind persons do not easily process two separate spatial representations. On the other hand, rehabilitation programs promoting bi-manual and proprioceptive approaches to tactile exploration might help to improve spatial abilities.

Topic Area: PERCEPTION & ACTION: Other

A tool to cooperate: dissociating peri- and interpersonal space

Poster D110, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Ivan Patané[1,2,3], Alessandro Farnè[2,3,4], Frassinetti Francesca[1,5]; [1]Department of Psychology, University of Bologna, Bologna, Italy, [2]ImpAct Team, Lyon Neuroscience Research Centre, INSERM U1028, CNRS UMR5292, Lyon, France, [3]UCBL, Lyon I University, Lyon, France, [4]Hospices Civiles de Lyon, Neuro-immersion & Mouvement and Handicap, Lyon, France, [5]Fondazione Salvatore Maugeri, Clinica del Lavoro e della Riabilitazione, IRCCS – Istituto Scientifico di Castel Goffredo, Mantua, Italy

The space around the body is termed Peripersonal (PPS) in neuroscience and Interpersonal (IPS) in social psychology. Within the debate about their origin, the prevalent idea is they share common functional characteristics. Bunking the trend, here we report a dissociation between them. To probe their plasticity we introduced a novel type of "social" long-tool-use that would modify both spaces. Reaching- and Comfort-distance tasks, designed to respectively measure PPS and IPS, were performed before and after a cooperative long-tool-use session. Participants were asked to approach a confederate and to stop themselves either at the distance they could reach the confederate (Reaching-distance task) or at the shortest distance they still felt comfortable before the confederate (Comfort-distance task). During long-tool-use session, participants and the confederate had to cooperate by using a 70 cm-long rake to retrieve objects. In two control experiments, the same procedure was adopted, except that in tool session participants used a short rake and were required to cooperate (cooperative setting) or not (neutral setting) with the confederate. Results showed the perceived IPS was reduced, as expected following a positive social interaction. By contrast, the perceived PPS toward the very same cooperative person was actually extended after use of the same long-tool. Control short-tool-use selectively reduced the IPS (when performed in the same cooperative context) or had no effect (when in a neutral context). The use of tools to perform actions in social settings allows us to report the first strong evidence that PPS and IPS underlie dissociable plastic representations.

Topic Area: PERCEPTION & ACTION: Other

Strategic adaptation to non-reward prediction error qualities and contextual volatility in fMRI

Poster D111, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Daniel S. Kluger[1,2], Ricarda I. Schubotz[1,2,3]; [1]University of Muenster, Germany, [2]Otto-Creutzfeldt-Center for Cognitive and Behavioral Neuroscience, University of Muenster, Germany, [3]University Hospital Cologne, Germany

Prediction errors are deemed necessary for the updating of internal models of the environment, prompting us to stop or shield current action plans and helping us to adapt to environmental features. The aim of the present study was twofold: First, we sought to determine the neural underpinnings of qualitatively different abstract prediction errors in a serial pattern detection task. Second, we investigated predictive processing as a function of statistical context (volatility). We hypothesised that the prospective extent of model-based expectations might be adapted to the stability of respective contexts in such a way that unstable environments call for more frequent comparisons of model-based predictions with sensory input, resulting in incremental predictions. Distinct frontoparietal circuits were found for sequential terminations (inferior frontal gyrus, anterior operculum/insula, and precuneus) and extensions (superior frontal sulcus, posterior cingulate cortex, and angular gyrus), respectively. These findings provide a novel approach of distinguishing non-reward prediction error signals with regard to behavioural consequences they entail. Furthermore, changes in environmental stability resulted in activation of the temporoparietal junction and inferior frontal gyrus for the highly volatile context at potential points of violation (checkpoints). Notably, this effect was not due to fluctuations in stimulus-bound surprise. Data point towards a context-dependent adaptation of predictive strategies. Conceivably, enhanced BOLD responses at sequential checkpoints reflect stepwise processing rather than a full-length prediction. This strategic adjustment presumably relies on the iterant evaluation of model information retrieved from working memory, as suggested by strengthened functional connectivity of the parahippocampal area during epochs of high volatility.

Topic Area: PERCEPTION & ACTION: Other

Central olfactory mechanisms underlying sleep-dependent changes in food processing

Poster D112, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Surabhi Bhutani[1], Jay A Gottfried[1], Thorsten Kahnt[1]; [1]Northwestern University Feinberg School of Medicine

Previous research suggests a strong relation between sleep deprivation (<6 h/night) and weight gain, primarily due to excessive calorie consumption from energy dense snacks. However, the neural mechanisms underlying sleep-dependent increases in appetite and food intake are currently unclear. Here we use olfactory fMRI to test the hypothesis that sleep-deprivation alters neural responses to food odors in olfactory cortex and food reward-related brain regions. In a counterbalanced crossover design, participants were randomly assigned to a night of normal sleep (8 h, NS) or a night of partial sleep deprivation (4 h, DS). A 1-week sleep stabilization phase (7-9 h) preceded each experimental condition, which was separated by a 20-day washout period. A wrist wearable sleep monitoring actigraph verified that participants followed the assigned sleep schedules. Calorie intake was controlled on the experimental days. On the day following NS and DS, participants rated the pleasantness and intensity of individually selected savory and sweet high-caloric food odors and non-food control odors while fMRI responses were acquired. We find that across both sleep conditions, fMRI responses to food compared to non-food odors were enhanced in posterior orbitofrontal cortex, piriform cortex, and anterior insula. Critically, in the DS compared to the NS condition, fMRI activity to food vs. non-food odors was specifically enhanced in piriform and orbitofrontal cortex. By showing that early olfactory responses to food odors are elevated in a sleep-deprived state, our results highlight a role for bottom up modulation in sleep-dependent appetite and eating behavior

Topic Area: PERCEPTION & ACTION: Other

Use of Temporal Information in 6-Month-Old Infants' Expectations.

Poster D113, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Kyle Comishen[1], Scott A. Adler[1]; [1]York University

An understanding of time is imperative for any form of functioning in one's environment. Studies investigating time perception have revealed adults' ability to discriminate millisecond time intervals from one another. Such a pattern has been observed in young children and infants as well. The goal of this study was to examine if infants as young as 6-months of age encode and use specific temporal information when formulating expectations about their environment. While lying supine in a crib, 6-month-old infants viewed stimuli on an overhead screen while an eye tracker recorded their eye movements. A cue was displayed at the center of the screen for a duration of either 700 or 1200 milliseconds. After this duration, the screen was blank for an interstimulus interval of 1000 milliseconds. A target then appeared either on the left or right side of the screen for 1000 milliseconds. During the interstimulus interval, infants could anticipate the location of the target by making an eye movement to its location before it appeared. When the target's location was predicted by the cue's duration, infants' anticipations were correct at a rate of 78%, whereas they were correct at a rate of only 54% when target location was not predicted by the cue's duration. The findings from this study support the notion that infants do encode and use specific temporal information about events on the millisecond scale when formulating expectations.

Topic Area: PERCEPTION & ACTION: Other

External Control of the Stream of Consciousness: An EEG Study

Poster D114, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Wei Dou[1], Sabrina Bhangal[1], Hyein Cho[2], Allison K. Allen[3], Zaviera Reyes[1], Ezequiel Morsella[1,4], Mark W. Geisler[1]; [1]Department of Psychology, San Francisco State University, [2]Department of Psychology, The Graduate Center, The City University of New York, [3]Department of Psychology, University of California, Santa Cruz, [4]Department of Neurology, University of California, San Francisco

The Reflexive Imagery Task (RIT) reveals that involuntary cognitions can be systematically elicited by the presentation of external stimuli (Allen et al., 2013). In the basic version of the task, participants are presented with visual objects and instructed to not think of the names of the objects. Involuntary subvocalizations arise on roughly 80% of the trials. In previous RITs, objects were presented only one at a time, thereby not resembling the nature of everyday stimulus scenes. With this in mind, we developed an RIT variant in which two objects are presented simultaneously (6 s), with one object on the left of the screen and one object on the right of the screen. Participants (n = 44) were instructed to not think of any of the names of the objects. Participants indicated that they happened to think of the name of any of the objects on a high proportion of trials (M = .78, SE = .03). In addition, the RIT effect arose for both objects on a considerable proportion of the 38 trials (M = .34, SE = .05), demonstrating the external control of multiple thoughts in the stream of consciousness. In a follow-up study, we investigated the neural correlates of the RIT effect and of the attentional processes associated with this effect. Electroencephalography was recorded from eleven electrode sites (Fz, Cz, Pz, F3, F4, C3, C4, T3, T4, P3, and P4). We focused on the alpha (8-13 Hz), beta (13-30 Hz), gamma (30-150 Hz), and theta (4-8 Hz) frequencies.

Topic Area: PERCEPTION & ACTION: Other

Mapping the acoustical and categorical features of sounds in the occipital cortex of blind and sighted people

Poster D115, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Stefania Mattioni[1,2], Rezk Mohamed[2], Karen Cuculiza[1], Ceren Battal[1], Roberto Bottini[1], Markus Van Ackeren[1], Nick Oosterhof[1], Olivier Collignon[1,2]; [1]University of Trento, Italy, [2]Université catholique de Louvain, Louvain-la-Neuve, Belgium

It has recently been proposed that regions of the ventral occipital-temporal cortex (VOTC), previously considered purely visual, are in fact showing preference toward specific categories independently of the sensory input. Moreover, this functional architecture may develop in the absence of visual experience since studies have shown similar response profile of VOTC in early blind people. In this study, we relied on representational similarity analysis of fMRI data in order to link similarities of brain activity patterns with different features similarities of either visual (in sighted only) or sound (in sighted and blind) stimuli space. In sighted, only posterior middle temporal gyrus (pMTG) demonstrated a similar coding of auditory and visual categories (eg. animate-inanimate) bringing limited support to the idea that most of VOTC is abstracted from the sensory input. We also observed that the occipital cortex of blind individuals shows enhanced coding of both sound categories (animate-inanimate) and physical properties (pitch) of the acoustical stimuli. However, no postero-anterior gradient was observed for the coding of low- versus high-level features of sounds, showing that the hierarchical architecture of the occipital cortex is not preserved for acoustic processing in the blind. Additional analyses of the stability of the pattern of brain activity elicited by sound stimuli showed that early visual deprivation triggers a large-scale imbalance between occipital and temporal regions. Together, these results suggest that VOTC shows a strong sensory tuning toward visual stimuli in the sighted and reorganize to enhance its response toward non-visual input in case of early visual deprivation.

Topic Area: PERCEPTION & ACTION: Other

The search for the putative number form area: A meta-analysis

Poster D116, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Darren J. Yeo[1,2], Eric D. Wilkey[1], Gavin R. Price[1]; [1]Peabody College, Vanderbilt University, USA, [2]Nanyang Technological University, Singapore

A recent group of studies has revealed a putative “number form area” (NFA) in the inferior temporal gyrus (ITG) that is functionally specialized for Arabic numeral processing. Those studies suggest that an NFA has eluded prior fMRI studies as it falls within a region prone to signal dropout. Yet, several prior studies had found numeral-preferential activation in the ITG, suggesting that signal dropout might only partly account for past null findings. To evaluate whether existing findings support the existence of an NFA, we conducted an activation likelihood estimation meta-analysis of 31 neuroimaging studies with varying degrees of contrast specificity. All studies selected contrasted the visually presented Arabic numerals with other meaningful symbols across a variety of tasks in healthy adults. Concordant activation was only found in the bilateral parietal and right superior frontal regions. To test whether the inclusion of contrasts that did not control for task demands could potentially mask convergence in areas with weak effects, we conducted another meta-analysis on a subset of 20 studies. Along with the frontoparietal network found initially, convergence was found in the right ITG and inferior frontal gyrus. These findings suggest some degree of evidence for an NFA, but only after controlling for task demands, and that signal loss is not the only factor underlying null findings. Given that only five studies contributed to the NFA, the functional and localization specificity of an NFA requires more empirical evidence. Our findings also suggest a task-independent role of a frontoparietal network in Arabic numeral processing.

Topic Area: PERCEPTION & ACTION: Vision

Visual-Field Specific Category Learning

Poster D117, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Luke Rosedahl[1], Miguel Eckstein[1], Greg Ashby[1]; [1]University of California Santa Barbara

Although perceptual discrimination has often been found to be visual-field dependent, object recognition is commonly thought to be visual-field invariant. Here, the first fully controlled instance of visual-field specific category learning (using eye tracking) is described, supporting some level of visual-field dependence. Forty subjects performed a four-category categorization task during eye tracking. Subjects wore an eye patch over one eye and saw Gabor discs presented 5 degrees peripheral for 150ms. Any eye movement aborted the trial. Subjects trained with feedback in the right peripheral field of the right eye followed by testing without feedback in the same location and eye. Subjects were then tested without feedback with the stimulus moved to one of two locations: the left peripheral field of the same eye or the right peripheral field of the other (left) eye. This latter condition tests whether any change in stimulus condition affects performance. The results showed a significant ($p < .01$) decrease in performance when the stimulus was moved to the untrained location of the trained eye (i.e., when the stimulus was moved from the right peripheral field to the left peripheral field of the right eye) and no change for the other condition. This demonstrates that some types of category learning occur in a visual-field specific manner. Although performance dropped significantly when the stimulus was moved to the new location on the trained eye, it remained well above chance, showing that some position-invariant learning occurred as well. This might account for previous reports of visual-field invariant learning.

Topic Area: PERCEPTION & ACTION: Vision

Reward Associations Modify Neural Representations: An Event-related Potentials Study

Poster D118, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Huan Wang[1,2], Killian Kleffner[1], Patrick Carolan[1], Mario Liotti[1]; [1]Simon Fraser University, [2]UC Davis

Previous work showed that cues with learned incentive salience capture attention and affect task performance. It remains still unclear however, if passively perceived incentive cues can yield the same neural and behavioral effects. Using event-related potentials (ERPs), we investigated the implicit processing of rewarded cues with a design that allowed us to attribute incentive salience, assess the representations of these cues and how they could influence task performance. Forty-one participants learned how to obtain monetary reward, to avoid monetary punishment or to receive neutral outcome when cued by different neutral images. They then performed a passive repeats detection task in which only 10 percent of repeats required responses while scalp electroencephalography (EEG) was concomitantly recorded. Finally, participants underwent a priming task in which previous-learned cues served as primes to influence subsequent word recognition. ERP results showed larger amplitudes of frontocentral P2 (180 - 230 ms; p = .041) and left frontal early anterior positivity (EAP, 240 - 340 ms; p = .034) for rewarded than punished cues. Furthermore, larger P2 and EAP amplitudes were associated with better accuracy to detect rewarded than punished repeats (r = .34, p = .037; r = .33, p =.046). Finally, when primed with rewarded cues, positive or negative words recognition was delayed (ps < .001). It is concluded that indeed learning of reward associations is accompanied by implicit neural processing and behavioral effects

Topic Area: PERCEPTION & ACTION: Vision

Cortical and subcortical contributions to passive perception of visuospatial changes

Poster D119, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Maximilian Hauser[1,2], Stefanie Heba[3], Tobias Schmidt-Wilcke[3], Martin Tegenthoff[3], Christian Bellebaum[4], Denise Manahan-Vaughan[1,2]; [1]Ruhr-University Bochum, Bochum, Germany, [2]International Graduate School of Neuroscience, Bochum, Germany, [3]University Hospital Bergmannsheil, Bochum, Germany, [4]Heinrich Heine University, Düsseldorf, Germany

In rodents, passive perception of novel configurations of visuospatial stimuli results in robust synaptic plasticity in the hippocampus, in the form of long-term depression (Kemp & Manahan-Vaughan, 2012, Cerebral Cortex, doi: 10.1093/cercor/bhr233). Hippocampal processing of spatial information may be supported by the cerebellum (Rochefort et al., 2011, Science, doi: 10.1126/science.1207403). Here, we explored in humans, hippocampal and cerebellar participation in the processing of passively perceived visuospatial information. First we assessed event-related potentials (ERPs) recorded during passive perception of novel, repeatedly presented, as well as configurationally, or perspectively, changed three-dimensional objects to verify that passive perception occurred. We identified parieto-occipital ERP-components that differentiated between spatially reconfigured, familiar, and novel objects. Using single trial estimation and multivariate approaches, based on rapid event-related fMRI, we then conducted searchlight analyses across the brain, to correlate representational dissimilarity matrices (RDMs) derived from selected regions of interest (ROIs). We observed that the representational profile in the hippocampus significantly correlates with that of the cerebellum across novel, familiar, and spatially changed objects. Looking at the RDMs of our ROIs separately, both the hippocampus and the cerebellar vermis lobules I-V exhibited more unique representations for spatially changed objects. By contrast, vermis lobules VI-X displayed this pattern for all items that displayed some form of novelty. These findings suggest that, during passive visuospatial perception, an evaluative process takes place in the cerebellum that dissociates observer-independent configurational, and observer-related novelty. This process can be expected to support pattern separation in the hippocampus that enables processing of visuospatial change.

Topic Area: PERCEPTION & ACTION: Vision

Electrophysiological Evidence for Temporally Distinct Effects of Encoding, Maintenance, and Perceptual Fidelity in Object-Substitution Masking

Poster D120, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Christine Salahub[1], Stephen Emrich[1]; [1]Brock University

Both visual working memory (VWM) and visual awareness researchers have studied an event-related potential (ERP) called the sustained posterior contralateral negativity (SPCN). In VWM tasks, this component is related to changes in working memory load, whereas in awareness-related tasks it is affected by changes in awareness of a target stimulus. However, no study has examined the effect of concurrent manipulations of set size and visual awareness on the SPCN component. Therefore, the goal of the current study was to examine how set size and masking manipulations would interact to affect SPCN amplitude. To examine thresholds of awareness we used an object-substitution masking (OSM) paradigm. In this task, a sparse four-dot mask surrounds a target item and offsets at a slightly later time than the target. Twenty participants were shown either two or four Landolt Cs from which they had to find the target (masked or unmasked). The two manipulations had temporally distinct effects on the SPCN; mask condition had a significant effect in the early delay period (eSPCN) and set size in the late period (lSPCN). The eSPCN had greater amplitude during masked trials, whereas the lSPCN increased in amplitude for larger set sizes. Additionally, both early and late SPCN amplitudes were related to response precision, such that more precise responses resulted in greater amplitude than less precise responses. Overall, results from this study demonstrate that the SPCN reflects multiple processes occurring over time, including working memory encoding and maintenance as well as the fidelity of information maintained in memory.

Topic Area: PERCEPTION & ACTION: Vision

Lower visual field advantage as a default setting for processing facial and non-facial stimuli : evidence from a combined EEG and Eye-tracking study.

Poster D121, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Sandra Guerreiro Jacinto[1,2], Edwige Taniga[1], Anthony Hosein[1], Boutheina Jemel[1,2]; [1]Hôpital Rivière des Prairies, [2]Université de Montréal

Several studies have consistently shown that the human visual perception displays a low visual field (LVF) advantage, with stimuli presented in LVF being processed more efficiently than those in the higher VF (HVF). In addition, photoreceptors' distribution is denser in the upper half of the retina. Face research literature has outlined that the most relevant information is located in the upper part of the face (eyes), which triggers the largest brain electrical signal known as the face-sensitive N170 ERP. Furthermore, Zerouali et al. (2013) showed that fixating the top of a face stimulus elicits the highest N170 amplitude, whether the face is presented upright or inverted, suggesting that the observed upper-fixation bias is independent of the eye-region location but is rather a consequence of LVF advantage. To follow up on this conclusion, EEG and eye-tracking measurements were recorded and monitored simultaneously to allow an accurate sampling of electrical brain signals from fixated image regions, while participants viewed face photographs, face-like phase-scrambled images and face-like checkerboards. ERPs were averaged by gaze location (upper, mid and lower). Our results revealed a similar pattern between the three types of stimuli. We observed an optimal fixation position (i.e., eliciting the largest N170s) located on the upper-visual field, with N170 decreasing amplitude from the upper to the lower fixations. Such results suggest that N170 amplitude modulations arise from a general retinotopic visual setting enhancing visual information located in the LVF of facial and non-facial stimuli.

Topic Area: PERCEPTION & ACTION: Vision

Threat adaptation in human visual cortex: neuronal orientation tuning in a two-phase conditioning paradigm

Poster D122, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

L. Forest Gruss[1], Nathan M. Petro[1], Andreas Keil[1]; [1]University of Florida

The mammalian brain displays a perceptual bias towards learned threat signals. Classical aversive conditioning in the laboratory enables researchers to probe the mechanisms of this perceptual bias at the level of mass neuronal population activation through EEG. Rapid changes in visuocortical discrimination of threat versus safety cues are thought to have multiple mechanistic contributors: local inhibitory interactions of orientation-sensitive neurons and top-down modulation from anterior cortical structures. The aim of the current research was to investigate the temporal, adaptive changes of instructed threat and safety cues during a two-phase conditioning paradigm. In the first conditioning phase, a Gabor grating of a 45° orientation (CS+) was paired with a noxious acoustic stimulus (US; 96dB white noise) while 6 other orientations (15°-75°) functioned as safety cues (CS-). In the second conditioning phase a new CS+ was paired with the US, most proximal in orientation to the old CS+ (i.e. 55° and 35°, two experiments respectively). Results from both studies (N=29) indicate sustained visuocortical enhancement to the first CS+ via the steady state visually evoked potential (ssVEP) throughout all experimental blocks. Furthermore, enhanced activation to the new CS+ was accompanied by suppression of gratings most proximal to the direction of the new pairing (65° and 75° suppressed for a 55° CS+). Gratings in the direction of the old CS+, however, displayed increased activation into extinction. This asymmetrical activation pattern implicates a perceptual bias specifically to the first-acquired threat signal, including safety signals most similar to the first, but not second, threat cue.

Topic Area: PERCEPTION & ACTION: Vision

Temporal evolution of visual representation: From physical to perceived numerosity

Poster D123, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Michele Fornaciai[1], Joonkoo Park[1]; [1]University of Massachusetts Amherst

The physical properties of a visual scene become percepts through complex neural machinery in the visual stream. However, little is known about the processes that make a given percept available in the content of subjective visual awareness, and when such percepts arise in the visual stream. In this study, we investigated the temporal evolution of visual representation by exploiting a simple yet very powerful visual illusion, whereby the perceived numerosity of dot arrays containing pairs of connected dots is strongly underestimated compared to isolated dots. We recorded brain activity by means of electroencephalogram while participants passively viewed a stream of arrays containing 16 or 32 dots, either isolated or pair-wise connected by straight lines. The results showed that the early latency visual evoked potentials (~ 100 ms) reflect physical, rather than perceived, numerosity, while the later latency potentials (~ 150 ms) reflect perceived, rather than physical, numerosity. A multivariate pattern analysis in the time domain confirmed such a pattern and further demonstrated that both the effects of physical and perceived numerosity persist until later latency (~ 400 ms). These results demonstrate that the physical information of a visual scene undergoes a series of manipulations along the visual stream that could radically change its content before being available in the subjective visual experience.

Topic Area: PERCEPTION & ACTION: Vision

Exploring network connectivity during visual aesthetic experiences

Poster D124, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Ilkay Isik[1], Edward A. Vessel[1]; [1]Max Planck Institute for Empirical Aesthetics, Frankfurt am Main, Germany

Whether it is a painting or a natural scene, human beings consistently favor interactions with aesthetically pleasing objects. However, the mechanisms supporting aesthetically pleasing experiences remain to be discovered. Previous research found that the ventral visual pathway and the default-mode network (DMN), large-scale brain networks that are typically anti-correlated, become simultaneously active during moving aesthetic experiences, suggesting that such experiences are correlated with a change in the dynamics of large scale brain networks. We measured BOLD fMRI as eighteen participants made aesthetic judgments about landscapes, architecture and paintings (including portraits), and tested the hypothesis that ventral visual regions would show functional connectivity (fc) with nodes of the DMN and that this fc would be content specific and modulated by preference. Core regions of the DMN and category-selective visual regions in ventral occipito-temporal cortex (e.g. PPA, FFA, OFA) were identified for each individual using a rest scan and a visual localizer scan. We found that the three aesthetic domains differentially activated regions in ventral occipito-temporal cortex: FFA was most activated by art and PPA was most activated by architecture. The caudate and DMN were also modulated by aesthetic preference. A measure of dynamic fc (multiplication of temporal derivatives; MTD) revealed fc between category selective ventral visual regions and several nodes of the DMN, but that fc was not content specific nor modulated by preference. These results suggest that aesthetic appreciation may not be directly mediated by connections between content-specific brain regions and the DMN.

Topic Area: PERCEPTION & ACTION: Vision

The ventral and dorsal visual pathways exchange information during configural face processing.

Poster D125, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Valentinos Zachariou[1], Nicole Mlynaryk[1], Christine Gou[1], Leslie Ungerleider[1]; [1]Laboratory of brain and cognition, NIMH, NIH

Configural face processing, the processing of the spatial relationships among the features of a face, is a vital component of face perception. If configural processing depends on spatial information, might this process involve interactions between the face-processing regions of the ventral stream and visuospatial processing regions of the dorsal stream? We explored this question in healthy adults within the context of a thetaburst TMS experiment (TBS). First, using independent face and location localizer tasks, we identified dorsal location and ventral face-processing brain regions, separately for each participant. The dorsal, location-processing regions acted as the active TBS sites and the vertex acted as the control site. Participants were then presented with pairs of face exemplars that could differ in terms of the shape (featural) or the spatial configuration of their shape features (configural). Differences (featural/configural) were matched in RT and accuracy separately for each participant. Each participant was then exposed to two scan sessions (pre and post TBS) per TBS site, with TBS delivered on a single brain region in between the two fMRI sessions. BOLD activity within the face-processing regions decreased in the post TBS session, in comparison to the pre TBS session, but only for configural face differences and only when TBS was applied on the location-processing regions of the dorsal stream. The above effect was not observed for the vertex, the control site. We conclude that the location-processing substrates of the dorsal visual pathway exchange information with face-processing regions of the ventral visual pathway during configural face processing.

Topic Area: PERCEPTION & ACTION: Vision

An integrated view of visual lateralization: Correlations and modulating factors

Poster D126, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Sanne Brederoo[1], Mark R. Nieuwenstein[1], Frans W. Cornelissen[1], Monicque M. Lorist[1]; [1]University of Groningen

More than fifty years of research has shown that the left (LH) and right hemispheres (RH) are each specialized in a range of visual processes. However, these processes have been studied mostly in isolation from one another. As a consequence, it has remained unclear whether and how lateralization of one visual process relates to lateralization of another. We propose an integrated view of visual lateralization based on spatial attention, high (HSF) and low (LSF) spatial frequency processing, global and local level processing, visual word processing and face perception, as tested using the visual half field paradigm (n=122). In line with recently proposed theories, we found that stronger RH-lateralization for faces relates to stronger LH-lateralization for words ($r=.27$, $p=.005$), and stronger LH-lateralization for local level processing ($r=.19$, $p=.053$), the latter two which also positively correlate ($r=.24$, $p=.023$). Furthermore, the stronger the LH-lateralization for HSF processing, the weaker the RH-lateralized for face perception ($r=-.18$, $p=.049$), but the stronger the RH attentional bias ($r=.24$, $p=.012$). Finally, RH-lateralization for LSF processing correlates with RH-lateralization for global level processing ($r=.24$, $p=.013$). With regard to modulating factors, right-handed participants show stronger lateralization for faces ($t[109]=3$, $p=.003$), LSF processing ($t[118]=2.8$, $p=.006$), and words ($t[97]=2.5$, $p=.01$), than left-handed participants. Men show stronger lateralization for local processing ($t[83]=2.7$, $p=.009$) and marginally significantly stronger lateralization for global processing ($t[79]=1.8$, $p=.07$), than women. In sum, visual processes are not independently lateralized, but they form part of a lateralized network, which can be affected by factors such as handedness and sex.

Topic Area: PERCEPTION & ACTION: Vision

The role of the structural connectome in literacy and numeracy development in children

Poster D127, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Joe Bathelt[1], Susan Gathercole[1], Sally Butterfield[1], Duncan Astle[1]; [1]MRC Cognition & Brain Sciences Unit

Literacy and numeracy are fundamental skills acquired in childhood, a time that coincides with considerable shifts in large-scale brain organisation. However, most studies emphasise focal brain contributions to literacy and numeracy development by employing case-control designs in groups with selective deficits and voxel-by-voxel statistical comparisons. This approach is unlikely to capture the importance of broad differences in brain organisation that typically characterise brain development. In contrast, the current study was based on a more representative sample of 59 children between 6 and 16 years with varying levels of reading and maths ability, including difficulties in both domains. Further, broader differences in brain organisation were evaluated using a whole-brain structural connectome approach based on diffusion-weighted MRI data. Our results indicate an association between literacy and numeracy development in a distributed network of white matter connections that extends beyond regions implicated in a voxel-wise analysis. Further, graph theory measures of network organisation (characteristic path length, global clustering coefficient) were correlated with higher reading and maths scores. In addition, simulated disruption indicated that highly-connected regions that are particularly important for optimal network organisation also related to higher reading and maths performance. Together these findings show that changes in large-scale brain organisation contribute to literacy and numeracy development as children grow up.

Topic Area: THINKING: Development & aging

Skill-related structural brain changes over the first years of math acquisition.

Poster D128, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Janosch Linkersdörfer[1,2,3], Fumiko Hoeft[3,4], Sven Lindberg[2,5], Marcus Hasselhorn[1,2,6], Christian J. Fiebach[2,6], Jan Lonnemann[1,2]; [1]German Institute for International Educational Research, Frankfurt am Main, Germany, [2]Center for Research on Individual Development and Adaptive Education of Children at Risk (IDeA), Frankfurt am Main, Germany, [3]University of California, San Francisco, USA, [4]Haskins Laboratories, Yale University, [5]Paderborn University, Paderborn, Germany, [6]Goethe-University Frankfurt am Main, Germany

Successful acquisition of arithmetic skills, especially in the early stages of school education, is an important prerequisite for future academic success and active participation in society. Despite its importance, however, our knowledge about the structural brain basis of the acquisition of arithmetic skills remains limited. The present study examines the structural brain changes that occur during the course of acquiring arithmetic skills, and how these changes are related to inter-individual differences in performance. To this end, we followed 45 elementary school children longitudinally from first to fourth grade. Every year, children's performance in simple (single-digit addition without carrying) and more complex (subtraction with borrowing) arithmetic tasks was assessed using standardized scholastic achievement tests. Additionally, we acquired structural brain images using T1-weighted MR imaging and assessed intra-individual changes in cortical thickness using surfaced-based analysis (Freesurfer). In a whole-brain analysis using linear mixed effects models, we observed that cortical thickness changes were associated with arithmetic performance (averaged over all measurement time points), while controlling for gender and general cognitive abilities. Results show a negative relationship between math performance and gray matter thickness changes (i.e., increased thinning of gray matter in more proficient children) in bilateral middle and anterior temporal as well as right orbitofrontal regions for simple arithmetic tasks, and bilateral inferior and middle frontal regions for complex arithmetic tasks. These findings suggest an association between arithmetic performance and structural brain changes in regions related to memory formation and fact retrieval (simple tasks) as well as regions underlying cognitive control (complex tasks).

Topic Area: THINKING: Development & aging

Relationships between ANS, intelligence and young children's ability to solve non-symbolic division problems

Poster D129, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Nayun Kwon[1], So-Yeon Kim[1]; [1]Department of Psychology, Duksung Women's University

Recently, it has become well-known that cognitive abilities such as Approximate Number System (ANS), number knowledge, and intelligence affect individual's fundamental mathematical ability. However, it is unclear which of these cognitive abilities impact children's fundamental mathematical ability the most. Therefore, in this study, we tested Korean children's ability to solve non-symbolic division problems, ANS acuity and intelligence all together. We also examine those factors in combination to find out the relationships between ANS acuity, division reasoning abilities, and intelligence. To test these relationships, we used Panamath Dot Comparison Paradigm to measure children's ANS acuity. Also, we employed McCrink's non-symbolic division tasks (2015, 2016) to measure children's ability to solve division problems. Also, we measured children's intelligence using K-WPPSI-IV. Our results showed that, in all conditions of division tasks, performance in 4-6 years old children is higher than chance level ($ts(23)=9.51$ and 6.33, $ps<0.05$). Also children's division performance showed positive correlation with Full scale IQ and ANS acuity ($r=.58$, $p<.05$ and $r=.54$ $p<.05$, respectively) in an easier condition. However, only the Full scale IQ was significantly correlated with the division performance in a more complex division task ($r=.62$, $p<.05$). Specifically, there were significant relationships between children's division performance and verbal comprehension ($r=.50$, $p<.05$), fluid reasoning ($r=41$, $p=.05$), and processing speed index scores($r=.47$, $p<.05$). Taken together, these findings suggest that both ANS and intelligence play essential roles in children's fundamental mathematic ability.

Topic Area: THINKING: Development & aging

The Relationship of Intraoperative EEG Measures with Pre & Postoperative Cognitive Function

Poster D130, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Jacob E. Gardner[1], Charlie M. Giattino[1], Kenneth C. Roberts[1], Faris M. Sbahi[1], Miles Berger[1], Marty G. Woldorff[1]; [1]Duke University

Every year, more than 16 million Americans over age 60 undergo general anesthesia for surgery. Up to 40% of these older patients develop postoperative cognitive dysfunction (POCD), a syndrome of cognitive deficits that can last for weeks to months, or even more permanently, following surgery. Currently there are no intraoperative physiological predictors for identifying patients at risk for developing POCD. General anesthesia profoundly changes activity in the EEG alpha band (8-12 Hz), including its distribution across the scalp: frontal alpha power typically increases while posterior alpha decreases, a process termed anteriorization. We hypothesized that intraoperative alpha activity patterns—such as anteriorization—would differ across patients, and that these patterns would correlate with pre- and/or postoperative cognitive scores. To test these hypotheses, we collected pre- and intraoperative 32-channel EEG on patients over age 60 undergoing general anesthesia for surgery. We examined whether changes in alpha power and/or scalp distribution during anesthesia correlated with neurocognitive data collected before and six weeks after surgery, as well as if they predicted POCD. Preliminary results indicate that low intraoperative frontal alpha power significantly correlates with lower preoperative cognitive performance ($rs = 0.79$, $p = 0.02$) and trends toward a significant correlation with lower cognitive scores six weeks after surgery ($rs = 0.67$, $p = 0.07$). These data suggest that intraoperative EEG parameters can be used to predict a patient's preoperative and postoperative cognitive status, as well as to possibly help understand the relationship between neural activity and cognitive resilience as we age.

Topic Area: THINKING: Development & aging

Assessing hierarchical self-similarity processing with univariate and multivariate analysis approaches

Poster D131, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Florian Ph.S Fischmeister[1,2], Georg Langs[3], Mauricio Martins[4,5,6], W. Tecumseh Fitch[4], Roland Beisteiner[2]; [1]High Field Magnetic Resonance Centre, Department of Biomedical Imaging and Image-guided Therapy, Medical University of Vienna, Austria, [2]Department of Neurology, Medical University of Vienna, Vienna, Austria, [3]Computational Imaging Research Lab, Department of Biomedical Imaging and Image-guided Therapy, Medical University of Vienna, Vienna, Austria, [4]Department of Cognitive Biology, University of Vienna, Vienna, Austria, [5]Berlin School of Mind and Brain, Humboldt Universität zu Berlin, Berlin, Germany, [6]Max Planck Institute for Human Cognitive and Brain Sciences, Leipzig, Germany

The ability to understand and generate complex hierarchical structures is a crucial component of human cognition. The investigation of the underlying neural bases is thus essential to understand the foundations of human cognitive architecture. Pattern analysis approaches such as Gini contrast represent a powerful new tool to probe functional imaging data for distributed multivariate patterns and link them to cognitive processes. Such an approach is of particular interest when studying subtle correlates across distributed networks serving complex cognition. Here we compared three approaches, classic GLM modeling, functional connectivity, and Gini contrast, with respect to their ability to describe and differentiate between recursive and iterative processing during the encoding and decoding of visual stimuli. On the group level all three methods showed a considerable overlap of brain regions commonly associated with hierarchical processing. Gini contrast revealed several network specific brain areas that were not visible when using standard GLM analysis. Brain areas more specific for recursive processing include the posterior cingulate cortex and lateral temporal cortices. Evidence from functional connectivity analysis suggest these additional areas to be part of the default mode network. Additional areas linked to non-recursive processing were detected e.g. in the fronto-parietal control network (e.g., inferior precuneus). In conclusion, each method reflects different components and aspects of the underlying neuronal process. Gini contrast, due to its multivariate nature, seems to represent a viable tool to describe complex cognitive functioning as processes utilizing distinct neuronal resources in a shared neuronal network.

Topic Area: THINKING: Other

Understanding the Unique NeuroCognitive Architectures of Individuals: A Resting State Functional Connectivity Analysis (rsFC) of the Multiple intelligences

Poster D132, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Branton Shearer[1]; [1]MI Research and Consulting

The concept of intelligence has been controversial since the introduction of IQ tests in the 1900s. Recently many neuroscientists have investigated the neural bases for either general intelligence or fluid – crystallized intelligences. Numerous alternatives to unitary intelligence have achieved limited acceptance by psychologists and educators. Multiple intelligences (MI) theory (Gardner, H. (1983/1999) Frames of Mind, Basic Books: NY) despite criticism that it lacks empirical validity, has had sustained interest by educators worldwide. MI theory was one of the first to be based on neuroscience evidence, however, this evidence has not been evaluated and advanced since 1983. This multi-part investigation began with a detailed review of core cognitive components for the eight multiple intelligences as well as general intelligence. Phase 1 determined that there is robust evidence that each intelligence possesses neural coherence comparable with general intelligence. Building on that evidence, this Phase 2 study reviewed 50 resting-state functionally connected (rsFC) studies. Seven to fifteen identified neural networks were found to be clearly

aligned with each of the multiple intelligences and general intelligence. Naturalist was not included. The neural networks identified are well matched with the evidence from task-based research obtained during Phase 1. As a third test of the neurological validity of MI theory Phase 3 compares Group Abilities levels: Skilled, Typical and Impaired. This investigation provides evidence that MI theory is deeply rooted in neuroscience evidence and can serve as a practical interface to advance educational cognitive neuroscience. Clinical and educational implications from resting-state neural experiments are discussed.

Topic Area: THINKING: Other

Diurnal Rhythms in Freedom of Thought: An Experience Sampling Study

Poster D133, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Caitlin Mills[1], Dylan Stan[1], Quentin Raffaelli[1], Kalina Christoff[1]; [1]University of British Columbia

Circadian rhythms can have a strong influence on our daily lives. Recent research suggests that there are time-of-day variations in neural activity in brain regions linked to the attentional orienting system (Marek et al., 2010). These findings may have implications for related phenomenon, such as mind wandering, which is less understood from the perspective of diurnal patterns. Mind wandering has been characterized as the dynamic "movement of thought" which includes how constrained versus unconstrained the mind is (Christoff et al., 2016). Thoughts that are more constrained are less likely to move freely, but it is unclear how this might fluctuate throughout the day. We conducted an experience sampling study to test whether there are diurnal patterns in free movement of thought. Our hypothesis was that participants would experience fluctuations in their freedom of thought throughout the course of a day. Participants answered probes on their cell phones throughout the day for five days. A total of 128 participants answered, on average, 67 probes yielding 8,610 probe responses in full. Indeed, the pattern of results suggests that participants experience marked fluctuations in freedom of throughout the day, beginning from the time they wake. Thoughts were increasingly less constrained within the first two hours of being awake. Participants then experienced a dip in their freedom of thought after having been awake for eight hours. These findings may eventually help us determine what time of day we can best pay attention versus when we should let our minds be free to wander.

Topic Area: THINKING: Other

The Brain on Tylenol: Acetaminophen Amplifies Disengagement from External Stimuli During Internally Directed Thought

Poster D134, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Sumeet Mutti[1], Daniel Randles[2], Diana Pricop[1], Julia W. Y. Kam[3], Steven J. Heine[1], Todd C. Handy[1]; [1]University of British Columbia, [2]University of Toronto, [3]UC Berkeley

Long known as an analgesic, acetaminophen (or Tylenol) has recently been shown to not just reduce social pain, but lessen reactivity towards affectively salient stimuli and attenuate error evaluation processing in cortex. Notably, these latter two effects directly parallel the impact of mind wandering on affective and error-related processing, raising the possibility that acetaminophen may facilitate neurocognitive disengagement from external stimulus inputs during periods of mind wandering. Here we tested this hypothesis in a double blind study that had participants ingest either 1000 mg of acetaminophen (N = 20) or a sugar placebo (N = 20) and then perform a modified Sustained Attention to Respond Task (SART) while their EEG responses to targets were recorded. During the task, participants were prompted at random intervals to report whether their thoughts were on task or mind wandering. We found that the mean amplitude of P300 event-related potential (ERP) component evoked by targets was attenuated in the time interval immediately preceding mind wandering vs. on-task attentional reports, and further, that the magnitude of this attenuation was significantly greater in the acetaminophen vs. placebo group. No between-group difference was found in the overall reported rates of mind wandering. Our findings suggest that acetaminophen has a direct, catalytic effect on the basic mechanism by which we neurocognitively disengage from the external environment during periods of internally directed thought.

Topic Area: THINKING: Other

Individual differences in grey matter structure predict frequency of certain types of stimulus-independent thoughts

Poster D135, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Sneha Sheth[1], Kieran Fox[1], Michael Jarrett[1], Manesh Girn[1], Mara Puertolas Lopez[2], Matthew dixon[1], Alexander Rauscher[1], Kalina Christoff[1]; [1]University of British Columbia, [2]National Institute on Deafness and Other Communication Disorders

Stimulus-independent thought has been most famously tied to activity in brain regions of the default mode network (DMN). However, almost nothing is known about how the brain's anatomical structure might vary in individuals with differing overall patterns of thought. For instance, individuals show marked differences in the frequency with which their thoughts are goal-related and emotionally positive – but are these individual patterns of thinking reflected at the level of neuroanatomy? We sought to explore the relationships between these individual propensities and grey matter concentration (using high-resolution T1 anatomical MRI scans). Following a morphometric neuroimaging scan, we allowed subjects to rest and think freely, interrupting their thinking at random intervals with occasional thought probes. A total of

120 probes asked subjects (i) whether their thoughts arose spontaneously, or whether they were intentionally directing them; (ii) whether thoughts were related to their current concerns and goals in life, or not; and (iii) whether they were emotionally pleasant, unpleasant or neutral. Overall individual difference scores were calculated for each participant (e.g., proportion of positive thoughts), and correlated with whole-brain grey matter concentration. We found distinctive patterns of grey matter structure correlated with individual propensity toward spontaneously arising vs. intentionally directed thoughts; thoughts related vs. unrelated to current concerns and goals; and emotionally pleasant vs. unpleasant thoughts. Moreover, these differences were observed in many regions beyond the DMN. Our results suggest that distinctive individual tendencies in the content and valence of stimulus-independent thinking are linked to correspondingly distinctive neuroanatomy.

Topic Area: THINKING: Other

Sleep On It – The Impact of Problem Reactivation during Sleep on Problem Solving

Poster D136, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Kristin Grunewald[1], Samuel Osburn[1], Katherine George[1], Ken Paller[1], Mark Beeman[1]; [1]Northwestern University

Numerous scientific breakthroughs have been associated with sleep including Otto Loewi's experiment that demonstrated neurons communicate via neurotransmitters and Dmitri Mendeleyev's organization of the periodic table. Additionally, several experiments have demonstrated enhanced problem solving or greater insight into a problem's structure after sleep compared to similar periods of wake (e.g. Sio et al., 2003; Wagner et al., 2005). However, the mechanism for sleep's facilitation of problem solving remains unknown. We hypothesize that the reactivation of the problems during slow-wave sleep underlies the facilitation. To test this hypothesis, we employed targeted memory reactivation (TMR) to selectively reactivate specific problems during sleep. Participants completed an evening session in the lab where they attempted to solve puzzles. Each puzzle was paired with a unique sound that played throughout the solving attempt. Participants then took a device home that monitored their sleep and, when they were in slow-wave sleep, played some of the sounds that were associated with their unsolved puzzles. In the morning, participants returned to the lab and reattempted all puzzles that they did not solve the prior evening. Preliminary results suggest that in the morning participants were more likely to solve puzzles whose paired sound had been played overnight than puzzles whose paired sound had not been played. This result supports our hypothesis that the reactivation of problems during slow-wave sleep enhances problem solving.

Topic Area: THINKING: Problem solving

Electrocorticography reveals the neural mechanisms of the arithmetic problem-size effect

Poster D137, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Pedro Pinheiro-Chagas[1], Amy L. Daitch[2], Josef Parvizi[2], Stanislas Dehaene[1]; [1]Collège de France, Paris, [2]Stanford University

Both the intraparietal sulcus (IPS) and the posterior inferior temporal gyrus (pITG) are known to be involved in arithmetic thinking, but their precise roles remain poorly understood. To characterize them, we recorded electrocorticography signals from 17 neurosurgical subjects implanted with grids of electrodes, while they were asked to verify additions such as 15+3=17. Behavioral results showed a classical problem size effect: RTs increased as a function of the size of the smallest (min) operand. We next examined how high-gamma activity is modulated by problem size. We found that the total activation across the decision period increased as a function of the min operand around the IPS, but remained constant within the pITG. Electrodes within the pITG, however, showed decreasing activation during the first second after calculation onset as a function of the min operand. Importantly, when regressing out the effect of RT, modulation of the total activity in the IPS vanished, while modulation of the initial activity in the pITG remained intact. The results suggest two distinct neural mechanisms underlying mental calculation, which would have been virtually impossible to disentangle using conventional noninvasive neuroimaging methods. While the activity in IPS seems compatible with an 'accumulation of evidence' pattern, similarly to neurons in the monkey LIP during a motion detection task, the activity in the pITG may represent the saliency of the evidence, similarly to neurons in the monkey MT area. Thus, we propose that the neural mechanisms previously described in basic perceptual decisions also operate during more complex symbolic reasoning.

Topic Area: THINKING: Problem solving

Selective Attention to Global Stimuli Induces Analytic Problem Solving

Poster D138, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Tiffani Ng[1], Mark Beeman[1]; [1]Northwestern University

Attention putatively mediates the distinctions between local versus global visual processing and between analytic versus insight problem solving. Processing local features of hierarchical displays requires narrow attention, whereas processing global features requires spatially broad attention. Similarly, solving problems analytically requires narrow and selective conceptual attention, whereas solving with insight is thought to require conceptually broader (and likely less selective) attention. Two experiments investigated whether and how attention to local versus global stimuli modulates problem solving. Participants completed Compound Remote Associates problems, then a modified hierarchical letter task, followed by more problems. If processing local features narrows attention, participants should increase analytic solving; however, detecting local targets only slightly (non-reliably) increased analytic solving. If attending to global features broadens attention and weakens selection,

then participants should increase insight solving. Alternatively, if processing global features requires selective attention to the large (global) letter (while inhibiting local letters), participants should increase analytic solving. Results support the latter hypothesis: Participants who detected target letters at the global level reliably increased analytic solving ($p<.01$ in each experiment), without affecting insight solving. Additionally, the congruency effect (slower responses when the two levels conflicted) was larger, suggesting more selective attention was required, when responding to global letters ($p<.05$). Finally, across individuals, the size of the congruency effect correlated with initial problem solving processes: smaller congruency (better selection) with more analytic solving ($r=-.22$, $p=.05$), and larger congruency with more insight solving ($r=.39$, $p=.01$). Thus, in our paradigm, processing global letters requires selective attention, and induces more analytic solving.

Topic Area: THINKING: Problem solving

Creative Cognition under Performance Pressure: Investigating How Anxiety Affects Attentional Styles and Creativity

Poster D139, Monday, March 27, 8:00 – 10:00 am, Pacific Concourse

Kyle Nolla[1], Mark Beeman[1]; [1]Northwestern University

Creative cognition involves different attentional resources and strategies in its processes. One way to conceptualize these strategies is in terms of divergent thinking (open-ended production, with leaky attention) and convergent thinking (narrowing evaluation, with selective attention). Existing creative tasks depend on these thinking styles differently--for example, the Alternative Uses Task (AUT) requires continued generation of responses to an open-ended cue. Similarly, Compound Remote Associate Problems (CRAs) require divergence to rapidly access distant associations between words, but also problem-solving that convenes on a correct answer. Even within the CRAs, solving styles differ in their use of convergent/divergent thought: solving by insight requires low-level activation of many concepts which eventually converge to a solution, while analytic solving is a more directed, step-by-step method to find a solution. Because these thinking styles can be connected to attention, and attention can be modulated by moods such as anxiety, I investigated how performance pressure and its resulting anxiety affect creative cognition. In the presented studies, participants performed CRAs, AUTs, WM measures, and anxiety measures under high- or low-pressure conditions. Although the pressure manipulation failed, results relating the constructs were found. Multiple regressions of analytic and insight solving of CRAs, WM capacity, and anxiety measures were used to predict the 3 AUT subscores. CRA Insight solving negatively predicted the number of category shifts in AUTs ($p=.006$), while CRA Analytic solving positively predicted AUT category shifts ($p=.04$). WMC predicted performance on all three aspects of the AUT, and also analytic CRA solving. Implications will be discussion.

Topic Area: THINKING: Problem solving

Polarity-dependent effects of biparietal tDCS on the interplay between top-down and bottom-up processes in visual attention

Poster E1, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Magdalena Chechlacz[1,2], Dario Cazzoli[3], Joy J Geng[4], Peter C Hansen[2]; [1]University of Oxford, [2]University of Birmingham, [3]University of Bern, [4]UC Davis

Visuospatial attention allows the allocation of limited neural processing resources to behaviourally relevant stimuli. The selection of task-relevant visual targets entails the processing of multiple competing stimuli and the suppression of distractors which may be either perceptually salient or perceptually similar to targets. The posterior parietal cortex (PPC) controls both the interaction between top-down (task-driven) and bottom-up (stimulus-driven) processes competing for attentional selection as well as the spatial distribution of attention. Transcranial direct-current stimulation (tDCS) can be used to modulate cognitive processes by affecting cortical excitability (i.e., anodal stimulation increases while cathodal stimulation decreases cortical excitability). We used tDCS applied bilaterally over the PPC to modulate the interaction between top-down and bottom-up processes in visual attention. We measured the accuracy of performance in a visual search task prior to and during three within-subjects stimulation sessions (sham, right cathodal/left anodal and left cathodal/right anodal) in which a lateralized (left or right visual field) target was presented alone or together with a contralateral similar or salient distractor. Consistent with prior studies, the perceptually salient distractor facilitated, while the similar distractor hampered, target detection. In addition to the main effect of stimulation, we found a significant interaction between stimulation, target location and distractor saliency. This finding was attributable to the opposite effects of right cathodal/left anodal versus left cathodal/right anodal stimulation on the detection of the target which was accompanied by a perceptually similar distractor. We conclude that biparietal-tDCS can alter the relationship between task-driven and stimulus-driven attentional selection in a polarity-dependent manner.

Topic Area: ATTENTION: Spatial

Alpha oscillations during exogenous and endogenous attention in touch

Poster E2, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Alexander Jones[1], Bettina Forster[2]; [1]Middlesex University London, [2]City University London

One of the strongest predictors of attention measured in the brain is the change in alpha oscillations, as measured by electroencephalogram (EEG). Contralateral decreases and ipsilateral increases in power, measured over sensory cortices, in the alpha frequency (8-12Hz) have shown to correlate with shifting attention to a

location in space. The present study explored the role of alpha oscillations when expecting a lateralized tactile stimuli in three tasks. In an exogenous task (A) a non-predictive tactile cue to the index finger was followed by a target after 800 ms, presented to the same (cued) or opposite (uncued) finger. In an endogenous task (B) the same stimuli were presented but the cue was informative. If the cue appeared to the left the target was also most likely (80%) to appear to the left. In an endogenous counter-predictive task (C) a left cue indicated a target was most likely (80%) to appear to the right hand. Response times showed inhibition of return in the exogenous task and facilitation of responses by cues to targets in the two endogenous tasks. Wavelet analysis demonstrated a modulation of lateralized alpha oscillations in the endogenous task (B) in the cue-target interval. Interestingly, a similar but reduced lateralized effect was present in the exogenous task (A). In the counter-predictive task (C) there was evidence of competing alpha oscillations resulting from both endogenous and exogenous orienting. Taken together, these findings demonstrate that alpha oscillations relate not only to endogenous but also exogenous shifts of attention.

Topic Area: ATTENTION: Spatial

Cerebellar contributions to reflexive and voluntary covert visual attention

Poster E3, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Christopher Striemer[1,2], Brandon Craig[1], Britt Anderson[3], James Danckert[3]; [1]MacEwan University, Edmonton, Alberta, Canada, [2]University of Alberta, Edmonton, Alberta, Canada, [3]University of Waterloo, Waterloo, Ontario, Canada

Over the past 20 years evidence from functional neuroimaging and human lesion studies indicate that, in addition to its central role in motor control, the cerebellum may also play a role in controlling attention. Recent functional neuroimaging and patient work from our lab (and others) suggests that the cerebellum may play a greater role in controlling reflexive compared to voluntary covert attention (i.e., Striemer et al., 2015a; 2015b); However, this has never been examined directly. Therefore, in the current study, we compared the effects of cerebellar lesions (n=10) on reflexive and voluntary versions of Posner's covert visual attention task in which participants must attend to peripheral locations without making eye movements. To examine reflexive covert attention, we used non-predictive peripheral cues, and stimulus onset asynchronies (SOAs) of 50, 100, 300, and 600ms. To examine voluntary covert attention, we used predictive central arrow cues, and SOAs of 250, 350, and 550ms. Preliminary results indicate that, for the reflexive covert attention task, patients with cerebellar injury demonstrate a larger overall cueing effect (i.e., invalid RTs – valid RTs), and a delayed onset of inhibition of return, compared to age-appropriate controls. In contrast, for the voluntary covert attention task, preliminary analyses suggest that there are no significant differences in the cueing effect for cerebellar patients vs. controls. Overall, these preliminary findings are consistent with the notion that the cerebellum plays an important role in controlling reflexive, but not voluntary covert attention shifts.

Topic Area: ATTENTION: Spatial

Males and Females use different spatial strategies when navigating a novel tabletop navigation task

Poster E4, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Mashal Fida[1], Erin L. Zelinski[2], Sean G. Lacoursiere[1], Robert J. Sutherland[1]; [1]Canadian Centre of Behavioural Neuroscience, University of Lethbridge, [2]Cumming School of Medicine, University of Calgary

Sex differences in spatial abilities have been reported in many mammalian species, including humans. The Morris Water Task (MWT) is an often-used behavioural assay of spatial ability in rodents that has been adapted to use in humans, typically as virtual reality. Such variations have lead some to theorize that males and females implement different strategies to solve spatial problems. On average, men tend to use cardinal directions, whereas women tend to use landmarks to solve these tasks. In our previous studies using the Real-World version of the MWT, we found superior male performance in the allocentric version of the MWT while a clear female advantage was observed in the egocentric version of the task. These findings led us to design allocentric and egocentric tabletop versions of the MWT. We hypothesized that men would excel at the allocentric version where as females would excel in the egocentric version of the task. Sixty subjects (30 women) ages 18-25, were asked to locate a single, hidden target location in the allocentric condition over several trials with varying start locations. Male performance was significantly better than females on this version of the task. A second experiment containing sixty subjects (30 women) ages 18-25, performed the egocentric version of the task. In the egocentric condition, women demonstrated a clear advantage relative to males. Together, these results indicate that although men and women can both solve spatial tasks, the default strategy is allocentric for men and egocentric for women.

Topic Area: ATTENTION: Spatial

Neural Activation Patterns of Binge Drinking Young-Adults When Performing a Mental Rotation Task: A Functional Magnetic Resonance Imaging (fMRI) Study

Poster E5, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Karl Kashfi[1], Peter Syapin[1], Michael O'Boyle[1,2]; [1]Texas Tech University Health Sciences Center, [2]Texas Tech University

Here we investigate the relationship of binge drinking in young adults to subsequent changes in their brain/cognitive functioning. Seven binge drinkers (i.e., consumption of 5 or more drinks in two hours for men; 4 or more for women, on three or more occasions in the last 30 days) and 7 moderate drinkers (who drink but do not binge) mentally rotated a shape to determine which of four options matched a target. Concomitant fMRI scans were acquired and response accuracy and reaction (RT) were monitored. Binge drinkers and moderate drinkers did not differ in either accuracy or RT. However, moderate drinkers showed significantly greater parietal activation, including bilateral activation of the fusiform gyrus (Brodmann 37) and left angular gyrus (Brodmann 39); binge drinkers exhibited significantly greater activation in the right superior temporal gyrus (Brodmann area 21) and the right insula. These patterns tentatively suggests that moderate drinkers engage a prototypical imagery-based mental rotation strategy (i.e., manipulating the shape in the mind's eye), while binge drinkers rely on a more verbally mediated approach, activating visual and auditory/language processing regions. Binge drinkers also recruited the right insula, reflecting greater attentional involvement in the task. These differential brain activation patterns are discussed in light of their potential as a neural marker of future alcohol dependence and/or misuse.

Topic Area: ATTENTION: Spatial

Cortical Expression of the Magnitude of Inhibition of Return

Poster E6, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Grace Whitaker[1], Ellen Poliakoff[1], Joanna Neill[1], Wael El-Deredy[1]; [1]The University of Manchester

Inhibition of return (IOR) is the phenomenon whereby individuals are delayed from re-attending stimuli, and is observed as slower reaction times (RTs) to targets appearing in previously-attended (cued) versus novel (uncued) spatial locations. The extent to which individuals exhibit IOR varies, measured by the difference in RT for cued versus uncued conditions. For the first time, we demonstrate that individual differences in behavioural IOR magnitude are reflected in cortical activity measured via electroencephalography (EEG). Participants underwent EEG whilst completing a visual target-target IOR task. Across participants, the average difference in N2pc amplitude was positively related to average difference in RT for cued versus uncued conditions ($r = .46$, $p = < .05$, $n = 43$). As the N2pc is linked to selective attention, these results suggest that individual differences in IOR reflect individual differences in selective attention, and highlight the relevance of studying individual differences in this area. Furthermore, the N2pc offers an alternative to RTs for measuring IOR magnitude.

Topic Area: ATTENTION: Spatial

Involuntary Mental Rotation and Visuospatial Imagery from External Control: Implications for Frontal Control Mechanisms

Poster E7, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Donish Cushing[1], Ezequiel Morsella[1,2]; [1]Department of Psychology, San Francisco State University, [2]Department of Neurology, University of California, San Francisco

The Reflexive Imagery Task (RIT) was developed to investigate the entry into consciousness of high-level, involuntary thoughts and imagery (Bhangal et al., 2013). In the basic version of the task (Allen et al., 2013), participants are presented with visual objects and instructed to not think of the names of the objects. Involuntary subvocalizations arise on roughly 80% of the trials. Can mental rotation and visuospatial imagery, too, arise in this involuntary manner? If so, it would be noteworthy, for these processes involve symbol manipulation and frontal control mechanisms. In Task 1, subjects were first taught to mentally rotate (30°, 60°, or 90°) two-dimensional nonsense objects. After training, participants were instructed to not mentally rotate in these ways a different set of objects. In Task 2, subjects were taught how to move in their minds (i.e., visuospatial imagery) objects in specified ways, much as one could imagine how, in the game of chess, a given piece can navigate the chessboard. Each object was associated with a unique pattern of potential movement on a chessboard-like grid. After training, subjects were instructed to not think of where each object could move on the grid. Systematic, involuntary imagery occurred on a substantial proportion of trials for Task 1 ($M = .44$, $SE = .11$) and Task 2 ($M = .65$, $SE = .11$). The order of presentation of the two tasks was fully counterbalanced across subjects. Of import, RIT effects arose even though the involuntary processes required symbol manipulation and frontal control mechanisms.

Topic Area: ATTENTION: Spatial

Distractor suppression varies with expectation

Poster E8, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

MaryAnn Noonan[1], Yannik Bauer[2], Alex Von Lautz[3], Christopher Summerfield[1], Mark Stokes[1]; [1]Department of Experimental Psychology, University of Oxford, Oxford, UK, [2]International Max Planck Research School, University of Tübingen, Germany, [3]Bernstein Center for Computational Neuroscience, Berlin, Germany.

We have recently suggested distractor inhibition emerges when the predictive information can be inferred directly from past experience. Specifically, we found that distractor suppression is only effective when distractors repeat across a block of trials and not when distractor location is cued on a trial-wise basis (Noonan et al., 2016, JON). We now explore whether predictions of environmental stability are embedded in higher order expectations. In a speeded target discrimination task subjects are implicitly cued to the location of the target or distractor via manipulations in the underlying predictability of the two stimuli. Repetitions of either target or distractor

location could therefore be either expected or unexpected. Behaviourally, reaction times were reduced when either stimuli was more spatially predictable. Critically this decrease in RT across spatial predictability is driven by expected stimulus repetition. We recorded EEG while subjects performed this task. Focusing on single repetitions, collapsed across all spatial predictions, we show enhanced P1 amplitudes controlateral to targets on target repetition trials and a suppressed P1 contralateral to distractors on distractor repetition trials. Further we report that this P1 suppression is driven by expected distractor repetitions. Notably the complementary effect is not seen in the expected target repetition trials. A follow-up study explores the temporal properties of distractor expectation. By varying inter-stimulus-intervals on a trial-wise basis we begin to disentangle repetition suppression from expectation.

Topic Area: ATTENTION: Spatial

Spatial selectivity and attentional modulation reflect coordinated processing of high frequency broadband and alpha signals in the human visual system

Poster E9, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Anne Martin[1], Liang Wang[1,2], Yuri B. Saalmann[1,3], Avgusta Shestyuk[4], Nathan E. Crone[5], Josef Parvizi[6], Robert T. Knight[4], Sabine Kastner[1]; [1]Princeton University, [2]Chinese Academy of Sciences, [3]University of Wisconsin – Madison, [4]University of California Berkeley, [5]The Johns Hopkins Hospital, [6]Stanford University School of Medicine

Classical effects of attention on low frequency (alpha) suppression have been characterized in human EEG, and high frequency spiking activity has been investigated in many animal neurophysiology studies. However, detailed electrophysiological analyses on spatial selectivity and the effects of attention across these frequency domains in the human brain have not been reported. We analyzed ECoG signals recorded from 8 epilepsy patients performing an Eriksen flanker task variant. Following a spatial cue and variable delay interval, subjects differentiated between two shapes at the cued location in an array of distracters, allowing us to measure selectivity within 25 degrees of visual angle. Using our probabilistic atlas of the human visual system (Wang et al., 2014), we localized electrodes to visual topographic areas and identified those with cue-evoked spatially-selective high frequency broadband power (HFB) or low frequency (alpha) suppression. We found that HFB and alpha spatial selectivity lasted into the delay as well as through the target array interval in higher-order areas of both the ventral and dorsal visual processing streams. In these areas, the HFB response field center was strongly correlated with the location of strongest alpha suppression. Further, the temporal progression of HFB and alpha selectivity indicate a specific, coordinated representation of space in low and high frequency bands, suggesting an organized functionality of processing that may facilitate information transfer across these cortical areas. Wang L, Mruczek RE, Arcaro MJ, Kastner S (2014) Probabilistic Maps of Visual Topography in Human Cortex. Cerebral Cortex:bhu277.

Topic Area: ATTENTION: Spatial

Internal consistency of spatial information in a cognitive map

Poster E10, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Yuri Dabaghian[1]; [1]Baylor College of Medicine, Houston, TX 77019 USA

Learning and memory emerge from the activity of groups of neurons, yet there are few models that can meaningfully connect data acquired at the level of individual cells with whole-animal behavior beyond mere correlation. We have begun to tackle this problem by computationally modeling spatial learning. The foundation of our approach is the hypothesis that the hippocampus provides a rough-and-ready topological framework of an environment rather than a precise metrical map. This model, which is supported by animal studies, allows us to employ algebraic topology to ascertain the effects of specific parameters (e.g., firing rate) on the ability of an ensemble of virtual neurons to correctly "learn" an experimental environment. We have recently studied the effects of two brain rhythms, θ- and γ-waves, on spatial learning. Both have been correlated with learning but it has been difficult to explain precisely why. We found that θ-phase precession parcellates place cell coactivity at the network scale (~150-200 msec), as recorded in animal experiments, and show how this enhances spatial learning. We also found that γ-rhythm synchronizes spiking in dynamical place cell assemblies to enable encoding and retrieval of spatial memories at the synaptic timescale (~50 msec). Topological theory thus provides a conceptually elegant description of the spatial learning process and enables us to explain a wide range of phenomena.

Topic Area: ATTENTION: Spatial

Aberrant expression of proteins with possible role in cognitive impairment in SCA12 patients

Poster E11, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Rajeswari Moganty[1]; [1]All India Institute of Medical Sciences, New Delhi ,INDIA

Spinocerebellar ataxia 12 (SCA12) is a unique dominant type of ataxia characterized by early and prominent action tremors, memory deficit, neuropathy, dysarthria etc. The expansion of DNA triplet (CAG) repeats in 5'UTR of PPP2R2B gene appears to be the cause for the pathogenesis of the neurodegenerative disorder, SCA12. The objective of the current study was to identify the aberrantly expressed plasma proteins for their potential application in therapy or diagnosis/prognosis of SCA12.

Sixty-two clinically suspected patients were assessed using International co-operative ataxia rating scale (ICARS) and genetic confirmation was done using PCR followed by DNA sequencing. Twenty patients who were genetically confirmed were included in the study. 2D-DIGE analysis of plasma proteins of SCA12 patients revealed 14 differentially expressed protein spots, which were confirmed as nine proteins by LC-MS/MS. The 6 downregulated and 3 upregulated proteins are known to have physiological role in transport (thyroxin and retinol to brain), lipid metabolism, memory, scavenging of free haemoglobin etc. Altered expression of some of the proteins of interest, transthyretin, haptaglobin, apolipoprotein C-II, apolipoprotein C-III are indicative of clinical manifestations such as neuropathy, cognitive impairment and altered lipid metabolism in SCA12 Keywords – Proteomics, Spinocerebellar ataxia type 12, Neurological disorders. Abbreviations – SCA12, Spinocerebellar ataxia type 12; 2D-DIGE, Two-dimensional difference in-gel electrophoresis; ICARS, International Co-operative Ataxia Rating Scale.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

Emotional mimicry beyond the face: Rapid face and body responses to facial expressions

Poster E12, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Catherine Reed[1], Eric Moody[2], Tara Van Bommel[3], Betsy App[3], Daniel McIntosh[3]; [1]Claremont McKenna College, [2]University of Colorado Anschutz Medical Campus, [3]University of Denver

Emotional mimicry—quick and spontaneous matching of another's expressions—is a well-documented phenomenon and is associated with numerous social outcomes. Although the mechanisms underlying this phenomenon are not fully understood, there is growing awareness that mimicry is more than a one-to-one motor matching of others' expressions (Hess & Fischer, 2013). Simulation theory (Wood, et al, 2016) suggests that when observing an emotional expression, the observer's brain simulates that emotion, and that activity may "spill-over" into other cortical areas leading to mimicry. If true, this could lead to rapid muscle reactions beyond the face. This study explored this possibility by exposing participants to facial expressions of emotions while taking electromyographic (EMG) recordings over face and arm muscles. As expected, we found that passively viewing faces with negative expressions (anger and fear) resulted in the typical facial mimicry response: participants deferentially activated their corrugator muscles in response to angry faces and frontalis muscles in response to fearful faces [$F(1,44)= 9.20$, $p = 0.004$, $\eta p2= 0.07$]. Of interest, we also found corresponding emotion-specific response in arm muscles even though no body information was presented: in response to anger faces, flexor muscles were activated that are part of making a fist and in response to fear faces, extensor muscles were activated that are part of lifting the hands for a defensive posture [$F(1,44)= 5.49$, $p = 0.02$, $\eta p2= 0.11$]. Consistent with embodiment theory, this suggests that observers simulate observed emotions and that activity may spill-over to other areas.

Topic Area: EMOTION & SOCIAL: Emotional responding

ERPs to the Military Affective Picture Set (MAPS)

Poster E13, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Marianna Eddy[1,2], Mary Boomhower[1], Breanne Hawes[1], Jennifer Rourke[1], Caroline Mahoney[1,2]; [1]U.S. Army Natick Soldier Research, Development, and Engineering Center, [2]Center for Applied Brain and Cognitive Sciences

The Military Affective Picture Set (MAPS) was developed to provide relevant affective images for the investigation of cognitive and emotional processing in Soldiers. The current study investigated the electrophysiological correlates of emotional responses to this image set in order to provide further evidence that these images are effective at inducing emotional responses consistent with labels given to the images. While extensive data exists for the civilian emotional dataset, supporting that the the International Affective Picture Set (IAPS) evokes particular affective states, there is limited data on the relatively new MAPS. In this study, a group of active duty US Army Soldiers viewed positive and negative valenced images that were either high or low arousal. While viewing the images, participants rated the images on the self-assessment manikin (SAM) on valence (happy-sad) and arousal (excited-dull) while event-related potentials (ERPs) were recorded. Consistent with previous ERP results for the IAPS, the MAPS images that were higher in arousal produced larger positive going P300 and LPP effects compared to lower arousal images. However, within low arousal images there was no difference between positive and negative images on the P300 or LPP, however, high arousal negative images produced a larger LPP than high arousal positive images, but did not differ on the P300. These results suggest the MAPS are effective at eliciting emotional responses in active duty military.

Topic Area: EMOTION & SOCIAL: Emotional responding

Context-dependent neural responses in insula and amygdala when viewing affective animal videos

Poster E14, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Christine A. Godwin[1], Sunya A. Fareed[1], J.C. Mizelle[2], Eric H. Schumacher[1]; [1]Georgia Institute of Technology, [2]East Carolina University

Animals have the ability to elicit a complicated and diverse set of affective responses. In particular, insects have been associated primarily with feelings of disgust. This has frequently been interpreted in the context of disease avoidance. However, the extent to which individuals experience feelings of disgust and other emotions in

response to insects may vary greatly depending on the environment in which these animals are encountered: Insects in home environments may elicit stronger disgust responses compared to insects in nature, in line with the idea of disease avoidance. To test this, we collected fMRI scans while participants (n=20) viewed 15-s videoclips of animals in dynamic, complex environments. The three primary categories of videos consisted of insects in nature, insects in the home, and fear-inducing animals in nature (e.g., sharks). Participants also rated each video for fear, disgust, and pleasantness. We selected the insula and amygdala as a priori regions of interest due to their respective roles in supporting disgust and fear responses. When comparing videos of insects in the home to insects in nature, we observed increased insula activation and increased self-reports of disgust. In addition, insects in general elicited greater insula activation compared to fear-inducing animal videos, whereas fear-inducing animal videos elicited greater activation in the amygdala compared to both insect video categories. These data emphasize the importance that context has on emotional processing, including affective responses to insects. Furthermore, these results provide further support that at least partially-segregated brain networks support the emotions disgust and fear.

Topic Area: EMOTION & SOCIAL: Emotional responding

The late positive potential (LPP) as a novel method for assessing fear conditioning in humans

Poster E15, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Felix Bacigalupo[1], Steven J. Luck[1]; [1]Center for Mind and Brain, University of California - Davis

Introduction: For more than sixty years, the gold standard for assessing fear conditioning in humans has been the skin conductance response (SCR). Although the SCR has been proven useful, it has three main limitations: 1) it is an indirect response of the peripheral nervous system rather than a direct response of the central nervous system; 2) it is slow, reaching a peak 4–5 seconds after stimulus onset; and 3) it decreases in amplitude after a few trials (habituation). Objective: To determine whether the late positive potential (LPP) in ERP recordings could provide an alternative method for assessing fear conditioning. Methods: SCR and EEG signals were measured in seventy volunteers who participated in a fear conditioning paradigm consisting of three blocks in which colored circles (blue, green and yellow) were either paired (CS+) or not paired (CS-) with a loud noise (100 dB). Participants also reported the perceived likelihood of being exposed to the noise for each color. Results: Both SCR and LPP showed significant differences between CS+ and CS- trials. However, SCR decreased steeply after the first conditioning block whereas LPP and self-reports were stable over time. Conclusion: The LPP has various advantages over the SCR for assessing fear conditioning in humans: 1) it is fast, peaking approximately 500 ms post-stimulus onset; 2) it is a direct response of the CNS; 3) it does not habituate over time; 4) it is more closely related to the participants' subjective experience.

Topic Area: EMOTION & SOCIAL: Emotional responding

Transient versus sustained neural responses to pleasurable aesthetic experiences

Poster E16, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Amy Belfi[1], Edward A. Vessel[2], Denis G. Pelli[1], Anjan Chatterjee[3], Helmut Leder[4], G. Gabrielle Starr[1]; [1]New York University, [2]Max Planck Institute for Empirical Aesthetics, [3]University of Pennsylvania, [4]University of Vienna

Aesthetic experiences, such as listening to music or viewing artworks, are often highly pleasurable. Here, we sought to investigate the dynamic nature of aesthetic experience using fMRI. Participants (N=30) continuously rated their pleasure while viewing images of paintings. To further probe the timecourse of aesthetic experience, images were presented for various durations: 1s, 5s, or 15s. After each trial, participants gave an overall summary rating of their pleasure from the on a sliding scale. Trials were characterized as 'high,' 'medium,' or 'low' pleasure based on this overall rating. Presentation duration (1s, 5s, 15s) did not alter the overall proportion of images rated as high, medium, or low overall. It is remarkable that increasing duration from 1 to 15s did not increase the overall pleasure rating. The overall summary ratings were highly correlated with peaks of the continuous ratings. We performed ROI analyses investigating the timecourse of neural activity in sensory, emotion, and default mode regions, which have previously been implicated in aesthetic experience. We observe a transient response in the striatum following stimulus onset that is correlated with the end-of-trial pleasure rating at all three durations, showing greater response for high-rated trials. Conversely, in default mode network regions we observe differences between high- versus low-rated trials in the 15s presentation condition that linger beyond the end of the stimulus. These results indicate that aesthetic experience is represented differently across brain networks based on the degree of felt pleasure.

Topic Area: EMOTION & SOCIAL: Emotional responding

Taking hyperscanning out of the lab: Evidence from EEG recordings on 1400 dyads during face-to-face interaction

Poster E17, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Suzanne Dikker[1,2], Georgios Michalareas[3], Matthias Oostrik, Hasibe Melda Kahraman[4,2], Imke Kruitwagen[1], Shaista Dhanesar[5], Marijn Struiksma[1], David Poeppel[2,3]; [1]Utrecht University, [2]New York University, [3]Max Planck Institute for Empirical Aesthetics, [4]Hunter College, [5]Washington University in St. Louis

What does it mean to be 'on the same wavelength' with another person? When we feel connected or engaged, are our brains in fact 'in sync' in a formal, quantifiable sense? To address this question, we collected EEG and questionnaire data from 2800 participants at eight different sites (museums and galleries). During the experiment, pairs of people interacted face-to-face for 7-10 minutes inside The Mutual Wave Machine, an interactive neurofeedback art/science installation that collects, compares, and visualizes brain-to-brain synchrony between two people in real time (light patterns reflect moving-window correlations between the two EEG signals). The large dataset allowed us to explore the relationship between brain-to-brain synchrony and character/relationship traits as well as emotional states. Findings from 700 EEG recordings, matched for experimental parameters and context, show that pairs with more empathetic personalities (Interpersonal Reactivity Index, Davis 1980) also exhibited higher brain-to-brain synchrony, and the same was true for pairs who felt more connected to each other. Further, brain-to-brain synchrony increased throughout the recording session - but only if dyads were explicitly told that the light patterns they saw reflected their brain-to-brain synchrony, or if pairs reported to be more focused at the end of their session. These findings support an account whereby brain-to-brain synchrony is a possible biomarker for social interaction that increases as a function of joint attention, as measured via factors like empathy, focus, and connectedness. Our interdisciplinary 'crowdsourcing neuroscience' approach may provide a promising new avenue to collect rich datasets pertaining to real-life face-to-face interactions.

Topic Area: EMOTION & SOCIAL: Emotional responding

EEG frontal alpha power asymmetry can evaluate temporal dynamics of our emotion

Poster E18, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Motoyuki Sanada[1], Kohei Fuseda[1], Jun'ichi Katayama[1,2]; [1]Department of Integrated Psychological Sciences, Kwansei Gakuin University, [2]Center for Applied Psychological Science (CAPS)

Current study investigated the temporal dynamics of physiological index corresponding to human emotion. It has been known that the asymmetry of frontal alpha power of the electroencephalogram (EEG) reflects our affective/motivational state: left and right high power reflects withdrawal and approach motivation, respectively (Davidson et al., 1990). In most studies, the alpha power has been calculated by the Fast Fourier Transform (FFT) analysis, thus the temporal information of the state has to be discarded. Our emotional state, however, varies over time, so the method to evaluate the temporal aspect of our emotional state must be very useful. We extracted alpha power by band-pass filter from EEG data in two frontal channels (F3 and F4), which were collected from 12 participants while they were watching two sad movie clips (7 min each). Our results showed (1) that asymmetric patterns of the alpha power derived by the filter method were highly correlated with that calculated by FFT, when they were averaged during whole movie length., (2) the asymmetric patterns of the filtered alpha power changed according to the transitions of the film scenes. These results indicate application potency of this method to assess temporal dynamics of the EEG index of our emotion.

Topic Area: EMOTION & SOCIAL: Emotional responding

The effect of narrative context on persuasive message processing

Poster E19, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Matthew Bezdek[1], Richard Gerrig[2], Tiffany Nguyen[1], William Wenzel[2], Eric Schumacher[1]; [1]Georgia Institute of Technology, [2]Stony Brook University

Past research has reported that medial prefrontal regions are recruited during the processing of strong compared to weak persuasive messages. Other work has suggested that transporting narratives may cause readers to process persuasive arguments on a deeper level, possibly through reduced counter-arguing. We probed for behavioral and neuroimaging evidence that narrative context affects the way in which arguments are processed. To test this hypothesis, we presented a series of strong and weak arguments concerning public health topics to participants and asked them to rate the strength of the arguments. To a second set of participants, we presented auditory and text versions of the arguments as we collected functional magnetic resonance imaging (fMRI) volumes. Narrative context (whether arguments were presented within stores or on their own) was manipulated between groups. Data from the set of behavioral participants showed an interaction effect for argument strength and narrative context: strong arguments were rated higher than weak arguments when presented alone, but this difference was attenuated when the arguments were presented in stories. A mixed ANOVA was performed on the fMRI data comparing the effects of argument strength and narrative context. This analysis revealed that argument strength and narrative context evoke greater activation in medial prefrontal regions. These cognitive and neural findings contribute to our understanding of theories of narrative transportation.

Topic Area: EMOTION & SOCIAL: Emotional responding

The association between residual cannabis use and the P300 event related potential on emotion processing in subclinical depression

Poster E20, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Robert Torrence[1], Joseph Davis[1], Lucy Troup[1]; [1]Colorado State University

Cannabis has been suggested to have anxiolytic and antidepressant effects, however research is conflicting. With the recent legalization of cannabis in Colorado, and other states, for medical and recreational purposes, there is a need to better understand the relationship between cannabis use and mood disorders, especially in ecologically valid models. The purpose of this research was to examine the interaction between cannabis use and depression symptoms, when processing emotional

expressions. A facial emotion-attention task was completed by 122 participants; neural activity was measured using EEG. The task had three conditions: implicit, explicit, and empathy; and four emotions: neutral, happy, angry, and fearful. Analysis of the P300 was conducted. Participants were classified into four groups: controls, nondepressed users, depressed nonusers, and depressed users. Depressed nonusers had reduced P300 amplitudes when implicitly processing fearful expressions, in comparison to controls. Depressed users had reduced amplitudes when explicitly processing fearful expressions, in comparison to controls. Within-group comparisons indicated that depressed non-users showed reduced P300 amplitudes for negative emotions, in comparison to happy and neutral in the implicit task. They also had reduced P300 amplitudes for angry, in comparison to fear in the explicit task. The largest P300 amplitude differences were found in depressed users, in particular, there was a significantly reduced amplitude in response to fearful faces in the explicit and empathy tasks. The results suggest that cannabis does not positively affect depression and may actually have negative effects on empathy. The results were consistent with past research that suggested cannabis affects empathic processing.

Topic Area: EMOTION & SOCIAL: Emotional responding

Individual differences in reactivity to reward partly account for variability in resilience to stress

Poster E21, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Polina Zozulinsky[1], Roee Admon[1], Tomer Shechner[1], Rachel Tomer[1]; [1]University of Haifa, Israel

Some individuals are vulnerable to the deleterious effects of stress, while others appear more resilient and maintain healthy functioning in response to aversive experiences. Individuals also vary in their response to appetitive events. Although the reward system received less attention in the study of stress resilience, lower reactivity toward rewards and alterations within the reward circuitry had been observed among subjects suffering from stress-related disorders. Therefore, we hypothesized that individual differences in reactivity to reward may contribute to the variability in resilience to stress among healthy individuals. Thirty healthy adults (18 females, mean age=24) completed the Connor-Davidson resilience scale followed by the mental stress task (Tanida et al 2004), a self-report measure of reactivity to stress, which served as an additional measure of resilience.The probabilistic reward task (PRT, Pizzagalli et al 2005) was used to measure responsiveness to reward. We found that higher resilience scores were associated with lower levels of perceived stress at baseline and smaller elevation in subjective stress ratings following the mental stress manipulation (p=0.02). As predicted, higher resilience scores were associated with higher reward responsiveness as measured by the PRT(p=0.04). Finally, self-reported levels of perceived stress both at baseline and following the stress manipulation were negatively correlated with reward responsiveness (r=-.395, p=0.03; r=-.489, p=0.01 respectively). These results suggest that higher reactivity toward appetitive events may contribute to individual's resilience to stress.

Topic Area: EMOTION & SOCIAL: Emotional responding

The brain network for emotional body language reading: Combined structural and effective connectivity

Poster E22, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Arseny SOKOLOV[1,2], Peter ZEIDMAN[2], Michael ERB[3], Frank POLLICK[4], Wolfgang GRODD[5], Richard FRACKOWIAK[1,6], Karl FRISTON[2], Marina PAVLOVA[3]; [1]Centre Hospitalier Universitaire Vaudois (CHUV), Lausanne, Switzerland, [2]University College London (UCL), UK, [3]University of Tübingen Medical School, Germany, [4]University of Glasgow, UK, [5]Max Planck Institute for Biological Cybernetics, Tübingen, Germany, [6]Ecole Normale Supérieure DEC, Paris, France

While understanding the emotions conveyed by body expressions of others is essential for social cognition and interaction, the underlying neural correlates remain largely unknown. We used functional MRI (fMRI) and diffusion tensor imaging (DTI) in healthy subjects viewing a point-light arm knocking on an invisible door with different emotional expressions (happy, neutral and angry). Data pre-processing and analysis were performed with SPM12 and FSL5. The right superior temporal sulcus (STS) and right caudate nucleus exhibit higher activation for happy as compared to neutral knocking. Angry versus neutral knocking activates the inferior insula, perigenual anterior cingulate cortex (ACC) and posterior midcingulate cortex (MCC) in the left hemisphere. The cerebellar vermis (lobule IX) and right amygdala respond strongest to neutral as compared to emotional body language. To further characterize the network architecture in a neurobiologically more plausible way, we developed an approach to integrate measures of structural connectivity obtained from probabilistic tractography within dynamic causal modelling (DCM) of effective connectivity. This analysis reveals key components and interactions subserving emotional processing, such as between the caudate nucleus and cingular areas. Furthermore, the connectivity data shed light on communication between the cerebellar vermis and amygdala potentially related to emotional regulation. In summary, this study provides the first characterization of the brain network for reading of emotional body language. Combining information on function and structure is useful for network analysis and lays ground for better understanding of neuropsychiatric conditions with deficits in visual social cognition.

Topic Area: EMOTION & SOCIAL: Person perception

Reconsidering the face inversion effect: A state-strength approach

Poster E23, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Robin I. Goodrich[1], Andrew P. Yonelinas[1]; [1]University of California, Davis

Face perception and recognition is more difficult when faces are inverted compared to when they are upright (i.e., the face inversion effect, FIE). Recent work has indicated that perceptual discriminations can be based on two functionally distinct processes: perceiving and sensing. However, whether the FIE impacts perceiving- or sensing-based perception is unknown. In the current study, we used confidence-based receiver operating characteristics (ROCs) to examine the effect of face inversion on perceiving and sensing for faces that had been either configurally or featurally manipulated. In Experiment 1, face inversion led to a reduction in the probability of discretely perceiving a difference, but did not impact sensing. Moreover, the FIE on perceiving was greater for faces with configural than featural changes. In Experiment 2, we replicated this pattern of results, albeit decreased in effect magnitude, for mono-oriented objects (i.e., buildings). In Experiment 3, we confirmed the earlier results and further verified that the findings based on ROC estimates of perceiving and sensing paralleled participants' subjective reports of perceiving and sensing. Furthermore, the results showed that perceiving, but not sensing, responses were directly related to conscious access of detailed, veridical information about a specific change that had occurred. These findings not only extend our understanding of the FIE and the processes underlying face perception and recognition, but also provide a new perspective, via the use of a novel (ROC) method, on the dual processes that contribute to face processing.

Topic Area: EMOTION & SOCIAL: Person perception

Preconscious and conscious stages of stimulus processing depend on whom we are with.

Poster E24, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

J. Bruno Debruille[1,2], Shahin Tavakol[1,2], Maud Haffar[1,2], Sheila Bouten[1], Hugo Pantecouteau[3]; [1]Douglas Institute Research Center, Montreal, Canada, [2]McGIll University' Montreal, Canada, [3]École Normale Supérieure de Lyon, France

Our immediate reactions to events can depend on which close others are present. The production of behaviors that fit those of well-known others reveals an ability at anticipating their reactions. It shows that we can process stimuli not only from our perspective but also from their perspective. Looking for the mechanisms of this social mode of processing, we found that the mere presence of a close other next to participants has a major impact on their event-related brain potentials (ERPs). These ERPs were evoked by images presented for simple memorization. They largely depended on whether participants were sitting side by side with a close one or with a stranger. Partners had larger N300s and N400s and smaller late posterior positivities than strangers. On the other hand, over the right prefrontal cortex, ERPs differed as early as 100 ms post stimulus onset. Discussion of these results led to suggest that stimulus processing could be initially performed in all learned perspectives. It would then depend on the assumed perspective of the close one present, with fewer aspects of the stimulus eventually reaching consciousness in such a presence.

Topic Area: EMOTION & SOCIAL: Person perception

Physical attraction to reliable, low variability nervous systems: Reaction time variability predicts attractiveness.

Poster E25, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Richard Ramsey[1], Emily Butler[1], Chris Saville[1], Rob Ward[1]; [1]Bangor University, UK

The human face cues a range of important fitness information, which guides mate selection towards desirable others. Given humans' high investment in the central nervous system (CNS), cues to CNS function should be especially important in social selection. We tested if facial attractiveness preferences are sensitive to the reliability of human nervous system function. Several decades of research suggest an operational measure for CNS reliability is reaction time variability, which is measured by standard deviation of reaction times across trials. Across two experiments, we show that low reaction time variability is associated with facial attractiveness. Moreover, variability in performance made a unique contribution to attractiveness judgements above and beyond both physical health and sex-typicality judgements, which have previously been associated with perceptions of attractiveness. In a third experiment, we empirically estimated the distribution of attractiveness preferences expected by chance and show that the size and direction of our results in Experiments 1 and 2 are statistically unlikely without reference to reaction time variability. We conclude that an operating characteristic of the human nervous system, reliability of information processing, is signalled to others through facial appearance.

Topic Area: EMOTION & SOCIAL: Person perception

Investigating the Familiar Face Processing Network with Multivoxel Pattern Analysis

Poster E26, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Matteo Visconti di Oleggio Castello[1], Yaroslav O. Halchenko[1], J. Swaroop Guntupalli[1], Jason D. Gors[1], M. Ida Gobbini[1,2]; [1]Dartmouth College, [2]University of Bologna, Italy

The familiar face processing network consists of distributed areas that overlap with the Theory of Mind (ToM) network, suggesting automatic activation of person-knowledge information. We investigated this network using multivariate pattern analysis to distinguish between abstract familiarity information (regardless of identity) and identity-specific information. We scanned 33 subjects using fMRI while they performed an oddball detection task looking at personally familiar and stranger faces. We analyzed the data using a searchlight approach with SVM and permutation testing. We could decode familiarity information (using a leave-two-identities-out cross-

validation scheme, thus controlling for identity information) in areas such as FFA, STS, Precuneus, and IFG. We found significant decoding in ToM areas such as TPJ and mPFC, confirming the involvement of these areas even during implicit processing of familiar face information (oddball task). Surprisingly, we found familiarity decoding in V1 even when controlling for identity information, suggesting that feedback connections might convey familiarity information. We found significant identity decoding in vATL and IFG, highlighting their role in face perception. We also investigated the relationship of representations in these ROIs using cross-validated RSA. The first dimension of a two-dimensional MDS solution revealed the known hierarchical separation between early and higher order visual areas involved in face processing; the second dimension revealed a distinction between the Precuneus and the other areas of the extended system. This experiment confirmed the involvement of ToM areas during implicit familiar face processing using MVPA, and of the IFG and vATL in processing the visual appearance of faces.

Topic Area: EMOTION & SOCIAL: Person perception

Semantic and episodic memory impairments for faces in frontotemporal dementia and Alzheimer's disease

Poster E27, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Jessica A. Collins[1,2], Bradford C. Dickerson[1,2]; [1]Massachusetts General Hospital, [2]Harvard Medical School

The goal of this study was to delineate the cognitive components and neural mechanisms underlying the person recognition difficulties experienced by patients with FTD and AD. Participants included 11 older healthy controls, 11 patients with AD, 10 patients with the semantic variant of FTD (semantic dementia or SD) and 4 patients with the behavioral variant of FTD (bvFTD). To assess semantic memory for famous faces, participants were first shown a set of 15 famous faces and 15 non-famous foils and were asked if they recognized the person (yes/no), and if so to retrieve the person's name. After a 20-minute break participants began the second portion of the task, which measured episodic memory for faces. They were shown a set of 60 faces (30 old) and on each trial indicated whether they saw the person in the previous session (yes/no). Relative to healthy controls, FTD patients (both bvFTD and SD) were significantly impaired at recognizing famous faces as being familiar. SD patients exhibited particular difficulty naming the famous faces they had endorsed as familiar. Patients with AD exhibited preserved performance on the semantic memory portion of the task. Contrary to our expectations, all three patient groups were significantly impaired on the episodic memory portion of the task relative to healthy controls, with no difference in performance observed between the three patient samples. Preliminary cortical thickness analyses in the FTD patient group revealed frontal and temporal cortical areas that predicted episodic and semantic memory performance.

Topic Area: EMOTION & SOCIAL: Person perception

Activation of left temporoparietal junction during mentalizing is directly related to performance in social interactions

Poster E28, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Abdulaziz Abubshait[1], George A. Buzzell[1,2], Paul J. Beatty[1], Eva Wiese[1,2]; [1]George Mason University, [2]Center of Excellence in Neuroergonomics, Technology, and Cognition (CENTEC)

In social interactions, we heavily rely on nonverbal cues to understand the behavior of others and the surrounding environment The gaze direction of others, for example, inform us about what they are currently interested in and warn about potential dangers in the environment. How we react to these cues is strongly determined by the degree to which they are believed to originate from an entity with a mind that possess internal states. Mind perception is subserved by a brain network consisting of the medial prefrontal cortex (mPFC) and the temporoparietal junction (TPJ) and is a prerequisite for theory of mind and mentalizing. Here, we investigate whether activation in the mentalizing network is directly related to performance during so-cial interactions. We measured fMRI activation during a social judgment task and related patterns of activation to performance during a socially interactive task using parametric analysis. Specifically, we asked participants to rate agents of differing degrees of humanness regarding their capabilities of having internal states and test-ed whether a parametric analysis of this activation, weighted by behavior during a gaze-cueing task that used the same agents, revealed significant activation within the mentalizing network. Results showed activation in the whole mentalizing network during the social judgment task, however, only activation in the left TPJ was related to performance during the social interaction task. This finding is in line with the involvement of the left TPJ in anthropomorphism and mental perspective taking and emphasizes the high degree of specialization within the mentalizing network.

Topic Area: EMOTION & SOCIAL: Person perception

Bilingualism interacts with cognitive control to predict parietal grey matter volume

Poster E29, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Kelly A. Vaughn[1], Pilar Archila-Suerte[1], Arturo E. Hernandez[1]; [1]University of Houston

Recent research has uncovered increases in grey matter volume (GMV) associated with bilingual experiences (Della Rosa et al., 2013; Elmer, Hanggi, & Jancke, 2014; Mechelli et al., 2004; Olsen et al., 2015). Because these GMV changes develop throughout the lifespan, they serve as a potential neural mechanism for differences between bilinguals and monolinguals in cognitive control tasks; however, no study to date has directly associated GMV in bilinguals and monolinguals with performance

on cognitive control tasks. The current study compared 48 Spanish-English bilinguals and 37 English monolinguals performing the Simon task, which requires responses to colored shapes while inhibiting the prepotent response. The researchers extracted GMV measures from the bilateral angular and supramarginal gyri from participants' MRI scans using Freesurfer. These regions were chosen based on previous research finding GMV differences between bilinguals and monolinguals in the inferior parietal lobule (Della Rosa et al., 2013; Mechelli et al., 2004). Controlling for participant age, there was an interaction between task performance and bilingual status in the left angular gyrus and right supramarginal gyrus. GMV in the left angular gyrus showed a positive association with the magnitude of the Simon effect in bilinguals and a negative association in monolinguals. GMV in the right supramarginal gyrus was negatively associated with response time for congruent and neutral trials for monolinguals, and positively associated with these response times for bilinguals. These findings connect the bilingual research concerning GMV and cognitive control, implicating the inferior parietal lobule as a potential mechanism for control.

Topic Area: EXECUTIVE PROCESSES: Monitoring & inhibitory control

Impact of dopamine depletion on N-40, a marker of the electrophysiological response selection

Poster E30, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

celine ramdani[1], franck vidal[2], thierry hasbroucq[2]; [1]french army biomedical research institute, [2]Aix-Marseille Université and CNRS

The N-40 is a fronto-central evoked potential, considered as an electrophysiological marker of response selection. Several lines of evidence point supplementary motor areas (SMAs) as a probable generator of the N-40. Indeed, on one side three independent methods, relying on different mathematical principles that the N-40 originates mainly from the medial frontal cortex and very likely from its more superficial part, i.e. SMAs (supplementary motor areas) and on the other side, the N-40 is a marker of the electrophysiological response selection and that response selection seems to take place in SMAs. Considering the existence of basal ganglia-SMAs loops implicated dopamine as a neuromediator, the aim of this study was to evaluate the impact of an acute dopaminergic depletion on the slope of the N-40 to provide a pharmacological argument of the involvement of SMAs in the generation of this evoked potential. The acute dopaminergic depletion was obtained by an acute phenylalanine/tyrosine depletion (APTD); APTD is based on the oral administration of an amino-acid mixture lacking tyrosine and phenylalanine, which selectively lowers dopamine synthesis. The acute dopaminergic depletion decreased the steepness of the slope of the N-40 compared to the placebo session. This result is a pharmacological argument to design SMAs as generator of the N-40. Furthermore, the sensitivity of the N-40 to an acute dopaminergic depletion could be proposed to subjects at a prodromal stage of parkinson disease, before the first symptom. The analysis of this evoked potential could be as an early marker of Parkinson.

Topic Area: EXECUTIVE PROCESSES: Monitoring & inhibitory control

Dissociable late and early error monitoring processes: Error positivity in the absence of an error-related negativity.

Poster E31, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Martin E. Maier[1], Francesco Di Gregorio[1,2], Marco Steinhauser[1]; [1]University of Eichstätt-Ingolstadt, [2]Ospedale Maggiore Carlo Alberto Pizzardi di Bologna

The ability to detect one's own errors is crucial for the optimization of performance. The error-related negativity (ERN) and the error positivity (Pe) are electrophysiological markers of early unconscious and later conscious error monitoring processes. Although both components follow each other in close succession, it is currently unknown whether the earlier ERN is necessary for the emergence of the later Pe. The goal of the present study was to test this directly by eliminating the ERN in a condition where conscious error detection is nevertheless possible and investigate whether the Pe is observable in the absence of an ERN. We used a three-choice flanker task, where participants had to classify central targets while ignoring lateral flankers. Targets and flankers always required different responses. Targets but not flankers were masked at varying intervals. Crucially, on some trials, the target was entirely replaced by the mask (target absent trials). Because the ERN requires a representation of the correct response, we predicted the ERN to be absent when errors were committed on these trials. However, because participants knew that the flankers required a different response than the target, they could nevertheless deduce that they had committed an error when the error involved responding to the flankers. The results showed no ERN but a sizeable Pe on those target absent trials where participants had responded to the flankers. This shows that the Pe can emerge also in the absence of an ERN and thus speaks for independent neural mechanisms underlying these components.

Topic Area: EXECUTIVE PROCESSES: Monitoring & inhibitory control

Error-Induced Blindness: Error Detection Leads to Impaired Sensory Processing and Lower Accuracy at Short Response-Stimulus Intervals

Poster E32, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Paul Beatty[1], George Buzzell[2], Natalie Paquette[1], Daniel Roberts[1], Craig McDonald[1]; [1]George Mason University, [2]University of Maryland

Empirical evidence indicates that detecting one's own mistakes can serve as a signal to improve task performance. However, little work has focused on how task constraints, such as the response-stimulus interval (RSI), influences post-error adjustments. In the present study, event-related potential (ERP) and behavioral measures revealed that errors committed during a visual discrimination task led to a marked reduction in task performance on the following trial when RSIs were short, but that such impairments were not detectable at longer RSIs. Critically, diminished sensory processing at short RSIs, indexed by the stimulus-evoked P1 component, was predicted by an ERP measure of error processing, the Pe component. A control analysis ruled out an overall lapse in attention producing both error commission and subsequent reductions in sensory processing; instead, the data suggest that error detection causes an attentional bottleneck, which can impair performance on subsequent trials that occur in short succession. The findings demonstrate that the neural system dedicated to monitoring and improving behavior can, paradoxically, at times be the source of performance failures.

Topic Area: EXECUTIVE PROCESSES: Monitoring & inhibitory control

Behavioral and Electrophysiological Measures of Conflict Monitoring

Poster E33, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Peter Egeto[1], Tisha J Ornstein[1], Eleenor H Abraham[1]; [1]Ryerson University

Conflict monitoring is a process that resolves competition between potential responses, and then choosing the appropriate response. Electroencephalographic (EEG) methods have identified the N2 as the marker for conflict monitoring. However, a behavioral measure has not been established. Few reports have linked reaction time (RT) to the N2, although this association has not yet been elucidated. To identify a behavioral measure, the subtraction method was used to isolate conflict monitoring. Here, the RT from a simple RT task (SRT) was subtracted from a forced-choice RT task (Stop Signal Task; SST); the subtraction parses out common processes while isolating the conflict monitoring unique to the SST. Longer time spent resolving conflicts (larger RT difference) was hypothesized to correlate positively with N2 magnitude. EEG data from 35 healthy participants (mean age 32.3 [14.1]) were obtained. Stimulus-locked components at Fz and FCz were used to calculate difference waves between SRT and SST at 250-350 ms post-stimulus. The mean SST RT and RT difference were correlated with the N2 difference wave. The RT difference correlated positively with the N2 difference wave at Fz ($r = .38$, $p < .05$). The SST RT did not correlate with the N2. Longer conflict resolution time was associated with larger N2 magnitude. The N2 did not correlate with SST RT, indicating that the subtraction method was necessary to isolate conflict monitoring. These findings provided support for a novel behavioral measure of conflict monitoring. Replication to establish its validity, reliability, and application with other tasks (e.g., Stroop) is required.

Topic Area: EXECUTIVE PROCESSES: Monitoring & inhibitory control

Effect of language proficiency and age of acquisition on executive function in bilinguals

Poster E34, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Vickie Yu[1], Emma Aleksanyan[1], Kathryn Balina[1], Bernice Briones[1], Katya Gomez[1]; [1]Department of Communication Disorders and Sciences, California State University, Northridge

Research has linked cognitive control to language performance. A considerable body of evidence has accumulated suggesting positive effects of bilingualism on executive function control tasks. Studies in second language (L2) acquisition have reported that age of acquisition and daily usage of L2 are important elements that may affect the degree of proficiency attained in L2. However, most studies of executive functioning in bilinguals only include those with high proficiency in both languages. Very little research has been done on the topic of unbalanced bilinguals; that is, those whose L2 proficiency has not yet reached the same level as that of their first language. The current proposal thus aimed to investigate whether the degree of proficiency, daily usage and age of acquisition in L2 affect the cognitive advantage in bilinguals, and further aimed to elucidate how these factors possibly interact while examining cognitive advantage in bilinguals. Experiments consisted of a language background questionnaire and three computer-based tasks, including naming, strip and Simon tasks. We tested 80 participants consisting of 60 bilinguals and 20 monolingual speakers as a control group. The bilingual speakers were divided into three groups according to age of acquisition, proficiency level, and daily usage of L2. The results show a high positive correlation between the executive control function and proficiency level as well as daily usage of L2. These data further indicate that age of acquisition may not be the only factor that must be considered in examining executive function in bilinguals.

Topic Area: EXECUTIVE PROCESSES: Monitoring & inhibitory control

Monitoring In Second Language Reading: Evidence From ERPs

Poster E35, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Marieke Engbrenghof[1,2], Nan van de Meerendonk[3], Megan Zirnstein[4], Judith F. Kroll[4,5], Dorothee J. Chwilla[1]; [1]Donders Institute for Brain, Cognition and Behaviour, Radboud University, Nijmegen, The Netherlands, [2]University of Groningen, Groningen, The Netherlands, [3]Thebe, The Netherlands, [4]University of California, Riverside, [5]Pennsylvania State University

Clear evidence has been presented for monitoring in first language (L1) comprehension. The goal of this study was to examine monitoring in a second language (L2). For the L1, constraining sentences (e.g., "The eye consisting of a pupil, iris and…") with a mild conflict (e.g., "eyebrow") have been shown to elicit an N400, whereas those with a strong conflict (e.g., "sticker") elicit both an N400 and P600 (Van de Meerendonk et al., 2010). Strong conflict may be needed for the brain to reanalyse the input, in order to check for possible processing errors, as reflected by P600. In the current study, we investigated monitoring in the L2 by manipulating the plausibility

of a critical word in a sentence to create differences in conflict strength (no, mild, and strong conflict). Dutch-English bilinguals read sentences in the L2 (English) while EEG was recorded. The key question was whether a strong conflict would elicit a monophasic N400 or a biphasic N400-P600 pattern, as was found for the L1 in the previous study. Results for the L2 showed a native-like N400 effect for both mild and strong conflicts. Importantly, a strong conflict also elicited a P600. These results in the L2, therefore, were similar to those for the L1 readers. However, the scalp distribution of the effects in the L2 differed somewhat from the L1, suggesting the involvement of different neuronal populations. In conclusion, the biphasic N400-P600 pattern for L2 readers observed for strong conflicts supports the view that monitoring occurs during L2 comprehension.

Topic Area: EXECUTIVE PROCESSES: Monitoring & inhibitory control

Adolescents and Young Adults with Autism Spectrum Disorder Show Differences in Dynamics and Recruitment of Cognitive Control Networks

Poster E36, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Matthew V. Elliott[1], Marie K. Krug[1], Cory C. Coleman[1], Jennifer E. Farren[1], Andria J. Farrens[1], J. Daniel Ragland[1], Tara A. Niendam[1], Cameron S. Carter[1], Marjorie Solomon[1]; [1]University of California at Davis

Adolescents with autism spectrum disorder (ASD) show impairments in cognitive control, as they engage reactive control networks (associated with “last-minute” error prevention) in situations where typically developing (TYP) adolescents recruit proactive (strategic and preparatory) control regions (Solomon et al., 2014). To further investigate the development of cognitive control from adolescence to young adulthood, we recruited 17 ASD (M=16.29(2.44)) and 21 TYP (M=16.38(2.94)) youth and young adults to perform a cognitive control task (Preparing to Overcome Prepotency (POP)) during rapid event-related fMRI. Colored cues informed a directional button response to an upcoming arrow (Red cue=respond opposite to the direction of the arrow; Green cue=respond in the same direction as the arrow). ASD showed greater interference effects in reaction time and accuracy. fMRI results indicated that during the cue (red>green), ASD activated the dorsal anterior cingulate cortex (dACC), as well as ventrolateral prefrontal cortex (VLPFC), insula, and anterior PFC. TYP activated dorsolateral prefrontal cortex (DLPFC), as well as VLPFC and insula. For the probe phase (red>green), TYP did not recruit cognitive control related brain regions while ASD activated dACC, VLPFC, and insula. Results suggest that ASD exhibit task set conflict at the cue and insufficient engagement of control mechanisms, as evidenced by behavioral deficits and continued dACC-mediated conflict processing and reactive control during the probe. TYP implement DLPFC-mediated proactive control during the cue phase only, which is more effective at resolving response interference. Data collection is ongoing. Future analyses will explore functional connectivity, age effects, and relationships to functional outcomes.

Topic Area: EXECUTIVE PROCESSES: Monitoring & inhibitory control

Neurophysiological differences in deliberate and spontaneous mind-wandering

Poster E37, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Adrien Martel[1], Mahnaz Arvaneh[2], Paul Dockree[1], Ian Robertson[1]; [1]Trinity Institute of Neuroscience, [2]The University of Sheffield

Mind-wandering (MW) occupies up to 50% of our daily mental activity and recent findings suggest that MW is a heterogenous mental phenomena, occurring with or without awareness. The former being described as deliberate MW (dMW), associated with positive aspects of cognition such as creative incubation and planning, and the latter, spontaneous MW (sMW), correlated with depression and other mental health issues. The aim of the study was to determine whether dMW and sMW exhibit distinct neurophysiological correlates. Twenty-six subjects performed a breath counting (BC) task and the fixed SART while 64-channel electroencephalographic (EEG) data was recorded. MW was assessed in both tasks via 5-scale probe-caught (PC) or self-caught (SC) interruptions with the following options: Attention was, (1) on-task, (2) on thoughts pertaining to the task, (3) distracted by internal sensations or external distractions, (4) on reminiscing or planning thoughts (dMW), (5) daydreaming (sMW). Behavioral results revealed significant differences in RTCV for grouped trials leading up to different types of MW during the SART. ERP analysis for trials preceding MW reports identified two significantly discriminative clusters of electrodes with reduced P1 and P3 amplitudes for MW. Time-frequency analysis revealed increased α activity and stimulus evoked synchronization during trials preceding self-reported dMW when compared to sMW reports. Oscillatory neural response revealed a decrease in theta band phase-locking for PC mind-wandering and sMW pre-trials when compared to on-task and dMW pre-trials, respectively. Together, these findings suggest that perceptual processing is reduced during mind-wandering episodes in general and is actively inhibited during dMW.

Topic Area: EXECUTIVE PROCESSES: Monitoring & inhibitory control

Interactions between oscillatory dynamics support adjustment of stimulus representations during reinforcement learning

Poster E38, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Irene van de Vijver[1,2], Joram van Driel[2,3], Arjan Hillebrand[4], K Richard Ridderinkhof[2]; [1]Radboud University, [2]University of Amsterdam, [3]VU University, [4]VU University Medical Center

Reinforcement learning (RL) in humans is subserved by a network of striatal and frontal brain areas. The electrophysiological signatures of feedback evaluation are increasingly well understood, but how those signatures relate to the use of feedback to guide subsequent behavior remains unclear. One mechanism for post-feedback behavioral optimization is the modulation of sensory processing. We used MEG and source localization to test the hypothesis that feedback induces changes in the interactions between oscillatory dynamics in the learning network and task-relevant stimulus processing areas. Participants performed a probabilistic RL task in which they learned associations between colored faces and responses by trial-and-error using feedback. Delta-band (2-4 Hz) and theta-band (4-8 Hz) power in multiple frontal regions were sensitive to feedback valence, and low and high beta-band power (12-20 and 20-30 Hz) in occipital, parietal, and temporal regions differentiated between color and face information. Crucially, single-trial power coupling in frontal-posterior networks coded an interaction between feedback valence and the relevant stimulus characteristic (color versus identity). These results suggest that long-range oscillatory coupling supports post-feedback updating of stimulus-related processing, which in turn helps enable us to optimize behavior.

Topic Area: EXECUTIVE PROCESSES: Monitoring & inhibitory control

Markers of Early Adversity Associated with Reduced Error-Related Negativity in Early Childhood

Poster E39, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Oliver Medak[1], Ryan J. Giuliano[1], Leslie E. Roos[1], Kathryn G. Beauchamp[1], Elliot T. Berkman[1], Philip A. Fisher[1]; [1]University of Oregon

Adverse experiences early in life have been associated with deficits in self-regulation and underlying brain functions. The present study examined the relationship between early adversity and neural indices of error monitoring during a self-regulation task. Event-related potentials (ERPs) were recorded in young children (N=74) during a Go/No-go task, where children were shown pictures of animals and asked to push a button when they saw a picture if the animal was not a standard image of a chimpanzee. Analyses focused on response-locked ERPs for correct go trials and incorrect no-go trials in order to isolate the Error-Related Negativity (ERN). Cumulative exposure to adversity was calculated for each child based on measures of socioeconomic status, household chaos, and stressful life events. We also examined mothers' reports of their own traumatic life experiences (ACES). Results demonstrated a negative relationship between ERN amplitudes and early adversity, such that children who experienced higher levels of early adversity showed smaller ERNs. Visual inspection of ERPs suggests that this effect is carried by the presence of large ERNs in children who have experienced little adversity. A parallel relationship was observed for maternal trauma: children of mothers who self-reported more experiences of trauma showed a markedly-reduced ERN. These findings suggest that the development of neural mechanisms underlying error-monitoring are sensitive to adverse experiences early in life. More specifically, the presence of both static adverse life events and perpetual pressures of adversity support an inhibited neurocognitive reaction to error.

Topic Area: EXECUTIVE PROCESSES: Monitoring & inhibitory control

The feedback-related negativity indicates different use of feedback in two spontaneous strategies for handling changing values

Poster E40, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Sucheta Chakravarty[1], Isha Ober[1], Christopher R. Madan[1,2], Yvonne Y. Chen[1], Esther Fujiwara[1], Jeremy B. Caplan[1]; [1]University of Alberta, [2]Boston College

We investigated how feedback is incorporated in learning the values of a large set of items: 48 words, divided half high- and half low-value. Participants had to bet with (high value) or against (low value) each word to earn 10 or 1 point reward, respectively. Importantly, this equated utility of high- and low-value words in maximizing total reward. After 16 blocks of value learning, the values of half of the words were reversed without warning. One third of participants (N=21), when faced with changing values, responded based on their previous knowledge of value ("conservative"). Another third (N=19) appeared to guess randomly ("exploratory"). The groups were equivalent in performance during prior value learning. Analysis of the mean amplitude at FCz during the FRN window (200–300 ms post feedback onset) for this surprise reversal revealed that for the conservative group, there was no significant effect of correct (i.e. 10 points) vs. incorrect (1 point) feedback, whereas this effect was significant for the exploratory group ($p<0.05$). This suggests the exploratory participants used prediction error, as indexed by the FRN, to guide their learning of changed values, whereas the conservative participants used the feedback differently.

Topic Area: EXECUTIVE PROCESSES: Monitoring & inhibitory control

Electrophysiological Correlates of Reward Processing, Error Monitoring and Preferences

Poster E41, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

James Germi[1], Bradley Lega[1]; [1]UT Southwestern Medical Center

The orbitofrontal cortex (OFC) and anterior cingulate cortex (ACC) have been implicated in reward processing and error monitoring. Eleven patients undergoing stereoencephalography (sEEG) recording for the treatment of medically-refractory epilepsy participated in a reward task to study the electrophysiological biomarkers of reward processing and individual preferences. We present the oscillatory signatures of reward processing and error monitoring across the time-frequency domain for the medial and lateral OFC and the ACC. While the medial OFC shows decreased low frequency activity and increased high frequency activity for positive feedback relative to negative feedback, the lateral OFC shows decreased low frequency activity and increased high frequency activity for negative feedback relative to positive feedback. The ACC shows broad relative increases across the time-frequency domain during negative feedback. Analyzing activity in these three regions simultaneously, we found that the ACC shows greater functional connectivity with the lateral OFC than the medial OFC and that these two regions are more strongly connected during negative feedback. Further, we found that high-frequency activity (HFA) in the medial and lateral OFC during the second half of feedback presentation was positive correlated with subjects' preference levels while HFA in the ACC was negatively correlated with subjects' preference levels. Analyzing simultaneous recordings from these three regions revealed that the ACC has greater functional connectivity with the lateral OFC than the medial OFC. These findings expose neural correlates of preferences and provide insight into the neural networks that underlie reward processing and preferences.

Topic Area: EXECUTIVE PROCESSES: Monitoring & inhibitory control

Clinical perfectionism and associated traits: implications for error processing

Poster E42, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Sarah T Loew[1], Ronnie J Lockington[1], Kelsey A Rolefson[1], Samuel J Becker[1], A'Lea M Yonker[1], Simon M Moe[1], David S Leland[1]; [1]University of Wisconsin - Eau Claire

The Clinical Perfectionism Questionnaire (CPQ; Shafran et al., 2002) is designed for the diagnosis and treatment of clinical perfectionism, which entails maladaptively critical self-evaluation based on excessively high standards. Previously, non-clinical measures of perfectionism have been shown to correlate with anxiety, depression, and fear of failure. Likewise, non-clinical perfectionism and clinical traits such as anxiety are associated with increased electroencephalographic (EEG) responses to self-committed errors. As the first part of a two-phase study aiming to demonstrate clinical perfectionism's convergent validity, college students (n = 187, age = 18-26) completed an online survey including measures of anxiety (GAD-7), depression (CESD-R), and fear of failure (PFAI). Clinical perfectionism was positively correlated with all three (rs = .51, .47, and .51, respectively). Our findings thus far demonstrate that the CPQ has convergent validity with associated measures of anxiety, depression, and fear of failure, and suggest that clinical perfectionism may be involved in maladaptively elevated concerns over mistakes. Phase two of our study will test whether individuals high (versus low) in clinical perfectionism show greater amplitude EEG responses to self-committed errors, i.e. the error-related negativity (ERN) and error positivity (Pe).

Topic Area: EXECUTIVE PROCESSES: Monitoring & inhibitory control

The role of the frontoparietal cortex in attentional guidance by working memory: a TMS study

Poster E43, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

min wang[1,2,3,4], Ling Li[1,2,3,4]; [1]Key Laboratory for NeuroInformation of Ministry of Education, [2]High-Field Magnetic Resonance Brain Imaging Key Laboratory of Sichuan Province, [3]Center for Information in Medicine, [4]University of Electronic Science and Technology of China

Previous studies have demonstrated that working memory (WM) plays a crucial role in the control of visual selection. There is much evidence showing that frontoparietal regions are involved in visual search tasks, but the specific neural mechanisms involved in memory and search processes remain unclear. Here, we examined the role of the dorsal prefrontal cortex (DLPFC) and the posterior parietal cortex (PPC) in determining the interaction between WM and attention, using transcranial magnetic stimulation (TMS). Subjects maintained a color in WM while performing a visual search. The color cue indicated the target location (valid), the distractor location (invalid), or did not reappear (neutral). Repetitive TMS was applied to the right DLPFC, the right PPC, or the vertex site immediately after the onset of the search display. Search reaction times (RTs) and accuracy were recorded when subjects correctly memorized the color. Search performance was facilitated in the valid relative to the invalid and neutral conditions. The application of DLPFC-TMS and PPC-TMS showed stronger benefit of validity (valid-neutral) on search RTs, relative to the vertex-TMS. Specifically, PPC-TMS disengaged the interference of irrelevant memory color (invalid-neutral). These results suggest that the DLPFC and PPC are responsible for dividing relevant (search template) from irrelevant (memory template) information concurrently held in WM. When this process was interfered by TMS, activation of both templates accumulated and showed greater guidance on search in valid trials. Moreover, our findings reveal that PPC-TMS promotes the visual reorienting to sensory events which helped subjects disengage attention from the memory distractor.

Topic Area: EXECUTIVE PROCESSES: Working memory

Examining the Functional Network Structure of the Frontal Lobes Across Domains of Cognition

Poster E44, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Jordan Garrett[1], Robert Blumenfeld[1]; [1]California State Polytechnic University, Pomona

The frontal lobes implement control operations fundamental to flexible, goal-driven behavior. In the human, at least 19 cytoarchitectonically unique subregions comprise the frontal lobes, and a major aim of cognitive neuroscience has been to characterize the functional organization of these subregions. The aim of the present study was to investigate the topology of frontal lobes by examining patterns of co-activation amongst frontal subregions across a large number of studies in the neuroimaging literature. Using the BrainMap database, which contains activation foci from a large (>1600) set of studies in the neuroimaging literature, we derived meta-analytic co-activation matrices of the frontal lobes for the several specific cognitive domains (Memory, Attention, Working Memory, Language, Audition, Vision). Our initial results show several specific ways in which the functional wiring of frontal subregions varied according to behavioral domain. First, the density of these networks varied considerably with behavioral domain. Second, the modular structure of these networks varied considerably. Third, the anatomical location of some, but not all, central hub nodes varied with cognitive domain. In general, our initial results lend further credence to the notion that the frontal lobes as a whole, support domain-general control processing, however its functional wiring is highly adaptable and potentially allows different network configurations to support specialized domain-specific processes.

Topic Area: EXECUTIVE PROCESSES: Working memory

The Causal Role of Prefrontal Cortex and Somatosensory Cortex in Tactile Working Memory

Poster E45, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Di Zhao[1], Yixuan Ku[1,2]; [1]The Key Lab of Brain Functional Genomics, MOE & STCSM, School of Psychology and Cognitive Science, East China Normal University, Shanghai, China, [2]NYU-ECNU Institute of Brain and Cognitive Science, NYU Shanghai and Collaborative Innovation Center for Brain Science, Shanghai, China

The neural activity in the dorsolateral prefrontal cortex (DLPFC) and contralateral primary somatosensory cortex (SI) has been found to be associated with short-term retention of sensory information in tactile working memory (WM) tasks. Yet, two questions still remain unclear: (1) whether the ipsilateral SI is also involved in retention of tactile information in WM; (2) whether SI in both hemispheres receive the top-down regulatory influence of the DLPFC during WM processes. Here, we examined the role of bilateral SIs and the contralateral DLPFC in WM at different temporal stages using single–pulse transcranial magnetic stimulation (sp-TMS) while participants performed a vibrotactile delayed matching-to-sample task. In experiment-1, participants in one group received vibrotactile stimulation on the left index finger. sp-TMS over the contralateral SI at an early sensory stage (100 ms after the vibrotactile onset) deteriorated performance accuracy, and over the ipsilateral SI at a late maintenance stage (1600 ms after the vibrotactile onset) also impaired performance accuracy. In experiment-2, participants in another group received vibrotactile stimulation on the right index finger. sp-TMS over the bilateral SIs as in experiment-1 showed similar results. Furthermore, the deteriorating effects caused by sp-TMS over the contralateral DLPFC at 1600 ms were correlated with the effects caused by sp-TMS over the ipsilateral SI, indicating that information retained in the ipsilateral SI during the late delay may be associated with the DLPFC. Taken together, these results suggest that at different stages tactile WM involves the bilateral SIs that receive top-down signals from the DLPFC.

Topic Area: EXECUTIVE PROCESSES: Working memory

Dissociable neural and behavioral patterns of proactive interference for Emotion and Neutral Information in Working Memory

Poster E46, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Eda Mizrak[1,2], Henrik Singmann[3], Ilke Oztekin[1]; [1]Koc University, [2]UC Davis, [3]University of Zurich

Proactive interference (PI) is the tendency for information learned earlier to interfere with more recently learned information. Recently, we showed that emotional stimuli exhibit a different time course of PI than neutral stimuli (Mizrak, & Oztekin, 2015). In the present study we induced PI by presenting items from the same semantic category over several trials. This results in accumulation of PI and reduces the discriminability of the items in each subsequent trial. We introduced emotional (i.e., disgust) and neutral (i.e., furniture) categories and examined how varying PI affected performance when items were drawn from emotional categories compared to neutral categories. Participants were scanned using functional magnetic resonance imaging (fMRI) performing a 5-item short term recognition task. We modeled responses and corresponding response times with a hierarchical diffusion model and observed dissociable patterns in the control of PI for emotion and neutral trials. Evidence accumulation (i.e., drift rate) decreased linearly for neutral trials as a function of increasing PI, but this decline occurred only at the highest PI level for emotional stimuli. Evidence accumulation decline was accompanied with an increase in parahippocampal regions activation for neutral items while anterior lVLPFC activation mediated the resolution of PI for emotion trials. Our findings, consistent with prior work, suggest that emotion items are more resistant to forgetting due to PI.

Topic Area: EXECUTIVE PROCESSES: Working memory

Delayed enhancement in rule-based category learning following acute psychosocial stress

Poster E47, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

David B. Smith[1], Steve Hutchinson[1], Shannon K. McCoy[1], Shawn W. Ell[1,2]; [1]University of Maine, [2]Maine Graduate School of Biomedical Sciences & Engineering

Stressful situations result in the activation of multiple physiological responses. Recent research suggests that the time varying nature of these physiological responses has important implications for cognitive function, particularly processes dependent upon prefrontal cortical function. Presently we consider the temporal impact of this response in relation to rule-based categorization – a task thought to depend on working memory and cognitive control processes. Rule-based category learning performance was tested after completion of a social-evaluative stressor (modified version of the Trier Social Stress Test) at varying time delays relative to cessation of the stressor (no delay, short delay, and long delay conditions) or after a no stress, comparison condition. As expected, participants in the three stress conditions, but not the no stress condition, were physiologically and psychologically stressed. Participants in the long delay condition performed better on the rule-based category learning task than participants in the no delay, short delay, and no stress conditions. These data are consistent with a literature suggesting that cognitive processes dependent upon prefrontal cortex may be enhanced after physiological recovery from acute stress.

Topic Area: EXECUTIVE PROCESSES: Working memory

Encoding induced alpha EEG activity tracks changes in working memory manipulations

Poster E48, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Joel Robitaille[1], Stephen M. Emrich[1]; [1]Brock University

Previous fMRI studies have been able to decode features of an item held in working memory (Harrison & Tong, 2009) and track the changes applied to these features (Albers et al., 2012) from the activity detected within the visual cortex. More recently, Foster et al. (2016) were able to reconstruct orientation selectivity profiles from induced alpha-band (8 – 12 Hz) oscillations of electroencephalographic (EEG) data, enabling the identification of the contents held in visual memory. In an attempt to extend these findings this study examined whether the induced alpha activity, which has been shown to mediate the representation of orientations held in visual working memory, can be used to track an imagery manipulation of these representation via a mental rotation. A forward encoding model was applied to EEG activity recorded while participants were holding the orientation of a line in working memory and then applied a 60° mental rotation to the presented stimulus. The results replicate previous findings, revealing that induced posterior alpha-band activity contains sufficient information that allows for the identification of the representation maintained in working memory. Furthermore, the reconstruction of orientation selectivity profiles revealed reliable changes in the mental representation during the imagery manipulation suggesting a de-selection of the orientation presented at the beginning of the experiment.

Topic Area: EXECUTIVE PROCESSES: Working memory

ALPHA AND THETA BANDS RESTING EEG PREDICT DIFFERENT LEARNING PATTERNS IN VISUAL WORKING MEMORY

Poster E49, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Mara Golemme[1], Elisa Tatti[1,2], Giulia Grande[1], Caroline Di Bernardi Luft[3], Joydeep Bhattacharya[1], Marinella Cappelletti[1]; [1]Department of Psychology. Goldsmiths, University of London, United Kingdom., [2]Brain Investigation and Neuromodulation laboratory, Department of Medicine, Surgery and Neuroscience, University of Siena, Italy., [3]School of Biological and Chemical Sciences, Queen Mary University of London, United Kingdom

Brain oscillations at rest have been associated to higher-order cognition and predictability of behavioural changes. Here we investigated whether resting EEG in 30 adults predicts performance changes in a retro-cueing Visual Working Memory (VWM) task (Bays et al., 2011), which probes the ability to re-direct attention by means of retrospective cues (valid, invalid or neutral: 137, 66, 89 trials respectively). Resting EEG was obtained for pre and post performing 7 VWM blocks. Participants were divided in three groups based on their prevalent learning pattern: using cues effectively (increased valid cues benefit), suppressing distractors (decreased invalid cues cost) or ignoring the cue (increased neutral cue benefit). Across valid and invalid cue-groups, performance improvement was correlated to a decrease in fronto-central theta power (4-7 Hz) in the post-test resting-EEG. Specifically, individuals who increased the valid cue's benefit showed reduced magnitude of pre-task individual alpha peaks and parieto-occipital alpha power (8-13 Hz), in the post task. In these same regions, increased lower alpha-band power and greater levels of theta were observed at pre-test in participants that improved task performance by suppressing the cues altogether, suggesting reduced attentional investment towards the cues (MacLeanet al., 2012). Interestingly, these values predicted the learning rate of the latter group. Our results indicate that resting, pre and post task, alpha and theta oscillations are associated with how retro-cue information may be differently used to enhance VWM. These findings suggest that resting-EEG could be used to predict individual learning strategies in healthy adults.

Topic Area: EXECUTIVE PROCESSES: Working memory

Reducing Available Working Memory Capacity Affects DRM False Memory

Poster E50, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Lilian Cabrera[1], Jianjian Qin[2]; [1]University of Michigan, Ann Arbor, [2]California State University, Sacramento

Previous studies have demonstrated the importance of working memory capacity (WMC) as an individual difference factor in source-monitoring and reducing false memory in the Deese-Roediger McDermott (DRM) paradigm (e.g., Watson et al., 2005). In the current study, we further examined the relationship between WMC and false memory by directly manipulating the concurrent cognitive demand in a DRM paradigm. Sixty participants (46 females, age ranged 18 to 37 years) viewed 18 DRM lists. A concurrent digit load task was introduced to reduce available WMC for the DRM task during encoding: Participants held either a 0-digit, 3-digit, or 6-digit sequence in working memory while viewing each list. Additionally, WMC as an individual difference factor (low- vs. high-WMC), and the effect of forewarning participants about the nature of the DRM task prior to encoding (warning instructions: present vs. absent) were examined as between-subjects factors. The results indicated that reduced available WMC (3- vs. 0-digit load) led to higher false recall of critical lures, but only for individuals with high-WMC who were forewarned. Forewarning participants reduced false alarms for critical lures and individuals with high-WMC had marginally fewer false alarms for critical lures compared to individuals with low-WMC. While an initial reduction in available WMC (3- vs. 0-digit load) resulted in higher false alarms for critical lures, further reduction (6- vs. 3-digit load) resulted in lower false alarm rate (inverse U-shaped pattern). The implications of these results for the role of working memory in DRM false memory will be discussed.

Topic Area: EXECUTIVE PROCESSES: Working memory

Single-word ERPs reveal age-related changes in incremental context processing

Poster E51, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Brennan Payne[1], Kara Federmeier[1]; [1]University of Illinois

Event-related potential (ERP) studies looking at responses to expected and unexpected sentence-final words have reliably found that older adults (OA) show reduced effects on the N400, a component linked to meaning processing. These findings have been taken to suggest that OA are less efficient in utilizing contextual constraints. In the current study, we directly examined whether OA are less able to take advantage of accumulating contextual constraints over the course of a sentence. Linear mixed-effects models of single-word ERPs were used to examine age-related changes in the effects of context on multiple aspects of lexical processing. We recorded EEG while younger (YA) and OA read congruent sentences, syntactic prose (grammatical but nonsensical), and random word strings. In YA, open-class words elicited N400 reductions with increasing word position in congruent sentences only, replicating the classic word position effect. In OA, this effect was attenuated, suggesting a reduced sensitivity to accumulating contextual constraints in aging. Sensitivity of the N400 to lexical variation (e.g., word frequency) was overridden by accumulating semantic context in YA. In OA, the N400 was sensitive to lexical frequency, but this effect was not modulated by word position. Collectively, these findings support the claim that aging is associated with a reduced ability to build up and use context information over time and that modeling variability in single-trial event-related EEG activity can reveal mechanisms by which different sources of information simultaneously contribute to the unfolding dynamics of comprehension in the brain in real time.

Topic Area: LANGUAGE: Development & aging

Better maternal reading fluency is related to stronger functional connectivity in future reading networks in preschool children

Poster E52, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Tzipi Horowitz-Kraus[1], John Hutton[2], K. J Philean[2], Scott Holland[2]; [1]Technion, [2]Cincinnati Childre's Hospital Medical Center

The American Academy of Pediatrics supports shared reading starting from birth due to evidence showing that language exposure in early development is a facilitator for future language and cognitive abilities[1]. These recommendations are accompanied by evidence of the positive effect of high home literacy environment on brain development related to language processing and reading. However, the quality and quantity of shared parent-child reading is a consequence of the parent' reading ability. The aim of the current study was to explore the effect of the parent reading ability on functional connectivity of the child's future reading network, comprised of neural circuits related to visual processing, language and cognitive control during narrative comprehension. Twenty-two 3-4 years old girls and their mothers participated in the current study. Children were asked to listen to stories while functional MRI data was collected. Mother's reading ability (fluency and word reading accuracy) were assessed separately. Mothers reading accuracy and fluency scores were correlated with functional connectivity in the child's reading and language networks. Results pointed at greater functional connectivity in the child's networks when listening to stories (Fig 1) as a function of the mothers' fluency scores but not with the mother's accuracy scores (Fig 2). These results highlights the importance of mother's reading fluency on facilitating the child's future reading network. Implications regarding joint reading are discussed.

Topic Area: LANGUAGE: Development & aging

Functional deficit of EEG brain network in adult who stutter

Poster E53, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Amir Hossein Ghaderi[1], Bahar Barani[2], Soroush Haghparasti[3], Hossein Shiravi[4], Fatemeh Akrami[5]; [1]Cognitive Neuroscience Lab., Department of psychology, University of Tabriz, Tabriz, Iran, [2]MD. Student at University of Kansas Medical Center, Kansas city, USA, [3]Department of engineering,

University of Kashan, Kashan, Iran, [4]Department of engineering, University of Shahid Beheshti, Tehran, Iran, [5]School of Health Management and Information Sciences و Iran University of Medical Sciences, Tehran, Iran

Stuttering is associated with abnormalities in complex cognitive functions such as speech and language. Recent studies suggest that functional deficit in motor system is involved in stuttering and also new evidences suggest that the brain network deficit is evident in people who stutter. In this study, as a first attempt using QEEG, graph theory analysis is applied to investigate the functional brain deficits in adults who stutter. EEG phase lag in different frequency bands is used as edges of graph. Various thresholds were applied and binary adjacent matrices were created. Finally clustering coefficient, global efficiency, transitivity and entropy were used to report functional brain connectivity in the stuttering group compared with normal subjects. , significant differences were observed in the beta (13.5-25 Hz) and the high beta (25-30 Hz) bands. F7, F8, T3, T4 and T5 are completely disconnected, in the high beta band (25-30 Hz). Also, in this frequency band, distorted functional brain network, significant differences in clustering, global efficiency and entropy were observed. In other bands (delta, theta and alpha), the global efficiency and entropy difference was not significant but the clustering coefficient difference was significant only in a few thresholds. The beta oscillation in the striatum is related to movement planning and preparations. Results indicate that the stuttering group exhibit Lower integration and higher segregation in the beta and high beta bands. This is related to more functional modularity and lower speeds of signal propagation in the motor function.

Topic Area: LANGUAGE: Development & aging

Speech encoding in quiet and background noise in 2 year olds

Poster E54, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Sree Rajendran[1], Cynthia Roesler[1], Julie Morgan-Byrne[1], Silvia Ortiz-Mantilla[1], Gabriella Musacchia[2,3], April Benasich[1]; [1]Center for Molecular and Behavioral Neuroscience, Rutgers University - Newark, NJ, [2]Department of Speech-Language Pathology and Audiology, University of the Pacific, [3]Department of Otolaryngology Head and Neck Surgery, Stanford University Medical School

The maturation of proper speech perception ability depends on efficient neural encoding of rapid auditory changes in syllables, both in quiet and noisy background conditions. However, the impact of a noisy environment on speech processing at early developmental stages is unknown. The brain response to speech sounds has been reliably recorded and analyzed across the lifespan via the complex Auditory Brainstem Response (cABR) to the speech syllable /da/. The response comprises at least two major auditory mechanisms: the response to consonant onset (Waves V and A) and the frequency following response (FFR), which encodes the vowel periodicity. Collectively, these measures provide insight into the complexity of auditory processing involved in normal communication. We recorded monaural cABRs to /da/ with awake 24-month-olds in quiet (DaQ) and embedded in 60dB background noise (DaN). Waves V and A in DaN were delayed and attenuated, compared to DaQ. The deleterious effect of noise was also observed in the FFR at specific frequencies. This suggests that syllable perception at the brainstem level is vulnerable to disruption as a result of background noise. Strong and significant correlations were observed within onset measures (i.e. between waves V and A) and within FFR measures, but not between onset and FFR measures. This finding supports the idea that infants have developed independent mechanisms for encoding transient and sustained features of speech by 24 months-of-age. Our findings are the first reported in 24-month-olds, who are experiencing a burst in language development.

Topic Area: LANGUAGE: Development & aging

A comprehensive examination of language in Parkinson's disease: Evidence from syntax, morphology, and lexical processing

Poster E55, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Jana Reifegerste[1], Karim Johari[2], Matthew Walenski[3], Farzad Ashrafi[4], Roozbeh Behroozmand[2], Michael Ullman[5]; [1]University of Potsdam, Germany, [2]University of South Carolina, [3]Northwestern University, [4]Shahid Beheshti University of Medical Sciences, Iran, [5]Georgetown University

Although Parkinson's disease (PD), which involves basal-ganglia degeneration, is clearly associated with motor deficits, language has also been implicated. We comprehensively examined several aspects of language, within-subjects, in Farsi-speaking patients with moderate-to-severe PD. On the basis of previous findings and the declarative/procedural model of language, we predicted PD impairments in syntax and regular morphology, which both depend on frontal/basal-ganglia circuits. We expected less impairment in females than males (especially for regular forms, which can be memorized) because of superior female compensation by medial-temporal-lobe-based declarative memory. The PD patients showed deficits, compared to healthy controls, at syntactic judgment, syntactic comprehension (negation, subject-cleft, object-cleft sentences), and the production of regular morphological (Farsi past-tense) forms. Additionally, an interaction between PD/control, male/female participants, and regular/irregular morphology indicated a greater impairment in male than female PDs in regulars, but not irregulars. Right-side hypokinesia (reflecting left frontal/basal-ganglia degeneration) correlated with regulars (across both sexes) but not irregulars, while left-side hypokinesia correlated with neither. Finally, PD patients were impaired at naming commonly-manipulated objects (e.g., hammer), but not non-manipulated items (e.g., mountain), suggesting a dependence of motor-skill object knowledge on frontal/basal-ganglia circuits. Overall, the results reveal a clear pattern of language impairment in moderate-to-severe PD: grammar deficits across syntax and morphology, modulated by sex and particularly dependent on left frontal/basal-ganglia degeneration, but no impairments in lexical processing, at least for words not semantically associated with motor skills. Findings will be compared to other studies of language in PD, including investigations of grammar and lexical processing.

Topic Area: LANGUAGE: Development & aging

Left Anterior-Posterior Aging effect for lexical production. Functional MRI assessment.

Poster E56, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Elena Hoyau[1,2], Emilie Cousin[1,2,3], Cédric Pichat[1,2], Assia Jaillard[3], Monica Baciu[1,2]; [1]Univ. Grenoble Alpes, LPNC, F-38040 Grenoble, France, [2]CNRS, LPNC UMR 5105, F-38040 Grenoble, France, [3]UMS IRMaGe, IRM 3T, CHU Grenoble, Univ. Grenoble Alpes, F-38043 Grenoble, France

Older adults report problems with finding words, suggesting difficulties with word retrieval and generation. However, experimental evaluation of lexical production does not indicate significant decrease in performance, suggesting compensatory strategies. Among explanations for naming difficulties, the access to semantic memory and lexical representations has been emphasized. Moreover, several models of functional reorganization were described (e.g., Hemispheric Asymmetry Reduction in Older Adult; Posterior-Anterior Shift in Aging). Our fMRI study evaluates the (a) inter- and (b) intra-hemispheric reorganization of cerebral networks underlying the lexical production during a Picture Naming (PN) task. Two groups of participants, Young (Y; < 56 years old, n=15) and Old (O; > 56 years old, n=14) were examined. They also underwent neuropsychological assessment for language and memory. PN reorganization was assessed within regions commonly activated during naming. The %CR for PN showed no difference between Y and O. Our fMRI results supporting compensatory mechanisms showed increased left anterior-posterior asymmetry for PN, with O being more posterior than Y. Two groups of O were observed, one with high posterior asymmetry (High Group, HG), one with low posterior asymmetry (Low Group, LG). Compared to HG, the LG showed (i) higher left inferior frontal gyrus (IFG) activation and (ii) lower verbal fluency scores. We suggest that the supplementary recruitment of the left IFG is related to increased neural resources for executive functioning to compensate for a decline of word-retrieval mechanism. We defend a new form of modulation of functional reorganization of language production, the left anterior-posterior aging (LAPA) effect.

Topic Area: LANGUAGE: Development & aging

Tones as predictors of suffixes in L2 processing

Poster E57, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Anna Hed[1], Andrea Schremm[1], Merle Horne[1], Mikael Roll[1]; [1]Lund University

L1 speakers of Swedish use tones on stems to predict which suffix is to follow. This is indicated by the event related potential (ERP) component pre-activation negativity (PrAN) (Söderström et al., 2016). In addition to this, when hearing a suffix which is invalid in relation to the preceding tone, L1 speakers show a left anterior negativity (LAN) or broadly distributed negativity and a P600 effect (Söderström et al., in press; Roll, 2015; Roll et al., 2013; 2015). The present study investigated how L2 learners of Swedish process the tone-suffix association before and after training. Low to intermediate level L2 learners with non-tonal L1, to control for transfer effects, trained the tone-suffix association for two weeks, using a web-based game, the "Language Melody Game" (Schremm et al., in preparation). Before and after training, participants took part in a pre- and post-test, in which behavioral data and ERPs were collected. The perception test consisted of auditory stimuli with valid and invalid tone-suffix combinations. After training, the PrAN effect increased, indicating that the participants used the tones as predictors more extensively after training. A LAN was also found for invalid stimuli, indicating that they had acquired the tone-suffix association. However, no P600 was found, suggesting that the participants did not reprocess the ungrammaticality, and relied more on the suffix itself. This was also seen in response times in the post-test, where invalidity did not yield longer response times for judging suffix meaning, as it does for L1 speakers.

Topic Area: LANGUAGE: Development & aging

Brain mechanisms underlying visuo-orthographic deficits in children with developmental dyslexia

Poster E58, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Gregory Spray[1], Xin Yan[1], Yanni Liu[2], Fan Cao[1]; [1]Michigan State University, [2]University of Michigan

The phonological deficit hypothesis has been the core hypothesis of developmental dyslexia (DD); however, reading is a complex process and orthographic skills play an important role in reading. Previous studies have suggested an orthographic deficit in children with DD; however, little is known whether the orthographic deficit is independent of visual skill. The current study examined the brain mechanisms of visuo-orthographic deficit in 23 Chinese children with DD in comparison to 19 age-matched controls (AC) and 15 reading-matched controls (RC) using functional magnetic resonance imaging (fMRI) under perceptual and lexical tasks. We found that AC and RC had greater activation than DD in the left precuneus for both the lexical and the perceptual tasks. It suggests a common brain mechanism of visual and orthographic deficit, which may be associated with visual spatial processing. Psychophysiological interactions (PPI) analysis revealed that the connectivity from the LMOG to the left IFG was greater in controls than DD for only the lexical task, whereas the connectivity from the LMOG to the bilateral cuneus was greater in controls than DD for only the perceptual task. It suggests differentiated brain mechanisms for orthographic and visual deficits in DD. In contrast, the group differences in the connectivity with the RMOG did not show task differentiation, suggesting that the RMOG is involved in both tasks in a similar manner. Our findings provide strong evidence for deficits in basic visual spatial processing in DD and some specific deficits in processing orthography in comparison to processing visual symbols.

Topic Area: LANGUAGE: Development & aging

Language-modulated perceptual compensation: Functional connectivity analysis of L1 and L2 reading impairments in Chinese-English bilingual children

Poster E59, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Manli Zhang[1], Xiaoxia Feng[2], Yue Gao[2], Xiujie Yang[1], Weiyi Xie[1], Feng Ai[1], Hehui Li[2], Xingnan Zhao[1], Chi Zhang[1], Li Liu[2], Guosheng Ding[2], Xiangzhi Meng[1]; [1]Peking University, China, [2]Beijing Normal University, China

Although neural alterations associated with reading deficits in native language have attracted extensive investigation, the number of studies regarding L2 reading difficulty is still limited. In current research, we conducted an fMRI experiment wherein 74 bilingual children (i.e. 29 typically developing (TD), 23 poor Chinese readers (PCR) and 22 poor English readers (PER)) passively viewed images of Chinese characters and English words. We defined ROIs through identifying brain areas activated during both L1 and L2 processing, or selectively to either of the languages. Intriguingly, we did not observe any group differences in terms of the activation within these ROIs. Further analysis demonstrated a reduced connectivity between left inferior frontal and left supramarginal gyrus in PCR compared to TD, which was positively correlated with subjects' phonological scores. In contrary, PCR was with a higher connectivity between left superior temporal and left superior frontal gyrus, left angular gyrus and right visual cortex, which were significantly correlated with orthographic and rapid automatized naming (RAN) performances, respectively. For PER, they showed decreased connectivity between right middle temporal gyrus (MTG) and bilateral precuneus, while their connection between bilateral MTGs was enhanced in comparison to TD, all of which were correlated with phonological performance. Together, these data suggest that children with disfluent reading tend to rely heavily on sensory cortices while processing written materials. However, this effect is subject to the modulation of different language systems. Specifically, PCR employ visual cortex to facilitate grapheme-phoneme mapping, while PER lean upon auditory processing to compensate inferior phonological awareness.

Topic Area: LANGUAGE: Development & aging

Neural mechanisms of speech versus non-speech detection in children with autism spectrum disorders

Poster E60, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Alena Galilee[1], Chrysi Stefanidou[2], Joseph P. McCleery[3]; [1]Dalhousie University, Nova Scotia, B3H 4R2, Canada, [2]University of Birmingham, Birmingham, West Midlands, B15 2TT, United Kingdom, [3]Children's Hospital of Philadelphia, Philadelphia, Pennsylvania, 19104, USA

In the current study, we utilized a Rapid Auditory Mismatch (RAMM) paradigm in order to investigate event-related potential (ERP) responses associated with the detection and discrimination of speech and non-speech sounds in children with autism spectrum disorders (ASD). Specifically, we compared a group of 4- to 6- year old high-functioning children with ASD with typically developing (TD) children matched on gender, chronological age, and verbal abilities. ERPs were recorded while children passively listened to pairs of stimuli that were either both speech sounds, both non-speech sounds, speech followed by non-speech, or non-speech followed by speech. Control participants exhibited temporal cortex N330 match/mismatch responses reflecting speech versus non-speech detection, bilaterally, whereas children with ASD exhibited this effect only in the left hemisphere. Furthermore, while the control groups exhibited match/mismatch effects at approximately 600 ms (temporal P600, central N600) when a speech sound followed a non-speech sound, these effects were absent in the ASD group. These findings suggest that children with ASD fail to activate right hemisphere mechanisms, likely associated with social or emotional aspects of speech detection, when distinguishing non-speech from speech stimuli. Furthermore, the ASD participants failed to detect the change from non-speech to speech at a late cognitive stage of evaluation, when a speech stimulus followed a non-speech sound. Together, these findings are consistent with the hypothesis that children with ASD rely more distinctly on physical stimulus properties versus social or emotional cues when distinguishing speech sounds from non-speech sounds.

Topic Area: LANGUAGE: Development & aging

Phonics Instruction Mediates the Relationship between Brain Structural Development and Reading Performances

Poster E61, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Tin Nguyen[1], Stephanie Del Tufo[1], Laurie Cutting[1]; [1]Vanderbilt University

Reading ability and the neurobiology underlying reading are assumed to be influenced by reading instruction during early childhood. In order to become fluent readers, children must learn letter-sound correspondences, which is typically taught through phonics instruction. Behaviorally, there is an established relationship between phonics instruction and reading performance, whereby children who receive such instruction (YES-P) later exhibit better reading comprehension and vocabulary knowledge than those who do not (NO-P). Here, we ask if there is a relationship between (1) whether children received phonics instruction when they were learning to read (YEP-P versus NO-P) and (2) later brain (cortical) development (ages 10-14; grades 4-9). We used magnetic resonance imaging (MRI) to measure and compare the structural brain properties between YES-P (n = 127) and NO-P (n = 33) groups. Age, gender, socio-economic status (SES), handedness, reading, and intracranial volume were controlled but did not differ significantly between groups. All brain regions were analyzed using the Destrieux (2009) atlas. After correcting for multiple comparison with cluster-wise Monte-Carlo simulations (10,000 iterations; $p < 0.05$), the YES-P group exhibited greater cortical thickness in (1) two major clusters in left

frontal and one in postcentral regions and (2) one cluster in right paracentral region. These results offer opportunities to further study the influential effects that receiving phonics instruction in beginning readers imposes on the later link between brain (cognitive/structural) development and reading comprehension.

Topic Area: LANGUAGE: Development & aging

EEG Evidence for Differences in Audiovisual Speech Processing in Apraxia of Speech

Poster E62, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Melissa Randazzo[1], Karen Froud[2]; [1]Adelphi University, [2]Teachers College, Columbia University

Speech perception is a unique audiovisual experience because timing of the speech signal is influenced by overlapping gestures in coarticulation. Apraxia of speech (AOS) is a motor planning disorder that impairs coarticulation. Although AOS is a motor planning disorder, individuals with AOS may have a disruption to the perceptual system for speech gestures. To evaluate this hypothesis we compared audiovisual mismatch negativity (MMN) via the McGurk effect in adults with AOS and a comparison group. Participants viewed a speaker articulating the syllable /ba/ (standard) and /ga/ (deviant) while the auditory stimulus /ba/ remained consistent. Responses to this McGurk audiovisual condition were compared to an inverse McGurk audiovisual condition in which the visual stimulus remained constant while the auditory stimulus changed, and a visual-only condition to control for activity from changes to the visual stimulus. McGurk deviants elicited an MMN in the comparison group, while the AOS group exhibited a later, attention-based response, P300. The AOS group similarly responded to inverse McGurk deviants with a P300 response. In the visual-only control condition, the AOS group showed an MMN, suggesting influence of visual processing for conflicting multisensory information. The comparison group's responses indicate early, automatic audiovisual integration of incongruent McGurk percepts while the responses of the AOS group show contributions of both attentional and visual processing. Response timing in the AOS group was correlated with aspects of motor speech production performance. Results support the hypothesis that AOS is a disorder beyond motor planning, including linguistic and cognitive systems.

Topic Area: LANGUAGE: Development & aging

Phonetic representations in young children with dyslexia

Poster E63, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Maaike Vandermosten[1,2,3], Joao Correia[2], Jolijn Vanderauwera[1], Jan Wouters[1], Pol Ghesquiere[1], Milene Bonte[2]; [1]KU Leuven, [2]Maastricht University, [3]Uuniversity of California San Francisco (UCSF)

There is an ongoing debate whether phonological deficits in dyslexics should be attributed to less well specified phonetic representations per se or rather to an impaired access to these speech sound representations. A study in adults with dyslexia, using a combination of fMRI multi-voxel pattern analysis (MVPA) and diffusion MRI connectivity measures, demonstrated intact neural quality of phonetic representations itself but decreased temporoparietal-to-frontal connectivity (Boets et al., 2013). The current study aims to capture the developmental trajectory of potential deficits in phonetic representations by applying a multimodal approach (fMRI MVPA and diffusion MRI) at the start of reading onset. Fifty-two children (grade 2), of whom half had a family risk for dyslexia and 15 developed dyslexia later on, participated in this study. In the scanner, children listened to various acoustic utterance of /baba/ and /dada/. MVPA analyses indicated that controls (i.e. typical reading children without a family risk) displayed distinctive phonetic decoding in bilateral superior temporal lobe (left: $p = .037$; right: $p = .019$), whereas children with dyslexia could not significantly decode (left: $p = .241$; right: $p = .946$). Children with dyslexia had less distinct neural phonetic representations than controls (left: $p = .031$; right: $p = .041$). In addition, white matter organization of the left arcuate fasciculus, examined prior to reading onset (kindergarten), predicted phonetic distinctiveness in grade 2 ($r = .373$, $p = .039$). Finally, typical reading children with a family risk for dyslexia show no deviances in neural connectivity but displayed the same problems in neural distinctiveness as dyslexic children.

Topic Area: LANGUAGE: Development & aging

The Effect of Instruction on People's Ability to Learn Simultaneous Statistical Inputs

Poster E64, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Tess Allegra Forest[1], Taraz Lee[2], Ashkan Kiyomarsi[1], Amy Finn[1]; [1]The University of Toronto, [2]The University of Michigan

While Statistical Learning is a powerful and largely automatic mechanism, it is important to know its limitations. We are specifically interested in 1) whether it's possible to learn two statistical patterns at the same time, and 2) if instructions to attend to one pattern boost learning for either. We exposed 54 adults to a 6-minute stream of black dots inside coloured circles; circles were one of 9 colors and dots occurred in one of 9 locations within them. The stream was comprised of 3 color triplets and 3 dot-location triplets. Color and dot triplets were offset so that the onset of each streams' triplets did not coincide. During exposure, participants completed a detection task, pressing X when a circle appeared and Y for a randomly-appearing blank square (10% of trials, no relationship to either pattern). Half the participants were given explicit instructions to learn the pattern of the dot locations, while the others received no stream-related instructions. Results showed that without explicit instructions, adults learned the triplets of each stream with minor success, while explicit instruction to attend to a particular stream (dots), improved learning for that stream. The poor learning in the no-instruction condition could stem from attempts to learn the relationship between, or bind, the streams, rather than learn each structure separately. In support of this, individuals with a preference for bound sequences over sequences that maintained triplet structures, displayed less knowledge of dot triplets.

Topic Area: LANGUAGE: Other

Differences in Foreign Vocabulary Learning Outcomes Between Virtual Environment Immersion-based, Text-based, and Picture-based Learning

Poster E65, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Brandin Munson[1], Arturo Hernandez; [1]University of Houston

The main focus of the present study was to compare foreign vocabulary learning outcomes between immersion-based, text-based, and picture-based training within a 3D virtual environment. The present study explored differences across time between groups assigned to one of these training methods on quizzes testing generalization of foreign vocabulary to real-world pictures. A 3D virtual foreign vocabulary learning environment created by ESLI, a language learning company, was utilized. Only the immersion group was able to explore the world and see the physical objects, while the other two were limited to learning Spanish audio from either 1) English text translations or 2) picture presentations, both within a classroom area. Each group completed all 3 sections of material on 4 separate occasions, and took quizzes on vocabulary knowledge and generalization after every section. A 3x4 mixed-measures ANCOVA was conducted, comparing participants of different foreign vocabulary learning methods (either immersion, text, or picture) on quiz accuracy over a time period of 4 learning and testing sessions, while controlling for prior foreign (Spanish) vocabulary knowledge. Analyses were conducted on a multiply imputed final sample of 32 participants. While Spanish vocabulary and time each significantly predicted accuracy (p's < 0.05), neither the main effect of condition nor the interaction of condition and time significantly predicted accuracy (p's > 0.1). T-tests reveal immersion-based learning to have lower overall accuracy than either text-based or picture-based learning, with no significant differences between text-based or picture based learning. Implications and potential future directions are explored.

Topic Area: LANGUAGE: Other

A sensorimotor network for voluntary oculomotor function in skilled reading: From cortex to brainstem

Poster E66, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Benjamin Schloss[1], Chun-Ting Hsu[1], Ping Li[1]; [1]Pennsylvania State University

Reading requires the integration of low and high level sensory and linguistic information with coordinated oculomotor sequences. This study examines how sensorimotor integration occurs in the brain during reading. Thirty adult participants read five 300-word expository texts in the MRI scanner while their eye-movements and BOLD signals were collected (see http://blclab.org/reading_brain/). Simultaneous multi-slice (SMS) fMRI data were acquired (TR = 400ms). This design greatly reduced the error in aligning the hemodynamic response function with the initial fixations on single words. Word frequency and word length were used as linear and quadratic parametric predictors of brain activity in a whole brain analysis. Our results not only replicated the quadratic effect of word length in the pontine brainstem (Schuster et al., 2016), but also showed significant quadratic effects of word length in the lingual gyri, lateral cerebellar cortex, primary motor cortex, primary auditory cortex, temporal parietal junction, and the paracingulate gyri. This network plausibly reflects the integration of linguistic (temporo-parietal areas) and visual (lingual gyri) representations of word length with a cortico-pontine-cerebellar motor circuit. Anatomical connections between primary motor cortex and the pons as well as between the pons and the cerebellum indicate the coordination and execution of oculomotor commands (Alloway & Pritchard, 2007; Schuster et al, 2016).This sensorimotor circuit is functionally interconnected during reading. Understanding of this network has significant implications for the neurocognitive mechanisms underlying individual differences in reading and typical and atypical function and development of the brain networks that support reading.

Topic Area: LANGUAGE: Other

A cross-sectional and longitudinal study of white matter pathways affected by literacy training

Poster E67, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Alastair Smith[1], Mark Bastin[2], Uttam Kumar[3], Ramesh K. Mishra[4], Viveka N. Tripathi[5], Anupam Guleria[3], Jay P. Singh[5], Falk Huettig[1]; [1]Max Planck Institute for Psycholinguistics, [2]University of Edinburgh, [3]Centre of Biomedical Research (CBMR), Lucknow, [4]University of Hyderabad, [5]University of Allahabad

Previous studies that have aimed to isolate white matter tracts affected by literacy training have examined differences in structural connectivity between typical readers and either atypical social populations or populations with reading impairments (e.g. dyslexia). Differences identified between such groups may therefore be driven by such atypical factors. In this study we avoid such confounds by performing the first combined cross-sectional and longitudinal study in which structural differences are examined between literate and illiterate groups recruited from the same societal community (two villages in a rural area near Lucknow, India). Using diffusion tensor imaging tractography we examine whether the integrity of 13 white matter tracts identified within the literature as influential for reading differ between a group of literates, and two illiterate groups, one of which was exposed to a literacy training program in which they learned to read and write Devanagari script. This design permitted investigating effects of literacy cross-sectionally across groups before training (N= 91) as well as longitudinally (training group N= 23). Cross-sectional analysis performed prior to training revealed that literate and illiterate groups differed in the density of the splenium section of the corpus callosum ($F(1,90) = 4.18$, $p = 0.044$).

Similarly, density in the splenium differed between fractional anisotropy values collected prior and post training for the illiterate group exposed to literacy training ($F(1, 50) = 6.62$, $p = 0.013$). This data therefore offers further support to claims that the splenium section of the corpus callosum plays an important role in typical reading acquisition.

Topic Area: LANGUAGE: Other

Electrophysiological Language Processing Signals Over Time: A Study of the Retest Reliability of the N400 and P600 Event-Related Potential Components

Poster E68, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Erin Kohnke[1], Mandy Faretta-Stutenberg[2], Darren Tanner[3], Kara Morgan-Short[1]; [1]University of Illinois at Chicago, [2]Northern Illinois University, [3]University of Illinois at Urbana-Champaign

Electroencephalography (EEG) is an increasingly popular tool among language researchers interested in understanding the neural processes underlying language behavior and processing. Using EEG, it is possible to identify specific event-related potentials (ERPs) that are associated with particular language processing events, such as the N400 component (a negative-going wave maximal around 400 ms post-stimulus onset), thought to be linked to semantic processing, and the P600 component (positive-going waveform, maximal around 600 ms post-stimulus onset), often associated with syntactic or combinatorial processing. Although non-linguistic ERP effects have been found to be moderately reliable over time (Hammerer et. al, 2013; Cassidy, Robertson & O'Connell, 2012; Weinberg & Hajcak, 2011; Gasper, Rousselet & Pernet, 2011), little is known regarding the retest reliability of language-related components such as the N400 and P600 (Tanner & Bulkes, 2015). The present experiment seeks to analyze the reliability of these two ERP components in native-language processing. In order to assess the stability of processing signatures over time, EEG data were recorded from monolingual English-speaking participants as they completed a grammaticality judgment task in English at two testing sessions separated by approximately 4.5 months. Analysis with ANOVAs comparing the responses at the two sessions did not reveal significant differences in either the N400 or P600 across the two sessions. These findings support the assumption that the N400 and P600 components are reliable over time in the absence of language development. These results have important implications for previous and future studies that investigate longitudinal change and stability in language processing signatures.

Topic Area: LANGUAGE: Other

Orthographic codes in the ventral visual system and the reading network revealed by complex grapheme manipulation

Poster E69, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Florence Bouhali[1,2], Zoé Bézagu[1], Stanislas Dehaene[3,4], Laurent Cohen[1,5]; [1]Inserm U 1127, CNRS UMR 7225, Sorbonne Universités, UPMC Univ Paris 06 UMR S 1127, Institut du Cerveau et de la Moelle épinière, ICM, [2]Université Paris Descartes, [3]Collège de France, [4]INSERM, CEA, NeuroSpin, U992, Gif-sur-Yvette, France, [5]AP-HP Hôpital de la Pitié Salpêtrière

The meaning of a written word can be accessed through a direct lexical route, or through a phonological route that relies on grapheme-to-phoneme mapping. While the phonological route requires fine-grained information on the precise ordering of letters to isolate graphemes, the lexical route is likely to operate using parallel processing of letters to select candidate words efficiently from the lexicon (Grainger and Ziegler 2011). At the neural level, the Visual Word Form Area (VWFA) has been described as a heterogeneous region specialized in the recognition of letters and words, feeding both reading routes. How this region may implement both fine- and coarse-grained orthographic codes and feed the relevant information into the reading network remains unknown. Taking advantage of the high frequency of multiletter graphemes in French, we designed a reading fMRI experiment modulating the reliance on fine-grained orthographic encoding. Letter strings were split into subunits, corresponding either to graphemes (congruent condition) or non-graphemic letter groups (incongruent condition), made salient using both letter spacing and alternating font color. To further influence the reliance on each reading route, lexical status (word vs. pseudoword) and task (lexical decision vs. reading aloud) were manipulated. In agreement with the role of graphemes as a relevant sublexical unit, incongruently chunked words were processed with more difficulty, especially in conditions with highest phonological demands. When reading pseudowords aloud, the perturbation of grapheme encoding induced higher activations in Broca's area and selected peaks of the VWF system, supporting the existence of two distinct codes in the VWFA.

Topic Area: LANGUAGE: Other

Classification of neural responses to contextually constrained sentence endings using single trial EEG data

Poster E70, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

James J. S. Norton[1], Ryan J. Hubbard[1], Cybelle Smith[1], Timothy Bretl[1]; [1]University of Illinois

Decades of cognitive neuroscience research have demonstrated that the brain rapidly integrates contextual and semantic information during sentence reading. Investigations into the neural basis of these processes -- predominantly using event-related potentials (ERPs) -- have revealed several neural signatures of information integration, including the N400, frontal positivity, and frontal theta responses. ERP investigations, however, are limited in that they assume the average response of many subjects over many trials is representative of single-trial activities in the brain. Several aspects of language comprehension, such as whether or not users make specific word predictions, cannot be explored after averaging. To test whether single trial data can be used to assess these aspects of semantic processing, we performed a classification analysis on EEG data from three separate datasets. The data were collected during three experiments in which subjects read highly constraining sentences with either expected or unexpected but plausible endings. For each of these datasets, we extracted features from the EEG data relating to spatial (using common spatial patterns), temporal, and time-frequency changes in brain activity following the presentation of the final word across two conditions (expected or unexpected). Using linear classifiers (LDA, naive Bayes, SVM), we successfully classified expectancy at accuracies above chance. We also explored classification performance on words from more weakly constraining sentences, as well as on semantically anomalous words. These results provide a first step towards the development of new single trial methodologies investigating language comprehension with EEG, and potentially have additional application to brain-computer interfaces.

Topic Area: LANGUAGE: Other

Electrocorticographic changes at different cortical regions in sentence production

Poster E71, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Johnathan Wu[1,2], Toshimune Kambara[1,3], Yasuo Nakai[1], Eishi Asano[1]; [1]Children's Hospital of Michigan, [2]Wayne State University School of Medicine, [3]Postdoctoral Fellowship for Research Abroad, Japan Society for the Promotion of Science

Numerous studies using picture stimuli have demonstrated that visual perception and overt responses are associated with an activation of visual and motor pathways, whereas noun and verb production is associated with left frontal activation. However, few studies have characterized the cortical dynamics of the brain before and during sentence production using methods that have both high temporal and high spatial resolution. The aim of this study is to use electrocorticography (ECoG) to examine changes in left cerebral cortical activity in sentence production. Patients were asked to describe pictures using sentences containing a noun phrase, a verb phrase, a time phrase, and a place phrase. The ECoG and sentence audio recordings were then analyzed with respect to the onset of the visual stimuli, the onset of the vocal response, and the onset of each of the four sentence elements. The results showed that immediately after the visual stimulus onset, the fusiform and inferior temporal gyri exhibited high-gamma augmentation, whereas the lingual and orbitofrontal gyri exhibited high-gamma attenuation. Immediately after the response onset, the precentral gyrus exhibited high-gamma augmentation. Prior to both time and place phrases, the pars opercularis and rostral middle frontal gyri exhibited high-gamma augmentation, whereas prior to verb phrases, the supramarginal gyrus exhibited high-gamma augmentation. These results suggest that our sentence production task activated the cortical network generally involved in noun and verb production tasks and also generate the hypothesis that specific cortical regions are differentially involved in the production of unique elements in sentences.

Topic Area: LANGUAGE: Syntax

Compounds emerge from the merge operation in human language syntax

Poster E72, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Tomomi Hida[1], Hiroaki Mizuhara[1]; [1]Kyoto University

Language has a syntactic hierarchical structure, and it is created by the recursive combining operation (i.e., Merge). This operation has a pot-type and a subassembly-type Merge. For example, Pot-Merge yields the expression, {latest {game strategy}} (“a game strategy which is the latest”), while Sub-Merge yields the expression, {{latest game} strategy} (“a strategy for the latest game”). In theoretical linguistics, the combining operation is used not only at the sentence level, but also at the compound level, although experimental evidence has never been provided for the compound level. We verified whether the compound is created by the Merge operation in a human behavioral experiment. The task was Merge order judgement. Three-word compounds were displayed serially, varying the word meaning connections based on their temporal and meaning proximity. The meaning connections were hard to cut off unless the time interval between the words became sufficiently large. If compounds are created by Merge in syntax, the chunking by meaning proximity should be modulated by the temporal proximity. In the psychometric function analysis, the meaning connection maintained until the time interval between the words became sufficiently large when the meaning connection was strong. The results indicate that the compound is created by Merge in syntax. Syntactic processing is a common rule for the combining operation of language hierarchical structure.

Topic Area: LANGUAGE: Syntax

Anticipating morphological and syntactic structures – investigating the pre-activation negativity

Poster E73, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Pelle Söderström[1], Merle Horne[1], Mikael Roll[1]; [1]Lund University

It is known that listeners can predict upcoming words based on constraining contexts (e.g. DeLong et al., 2005). In a recent study, we proposed a left frontal brain potential, the pre-activation negativity, PrAN (Söderström et al., 2016), thought to reflect pre-activation of expected word continuations. Time-locked to word-initial fragments, PrAN's amplitude was found to increase in a 136-280 ms time window as the number of possible continuations decreased, suggesting that PrAN increased with increased predictive certainty about a word's ending. In the present study, we tested whether a similar effect could be found for pre-activation of expected syntactic structures. In Swedish, intonation is used to signal whether an unfolding embedded clause is a main or subordinate clause. Specifically, a clause-initial word with a low boundary tone cues only subordinate clause structure. Conversely, a corresponding high tone signals that any kind of embedded main clause structure may follow, i.e. it cues a more open set of structures. Test participants listened to complex sentences and judged the word order of the verb (V) and negation (NEG) after the boundary tone as quickly as possible (NEG–V word order occurs in subordinate clauses and V–NEG in main clauses). ERPs were time-locked to the tone-bearing syllable. A repeated-measures ANOVA showed a negativity in left anterior electrodes at 136-280 ms for low initial boundary tones, which cue only subordinate clauses. We propose that this effect is a PrAN, but that it here reflects pre-activation of syntactic structures rather than possible word endings.

Topic Area: LANGUAGE: Syntax

Native language proficiency modulates spatial characteristics and magnitude of neural responses to phrase-structure violations: An MEG study

Poster E74, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Lyam Bailey[1], Lisa J. Beck[1], Morgan Johnson[1], Tim Bardouille[1], Aaron J. Newman[1]; [1]Dalhousie University

Past analyses of the neural correlates of sentence processing have largely been based on the assumption that native language (L1) users show homogeneity in language proficiency, and in corresponding brain activity. However, a growing body of research has shown that proficiency is not homogeneous among L1 users, and that variability in this — and other cognitive factors — could influence the way in which each individual processes language. Recent research from our lab and others indicates that components of the event-related potentials (ERPs) elicited during sentence processing vary between individuals as a function of language proficiency and other cognitive factors. The current investigation used magnetoencephalography (MEG) to investigate individual differences in the neural correlates of syntactic processing. We recruited 20 demographically diverse participants exhibiting a range of scores on tests of language and cognition. At the whole-group level, sentences containing phrase structure violations (for example, 'I banana the ate' vs. 'I ate the banana') elicited expected modulation of the MEG signal — equivalent to the P600 effect typically seen in ERP studies of similar design. Individual participant scores on the listening grammar and speaking grammar components of the Test of Adult & Adolescent Language (TOAL-3), a standardised measure of L1 proficiency, were positively correlated with amplitude change in the MEG signal. Moreover, higher scores on the speaking grammar component were associated with increased lateralisation of activity to the left hemisphere. These results further demonstrate that individual differences modulate neural activity underlying certain cognitive processes.

Topic Area: LANGUAGE: Syntax

A cognitive impairment for sentence planning after focal damage to the Frontal Aslant Tract

Poster E75, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Benjamin Chernoff[1], Alex Teghipco[1], Frank Garcea[1,2], Susan Smith[3], Webster Pilcher[3], Bradford Mahon[1,2,3]; [1]University of Rochester, [2]Center For Visual Science, [3]University of Rochester Medical Center

Frontal and temporal white-matter pathways have long been implicated in language processing, but the precise functional role of specific tracts is still under investigation. A functional role in speech planning has been proposed for a recently described pathway, the Frontal Aslant Tract (FAT), which connects Broca's area to the pre-supplementary motor area (SMA). Here, we use longitudinal functional and structural MRI and behavioral testing to compare a 63-year old woman, AF, who had neurosurgery to remove a glioma in her left frontal lobe, with a 35 year old woman, AG, whose left anterior temporal lobe was resected to remove a hippocampal tumor. AF and AG, cognitively intact pre-operatively, exhibited specific and doubly dissociable behavioral deficits post-operatively: patient AF had dysfluent speech but no word finding difficulty, while patient AG had word finding difficulty but otherwise fluent speech. Probabilistic tractography showed that the FAT was damaged by the surgery in patient AF (but not AG) while the inferior longitudinal fasciculus was damaged by the surgery in patient AG (but not AF). We also found that changes in functional connectivity to Broca's area directly related to areas of degraded structural connectivity. Specifically, there was decreased functional connectivity post-operatively between Broca's area and pre-SMA in patient AF (but not patient AG), and decreased functional connectivity between Broca's area and the middle/inferior temporal gyrus in patient AG (but not patient AF). These results motivate the novel hypothesis that the FAT serves as a key communicative link between sentence planning and lexical access processes.

Topic Area: LANGUAGE: Syntax

Investigating with Finger Tracking the Acquisition of Semantic and Syntactic Symbols in an Artificial Mini-language

Poster E76, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Fosca Al Roumi[1], Dror Dotan[1,2], Stanislas Dehaene[1,3]; [1]Cognitive Neuroimaging Unit, CEA DSV/I2BM, INSERM, Université Paris-Sud, Université Paris-Saclay, NeuroSpin center, 91191 Gif/Yvette, France, [2]Language and Brain Lab, School of Education and Sagol School of Neuroscience, Tel Aviv University, Tel Aviv, Israel, [3]College de France, 11 Place Marcelin Berthelot, 75005 Paris, France

Although non-human primates are able to learn symbols that have a semantic meaning, they do not have access to complex language. Moreover, the manner in which humans learn the abstract rules needed to acquire syntax is not yet clear. To understand if different learning mechanisms differentiate human linguistic capacities from those of monkeys, we developed a mini-language learning application on an iPad tablet. Novel to our paradigm was the addition of a syntactic operator, which is a crucial aspect of human generative language. 27 participants, with an age range from 18 to 35 completed the experiment over two consecutive days. By continuously tracking finger movement, we revealed the successive cognitive states associated to the sequential processing of the semantic and syntactic elements of the mini-language in real-time. All participants were able to understand the semantic component of our mini-language. They accumulated sequentially the evidence associated to each shape to make the decision that was the most likely to be rewarded. However, only half of them learned the rule underlying the processing of the syntactic operator. Our results are an encouraging first step in elucidating the way in which adult humans acquire syntax. However, this division into sub-groups evokes additional interesting questions, the answers to which will add to our understanding of how humans and non-human primates differentiate in their apprehension of sequences.

Topic Area: LANGUAGE: Syntax

The Effect of the Clause Boundary on Sentence Processing Costs

Poster E77, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Ryan Rhodes[1]; [1]University of Delaware

In this study I examine the relationship between processing costs associated with sentence comprehension and the structure of the clause. Gibson's (2000) Dependency Locality Theory claims that the cost of integrating the filler at the gap site in a filler-gap dependency is proportional to the number of referents introduced since the most recent activation of the filler. With an activation of the filler at the clause boundary (CP), integration costs in a dependency established across a CP boundary should be less than in a dependency crossing a noun phrase boundary (DP). Gibson & Warren (2004) found reading time evidence supporting this claim. This study uses anterior negativity (AN) as an index of the working memory cost of maintaining an active dependency and the P600 as an index of integration cost, following Phillips et al. (2005). Using the stimuli from Gibson & Warren (2004), I predict an attenuation of AN and a P600 at the complementizer in the extraction-across-CP condition, but no such effects in the extraction-across-DP condition. I find a clear P600 effect at the complementizer in the CP condition but not the DP condition. I interpret this as an index of an integration event which occurs with the activation of the filler at the clause boundary (an event absent in the DP condition). I also observe AN at the complementizer in both conditions. This effect does not differ between conditions, indicating that the clause boundary has no effect on working memory cost associated with the maintenance of the dependency.

Topic Area: LANGUAGE: Syntax

The effects of L1 morphology on subject-verb agreement processing in English

Poster E78, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Andrew Armstrong[1], Nyssa Bulkes[1], Darren Tanner[1]; [1]University of Illinois at Urbana-Champaign

Research on second language processing has provided conflicting results about the extent to which nonnative speakers anticipate during L2 comprehension. The present study investigates this issue further by examining the effects of L1 morphology on how English subject-verb agreement dependencies are processed by nonnative speakers. Tanner and Bulkes (2015) used sentences like 'The/Many cookies taste/*tastes the best when dipped in milk' to find evidence that quantifying the subject NP increased L1 English speakers' sensitivity to S-V agreement violations by providing an additional predictive cue about the upcoming verb's number feature. In the current study, we are replicating this experiment with L1 speakers of Spanish, a morphologically complex language, and L1 speakers of Mandarin Chinese, which lacks verbal agreement morphology. The L1 Spanish data collection is currently underway, but the data from 40 native Chinese speakers have already produced clear results. Event related potentials (ERPs) time-locked to the critical verbs showed that like the L1 English participants, the L1 Chinese speakers generated a P600 in response to ungrammatical words involving morphosyntactic violations. However, the L1 Chinese speakers' results differed in that the P600 for this group was larger when no quantifier was present. This indicates that while L1 Chinese speakers can process morphosyntactic features absent from their L1, they are integrated differently from native English speakers. Further testing with L1 speakers of Spanish will make it possible to determine if these results reflect a general L2 parsing strategy, or the influence of Mandarin's status as an isolating language on processing.

Topic Area: LANGUAGE: Syntax

Event-related potentials at study and test explain individual memory-performance differences in associative recognition

Poster E79, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Yvonne Y Chen[1], Jeremy B Caplan[1]; [1]University of Alberta, Edmonton, Alberta, Canada

A basic function of memory is to retain associations between items. Prior research has examined neural mechanisms of association memory at study and test separately. Here we track how brain activity, measured by event-related potentials (ERPs), at study leads to brain activity at test, in turn influencing memory outcome. Fifty-eight participants studied lists of word pairs and then were tested with associative recognition. They judged if the test probe was a pair from the study set (``intact'') or composed of words drawn from two different studied pairs (``rearranged''). Taking an individual-differences approach, we asked whether memory-related ERP features at study explained common variance with ERP features at test, across participants. We also asked whether those memory-related ERP features explained individual differences in memory performance. The Late Positive Component (400--700 ms) subsequent memory effect (hits minus misses), at study correlated with an early (400--600 ms) retrieval-success effect (hits minus misses) at test, $r(58) = 0.25$, $p<0.05$. Those features also correlated with memory performance (d'), $r(58)=-0.32$, $p<0.05$. Interestingly, the Slow Wave subsequent memory effect, which has been thought to index basic association-memory formation processes, did not correlate with associative recognition d' or response time, nor with any test ERP features. These results echo findings with item-recognition (Chen et al., 2014), where modulations of an early ERP signal at study may result changes in an early ERP signal at test, in turn leading to better recognition-memory.

Topic Area: LONG-TERM MEMORY: Episodic

Hippocampal theta oscillations differentiate recognition with and without correct source retrieval.

Poster E80, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Kamin Kim[1], Arne Ekstrom[2], Nitin Tandon[1]; [1]Department of Neurosurgery, University of Texas Medical School at Houston, [2]Center for Neuroscience and Department of Psychology, University of California Davis

Past EEG findings have suggested that theta oscillations are associated with recognition and may reflect hippocampal-driven reinstatement of the episodic memory representation (Nyhus & Curran, 2010). However, specific evidence of hippocampal theta-driven reinstatement during recognition is lacking. Here, using intracranial EEG (iEEG), we investigated the electrophysiological characteristics of the hippocampal processing during recognition. Six patients participated in a spatiotemporal source memory task comprised of encoding and retrieval phases. During encoding, patients were presented with pictures of objects and asked to associate them with either a spatial or temporal context. During recognition/retrieval, they were again presented with the same objects and some new foil items and asked whether they had previously been shown the picture (familiar vs. unfamiliar, i.e., recognition) and also the context they associated with the item (i.e., source retrieval). iEEG data from the electrodes placed in the hippocampus were analyzed in a time window starting from 1000ms preceding the recognition cue onset till 2200ms after cue onset. Correct recognition trials were sorted according to whether the item was later identified with the correct source context or not. Time-frequency analysis was conducted using Hilbert transformation, and a permutation test was used to test the statistical significance of conditional differences. Significant increases in theta-band (3-8Hz) oscillations were associated with the items in which the source was later correctly identified. The present results suggest that in hippocampal theta oscillations may initiate distinct levels of cortical reinstatement for episodic memory with and without rich encoding of details.

Topic Area: LONG-TERM MEMORY: Episodic

To The Neural Mechanism Supporting Episodic Retrieval is Sensitive to the Quality of Information in both Younger and Older Adults.

Poster E81, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Jamie Murray[1], David Donaldson[1]; [1]University of Stirling

Our ability to successfully retrieve episodic memories (i.e., memory for events) is diminished with healthy ageing. Much of what we know about age-related memory decline, however, is limited by measurement methods that simply probe whether retrieval was successful or not. Memory, however, not only grants us access to past experiences but also provides us with rich qualitative information that can vary with precision. To date, it is unclear whether healthy ageing simply diminishes one's ability to successfully recollect or whether ageing also affects the quality of retrieved information. Here, we employed Event Related Potentials (ERPs) to assess whether the neural mechanisms that support retrieval in younger and older adults are sensitive to the quality of retrieval. A continuous source task was employed, requiring participants to remember words paired with a location marked around a circle, allowing trials to be subsequently separated according to the level of source precision (i.e., the radial distance between the target location and the remembered location). Behaviourally, our results revealed that both the rate and precision of retrieval are reduced by healthy ageing. Importantly, the neural correlate of retrieval (i.e., the parietal retrieval success effect) is sensitive to the quality of information in both age groups but is significantly reduced in magnitude for older adults. The observed data strongly suggests that our understanding of age-related memory decline can be advanced by accounting for both the quantity and quality of retrieval success.

Topic Area: LONG-TERM MEMORY: Episodic

Implicit memory for content and speaker of messages heard during slow-wave sleep

Poster E82, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Simon Ruch[1,2], Romi Zäske[3,4], Marc Alain Züst[1,2], Stefan R. Schweinberger[3], Katharina Henke[1,2]; [1]Department of Psychology, University of Bern, Bern, Switzerland, [2]Center for Cognition, Learning and Memory, University of Bern, Bern, Switzerland, [3]Department for General Psychology and Cognitive Neuroscience, Institute of Psychology, Friedrich Schiller University of Jena, Jena, Germany, [4]Department of Otorhinolaryngology, Jena University Hospital, Jena, Germany

Although sleep is a state of unconsciousness, the sleeping brain does not completely cease to process external events. In fact, our brain is able to distinguish between sensical and nonsensical messages and can even learn contingencies between non-verbal events while asleep. Here, we asked whether sleeping humans can encode new verbal messages, learn voices of unfamiliar speakers, and form associations between speakers and messages. To this aim, we presented 28 sentences uttered by 28 unfamiliar speakers to participants who were in EEG-defined slow-wave sleep. After waking, participants performed three tests which assessed recognition of sleep-played speakers, messages, and speaker-message associations. Recognition accuracy in all tests was at chance level, suggesting sleep-played stimuli were not learned. However, response latencies were significantly shorter for correct vs. incorrect decisions in the message recognition test, indicating implicit memory for sleep-played messages (but not for speakers or speaker-message combinations). Furthermore, participants with excellent implicit memory for sleep-played messages also displayed implicit memory for speakers (but not speaker-message associations), as suggested by the significant correlation between response-latency-differences for recognition of messages and speakers. Implicit memory for speakers was verified by EEG at test: listening to sleep-played vs. new speakers evoked a late centro-parietal negativity. Event-related EEG recorded during sleep revealed that peaks resembling up-states of sleep slow-waves contributed to sleep-learning. Participants with larger evoked slow-wave peaks later showed stronger implicit memory. Overall, humans appear to be able to implicitly learn semantic content and speakers of sleep-played messages. These forms of sleep-learning are mediated by slow-waves.

Topic Area: LONG-TERM MEMORY: Episodic

The hippocampus promotes effective saccadic information gathering in humans

Poster E83, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Heather D. Lucas[1], Melissa C. Duff[2], Neal J. Cohen[1]; [1]University of Illinois Urbana-Champaign, [2]Vanderbilt University

It is well established that the hippocampus is critical for human learning and memory. Recent evidence suggests that one way in which the hippocampus contributes to learning is by allowing individuals to explore information in efficient, adaptive ways under active study conditions. Here we demonstrate that the link between the hippocampus and exploration extends even to eye movements made during an otherwise passive encoding task. In two experiments, we use the information-theoretic measure of entropy to assess the amount of randomness or disorder in participants' item-to-item gaze transition patterns as they studied multi-item visuospatial displays. In Experiment 1, scanpath entropy at study was negatively associated with performance on a relational memory task in both within- and across-subject analyses. In particular, participants who engaged in higher-entropy viewing showed a greater tendency to later "swap" or reverse the relative positions of objects within the array. In Experiment 2, we found elevated scanpath entropy in patients with amnesia due to hippocampal damage, suggesting that the hippocampus is necessary to adaptively constrain saccadic information sampling. These data reveal that hippocampal contributions to exploratory behaviors in humans are pervasive, operating even at the level of eye movements.

Topic Area: LONG-TERM MEMORY: Episodic

The Truth is Out There: Recall of Verifiable Naturalistic Events is Highly Accurate

Poster E84, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Michael J. Armson[1,2], Nicholas Diamond[1,2], Daniela J. Palombo[3], Margaret C. McKinnon[4], Anthony Nazarov[4], Brian Levine[1,2]; [1]Baycrest, [2]University of Toronto, [3]Boston University, [4]McMaster University

When presented with misleading information about previously experienced events, humans are prone to subsequent memory distortion. This and other demonstrations of the fallibility of human memory have supported a shift in emphasis from a storehouse metaphor of memory, characterized by a focus on quantity of items accessible to memory, to a correspondence metaphor, characterized by memory accuracy (Koriat & Goldsmith, 1996). Countless studies have examined memory accuracy through laboratory assessments, such as recognition memory tests or list-learning tasks. Relatively few studies, on the other hand, have investigated accuracy in a more ecologically valid naturalistic context, and none of these real-world memory studies have verified accuracy in autobiographical recall. Our lab assessed memory for three separate naturalistic events with objectively verifiable details – a traumatic airline flight, a standardized respiratory mask-fitting procedure, and an experimental museum-style tour of Baycrest Hospital. As part of the memory testing in these studies, we had participants (N = 90) recall their experiences according to the semi-structured Autobiographical Interview (Levine, Svoboda, Hay, Winocur, & Moscovitch, 2002). We leveraged our knowledge of event details to code for accuracy in addition to detail number and type. Across events, we found that participants were extremely accurate in terms of their verifiable recall. Excluding details that could not be confirmed or disconfirmed (e.g., thoughts), recall accuracy was approximately 90%. Our findings suggest that, in the absence of conditions known to produce false memory, narrative recall is highly accurate.

Topic Area: LONG-TERM MEMORY: Episodic

Overlap between fMRI novelty and recollection effects

Poster E85, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Marianne de Chastelaine[1], Julia Mattson[1], Tracy Wang[1], Brian Donely[1], Michael Rugg[1]; [1]The University of Texas at Dallas, USA

fMRI findings suggest that familiarity- and recollection-based memory judgments have distinct neural correlates. Most studies investigating fMRI correlates of familiarity have focused on contrasts assessing where greater familiarity is associated with greater BOLD activity. A smaller number of studies have identified regions where BOLD activity is lower for familiar than for novel items ('novelty effects'). In a large cohort of participants (n = 136), we examined the overlap between fMRI correlates of recollection, familiarity, and novelty. Participants were scanned during an associative recognition test following a study phase in which word pairs were visually presented in the context of an elaborative encoding task. Test items comprised studied, rearranged (items studied on different trials) and new pairs. Familiarity effects were operationalized as greater activity for studied test pairs incorrectly identified as 'rearranged' than for correctly rejected new pairs. The reverse contrast was employed to identify 'novelty' effects. Recollection effects were identified by greater activity for correctly identified studied test pairs than for those incorrectly identified as rearranged. There was almost no overlap between fMRI recollection and familiarity effects, but there was extensive overlap between novelty and recollection effects, including in the anterior hippocampus and perirhinal cortex. Across participants, the magnitude of the MTL novelty effects correlated with behavioral measures of both familiarity and recollection. By contrast, hippocampal recollection effects correlated only with recollection performance. The findings suggest that fMRI novelty effects in the MTL reflect a generic memory signal, while recollection effects reflect a memory signal selective for recollection-based judgments.

Topic Area: LONG-TERM MEMORY: Episodic

Reactivation of Emotional Context during Successful Recollection: A Partial Least Squares Analysis

Poster E86, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Holly Bowen[1], Elizabeth Kensinger[1]; [1]Boston College

Episodic memory involves bringing back to mind details from encoding at the time of retrieval. One marker of this is neural reactivation. In the current fMRI study, participants (N =18) intentionally encoded neutral words paired with a positive, neutral or negative face or scene. They then completed a remember/know judgment for the neutral words; the emotional face or scene was not re-presented at retrieval. We examined retrieval-related activation associated with words previously encoded in a positive, neutral or negative context, using mean-centered Partial Least Squares (McIntosh et al., 2004), a multivariate technique optimal for identifying spatio-temporal whole-brain patterns. One analysis was run for words that had been encoded with faces, and a second analysis examined words that had been encoded with scenes. The first analysis yielded a significant latent variable (LV) showing a pattern of activation in lateral frontal regions and the ventral visual stream that correlated with recollection of words previously encoded with a negative face compared to a positive or neutral face. A second analysis revealed an LV pattern that differentiated activation correlated with successful recollection of words encoded with a negative scene compared to positive scene context. Again, negative context was associated with distributed activation in lateral frontal and anterior sensory regions, but positive context with more medial frontal and posterior sensory regions. These results add to the growing literature suggesting negative valence leads to more detailed, vivid memories and shed light on how a neutral trigger can reactivate sensory details from a previously experienced emotional event.

Topic Area: LONG-TERM MEMORY: Episodic

The primacy of 'place' in neural representations of events containing people, places and objects

Poster E87, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Jessica Robin[1,2], Sigal Gat Lazer[2], Bradley R. Buchsbaum[1,2], Morris Moscovitch[1,2]; [1]University of Toronto, [2]Rotman Research Institute, Baycrest Health Sciences

Some theories of episodic memory hypothesize that spatial context plays a fundamental role in episodic memory, acting as a scaffold on which episodes are based (Maguire & Mullally, 2013). Accordingly, spatial context should be discernible based on the neural representation of an event. To test this hypothesis, we performed fMRI scans while healthy participants imagined novel events, comprising familiar places, people and objects. We used Multi-Voxel Pattern Analysis (MVPA) to determine which neural areas could discriminate events based on each cue type. The largest network of areas could discriminate events based on location, including the parahippocampal cortex and posterior hippocampus, retrosplenial cortex, posterior cingulate cortex, precuneus and medial prefrontal cortex. Events were discriminable based on person and object cues in smaller networks of regions. Representational Similarity Analyses (RSA) revealed that in a set of regions associated with autobiographical memory, events that shared a location were more similar to one another than events in which location differed. This effect was marginal for events sharing a person, and only significant for events sharing an object when they also had a common location, suggesting that under these conditions, spatial context is the dominant defining factor. Together, these results indicate that location and person information both contribute to the neural representation of a complex episode, though location effects were stronger and were in a larger network of areas. This study offers support for theories suggesting that spatial context underlies episodic memory in the autobiographical memory network.

Topic Area: LONG-TERM MEMORY: Episodic

False memory for context and true memory for context similarly activate the parahippocampal cortex

Poster E88, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Jessica M. Karanian[1], Scott D. Slotnick[1]; [1]Boston College

The role of the parahippocampal cortex is currently a topic of debate. The visual-spatial processing view posits that the parahippocampal cortex processes spatial layouts and sensory details, while the general contextual processing view posits that the parahippocampal cortex processes spatial and non-spatial contexts. Previous studies have found that true memories activate the parahippocampal cortex to a greater degree than false memories, which has been taken to support the visual-spatial processing view as true memories are typically associated with greater visual-spatial detail than false memories. However, in previous studies, contextual details were also greater for true memories than false memories. Thus, such differential activity may have reflected differences in contextual processing rather than visual-spatial processing. In the present fMRI study, we employed a source memory paradigm to investigate the role of the parahippocampal cortex during true memory and false memory for contextual information to distinguish between the visual-spatial processing view and the general contextual processing view. During encoding, shapes were presented to the left or right of fixation. During retrieval, old shapes were presented at fixation and participants indicated each shape's previous spatial location followed by a confidence rating. High confidence true memories for context and high confidence false memories for context similarly activated the parahippocampal cortex. Critically, high confidence true memories were associated with greater visual-spatial processing than high confidence false memories, while both memory types were associated with contextual processing. Therefore, the present results suggest that the parahippocampal cortex is associated with general contextual processing rather than visual-spatial processing.

Topic Area: LONG-TERM MEMORY: Episodic

How does the timing of acute stress modulate hippocampal connectivity following associative encoding?

Poster E89, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Alexa Tompary[1], Elizabeth V. Goldfarb[1], Elizabeth A. Phelps[1], Lila Davachi[1]; [1]New York University

Acute stress is known to influence episodic memory, and the directionality of this influence depends on the stage of memory formation during which the stressor is administered. Most prior work focuses on the influence of stress on recognition memory, leaving open the question of how hippocampus-based associative memory is affected by stress. We developed a two-day fMRI study with a fully within-subject design to investigate how neural processes during post-encoding rest are influenced by stressors that occur either before or after encoding, and how these processes relate to long-term memory. In the first session, participants completed a baseline rest scan, and then encoded neutral objects paired with previously normed negatively valenced words. The cold pressor stress manipulation was administered immediately after the second encoding block, resulting in three encoding conditions: no stress, post-encoding stress, and pre-encoding stress. These scans were interleaved with three post-encoding rest scans. 24 hours later, participants completed recognition and source memory tests. We investigated shifts in resting state connectivity between the hippocampus and object-sensitive regions in ventral temporal cortex. We found that following encoding with no stress, connectivity between the hippocampus and object regions increased relative to baseline, consistent with past work (Tambini et al., 2010). However, if stress occurred before encoding, hippocampal connectivity during post-encoding rest was significantly lower. This suggests that stress administered before encoding may disrupt consolidation processes that begin to unfold immediately after encoding. Further analyses will connect these imaging findings to individual differences in recognition and source memory across participants.

Topic Area: LONG-TERM MEMORY: Episodic

Long-term retention of vocabulary in two phonetically similar foreign languages is aided when learning occurs in highly distinctive virtual reality environments

Poster E90, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Joey Ka-Yee Essoe[1], Niccolo Reggente[1], Younji Hera Baek[1], Ai Aileen Ohno[1], Priyanka Mehta[1], Alvin Vuong[1], Jesse Rissman[1]; [1]University of California, Los Angeles

The environmental context in which a memory is encoded can impact its later accessibility by virtue of tagging the memory with unique retrieval cues. We examined whether distinctive virtual environments (VEs) could be used as a means to provide contextual support during the learning of two sets of easily confusable stimuli. Specifically, we taught participants the translations of 50 English words in two pre-experimentally unfamiliar languages: 10 were learned only in Swahili, 10 only in Chinyanja, and 30 in both languages. Participants in the Dual Context group learned each language in a different VE, whereas participants in the Single Context group learned both languages in the same VE. On Day 2, after the fourth VE learning session, participants' ability to recall the Swahili and Chinyanja translations of the English words was tested outside of the VEs. One week later (Day 8), participants were reached by telephone and performed a surprise recall test assessing their long-term retention of the foreign words. Our results revealed that while the Single and Dual Context groups showed comparable recall performance when tested on Day 2, the Dual Context group exhibited significantly reduced forgetting when tested on Day 8. This finding showcases how distinctive learning contexts can protect newly

acquired memories from succumbing to excessive interference and promote long-term retention. An additional fMRI dataset collected from a separate group of Dual Context participants during Day 2 cued recall should provide further insights into the mechanisms that underlie their memory advantage.

Topic Area: LONG-TERM MEMORY: Episodic

Ecological assessment of retrospective and prospective memory in early Alzheimer's disease: validity of a virtual reality task

Poster E91, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Valentina La Corte[1,2,4], Valentine Facque[1,2], Maria Abram[1,2], Agnès Michon[4], Aurélie Funkiewiez[4], Bruno Dubois[4,5], Pascale Piolino[1,2,3]; [1]Institute of Psychology, University Paris Descartes, Sorbonne Paris Cite, France, [2]Inserm UMR 894, Center of Psychiatry and Neurosciences, Memory and Cognition Laboratory, Paris, France, [3]University Institute of France, Paris, France, [4]Institut de la Mémoire et de la Maladie d'Alzheimer (IM2A), Département de Neurologie, Hôpital Pitié-Salpêtrière, AP-HP, Paris, France, [5]Institut du Cerveau et de la Moelle Epinière (ICM), CNRS UMR 7225- INSERM U1127 Paris, France; Sorbonne Universités, Université Pierre et Marie Curie-Paris 6, Paris, France

Retrospective memory (RM) involves remembering previous events or previously learned information. Prospective memory (PM) is the ability to form, maintain and execute intended actions after a delay, in the appropriate context in the future. According to the context of the intention retrieval, three different types of PM have been defined: time-based (TB), event-based (EB), and activity-based (AB) actions. Classical neuropsychological tools used to assess these two types of memory are far from what we experience in daily life. The aim of this study is to investigate the cognitive mechanisms underlying prospective and retrospective memory impairments in Alzheimer's disease (AD) patients using a naturalistic environment crated with virtual reality (VR). Participants walk in a virtual town, then perform a retrospective (RT) and a prospective memory tasks (PT). Results show that AD patients are impaired in both tasks. Nevertheless they are more impaired in the RT compared to the PT. In particular within the RT they show a severe deficit in feature binding (the association between what, where, when) in line with previous studies. Within the PT they are deeply impaired in TB tasks but interestingly they show significantly better performance in AB actions, in which they are asked to directly act in the VR environment suggesting the benefit of enactment effect in AD. Taken together these findings suggest that virtual environments entail considerable potential for the assessment of retrospective and prospective memory in early AD and they pave the way to future applications in cognitive rehabilitation programs focused on long-term memory.

Topic Area: LONG-TERM MEMORY: Episodic

Memory replay during sleep in human intracranial recordings

Poster E92, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Jessica Creery[1], David Brang[2], Vernon Towle[3], James Tao[3], Shasha Wu[3], Ken A. Paller[1]; [1]Northwestern University, [2]University of Michigan, [3]University of Chicago

A viable explanation for how sleep contributes to memory consolidation is that storage is facilitated when memories are replayed during sleep. However, additional evidence is needed to support the crux of this idea, ideally by observing neural evidence of memory replay during sleep and showing that replay benefits memory storage. The hippocampus has been implicated in sleep replay based on evidence of hippocampal place cell activity in rodents. Indirect evidence that replay benefits consolidation comes from sleep studies using targeted memory reactivation (TMR) — when sensory cues coupled with pre-sleep learning are re-presented during sleep, memory is superior post-sleep. Here we combined TMR with intracranial electroencephalography (iEEG) to observe activity in the hippocampus when specific memories are reactivated during sleep. We recorded activity from depth electrodes in three patients with epilepsy during a spatial learning task and subsequent sleep with TMR. We analyzed event-related spectral perturbations to sound cues during sleep and found an increase in hippocampal gamma (30-70 Hz) starting about 500 ms after sound onset. This response was larger for sounds associated with prior learning compared to novel sounds. Additionally, there was a larger increase in gamma when recall after sleep was better. Based on the inference that gamma reflects local neural activity, these findings indicate that the learning-related stimuli presented during sleep engaged hippocampal responses that predicted subsequent memory performance. We thus linked neural activation in the hippocampus during sleep replay to enhanced memory storage and consequently to consolidation.

Topic Area: LONG-TERM MEMORY: Episodic

Long-Term Effects of Concussion and Contact History on Cognitive Function in Middle-Adulthood

Poster E93, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Eleanna Varangis[1], Kelly Giovanello[1], Neil Mulligan[1], Kathleen Gates[1], Jessica Cohen[1], Kevin Guskiewicz[1]; [1]The University of North Carolina at Chapel Hill

Long-term effects of concussion history in older age are well-documented and include deficits in most domains of cognition and measures of neural efficiency and integrity. Studies in young adults with a history of concussions past the acute recovery period have been mixed - some have found an effect of concussions on executive

functioning and memory within a few years of their last concussion, while others have found no observed impairments as a function of concussion history. However, little is known about the neurocognitive health of individuals with a history of concussions in middle-adulthood. The present study recruited three groups of former athletes in order to assess the effect of concussions and contact sport participation on cognitive function in middle-adulthood: (1) former collegiate football players with a history of 4 or more concussions, (2) former collegiate football players with no history of concussions, and (3) former non-contact sport athletes with no history of concussions. Participants completed a battery of neurocognitive assessments, genotyping, and an fMRI scan including both structural and functional (resting and task-based) imaging. Task-based fMRI was collected in the context of a paired-associate learning paradigm in which word pairs varied by associative strength, and memory was tested during a cued recall period following encoding. Results showed some behavioral differences as a function of concussion and contact history, but significant neural network reorganization associated with concussion history, but not contact history. This pattern is suggestive of minimal observable cognitive impairment, but considerable neural inefficiency associated with concussion history in middle-adulthood.

Topic Area: LONG-TERM MEMORY: Episodic

Multimodal Investigation of Neurobehavioral Dynamics – MINDs – in Emotional Distraction

Poster E94, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Florin Dolcos[1], Matthew Moore[1], Alexandru Iordan[2], Yuta Katsumi[1], Ryan Larsen[1], Edward Maclin[1], Andrea Shafer[3], Anthony Singhal[4], Brad Sutton[1], Andrew Bagshaw[5], Monica Fabiani[1], Gabriele Gratton[1]; [1]University of Illinois at Urbana-Champaign, [2]University of Michigan, [3]National Institutes of Health, [4]University of Alberta, [5]University of Birmingham

The link between spatial (where) and temporal (when) aspects of the neural correlates of most psychological phenomena is not clear. Elucidation of this relation requires integration across multiple brain imaging modalities and tasks that reliably modulate the engagement of brain systems of interest. This poster will illustrate such an integration across 3 imaging modalities: functional magnetic resonance imaging (fMRI), electroencephalography/event-related potentials (EEG/ERP), and event-related optical signals (EROS), which shares the spatial resolution of fMRI and temporal resolution of ERPs. Executive tasks with emotional distraction were used, because such dual-task designs can dissociate between large-scale dorsal and ventral brain systems involved in cognitive and affective processing. Pilot data from subjects performing an emotional odd-ball task provided initial validation of simultaneous fMRI-EEG and EEG-EROS recordings, and identified prefrontal and parietal cortical responses consistent with unimodal spatial and temporal evidence. Additional pilot data extended these results to a combined working memory-emotion regulation task with emotional distraction, and showed further spatio-temporal dissociations convergent across the 3 modalities, in fronto-parietal areas, as a function of the source of distraction (external-percepts vs. internal-memories) and the type of ER (spontaneous vs. instructed). Moreover, EEG-informed fMRI analyses identified links between ERP amplitude at parietal electrodes and fronto-parietal hemodynamic responses when coping with distraction, further supporting the value of multimodal imaging integration. Finally, data resulted from simultaneous fMRI-ERP-EROS recordings further validated the feasibility of using EROS as a bridging tool in this tri-modal combination of brain imaging methods, which is a World Premiere in the study of brain function.

Topic Area: METHODS: Neuroimaging

Whole brain mapping of functional connectivity pattern dissimilarity reveals focal changes in task-dependent coupling across reasoning, memory, and perception

Poster E95, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Xiaoye Zuo[1], Andrew J. Westphal[1], Jesse Rissman[1]; [1]University of California, Los Angeles

Researchers interested in characterizing task-dependent changes in functional connectivity have traditionally relied on seed- or node-based approaches. However, advances in computing have made it possible to measure the connectivity between every voxel and every other voxel in the brain, an approach dubbed 'full correlation matrix analysis' (Turk-Browne, 2013). We applied such an approach to fMRI data from 20 participants to identify regions that showed the greatest changes in their functional connectivity properties across three distinct cognitive tasks. Importantly, these tasks shared identical stimulus characteristics and response demands, but differed in their engagement of analogical reasoning, episodic memory retrieval, and visuospatial perceptual processes. For each voxel in the brain, we generated a whole brain functional connectivity map for each task, and computed the dissimilarity of these maps as an index of task-dependence. Consistent with our prior work demonstrating commonalities in cortical engagement during reasoning and memory (Westphal et al., 2016), the connectivity properties of memory and reasoning were generally more similar to each other than to the perception task. Areas showing maximally divergent connectivity during perception included left posterior intraparietal sulcus, inferior frontal gyrus, and lateral occipital cortex. Our analyses also identified regions with marked alterations in their functional connectivity patterns across all three tasks, with peak effects found in default mode regions such as left posterior cingulate cortex and dorsal superior frontal gyrus, as well as several task-positive frontoparietal regions. Such data-driven findings can be followed up with seed-based analyses to more fully isolate the task-dependent changes in inter-regional coupling.

Topic Area: METHODS: Neuroimaging

Localizing Event-Related Potentials using New Approaches to Multi-source Minimum Variance Beamforming

Poster E96, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Anthony Herdman[1], Alexander Moiseev[2], Urs Ribary[2]; [1]University of British Columbia, Canada, [2]Simon Fraser University, Canada

Adaptive and non-adaptive beamformers have become a prominent neuroimaging tool for localizing neural sources of electroencephalographic (EEG) and magnetoencephalographic (MEG) data. We investigated single-source and multi-source scalar beamformers with respect to their performances in localizing and reconstructing source activity for simulated EEG data. We compared a new multi-source search approach (multi-step iterative approach; MIA) to our previous multi-source search approach (single-step iterative approach; SIA) and a single-source search approach (single-step peak approach; SPA). In order to compare performances across these beamformer approaches, we manipulated various simulated source parameters, such as the amount of signal-to-noise ratio (0.1 to 0.9), inter-source correlations (0.3 to 0.9), number of simultaneously active sources (2 to 8), and source locations. Results showed that localization performances followed the order of MIA>SIA>SPA regardless of the number of sources, source correlations, and single-to-noise ratios. In addition, SIA and MIA were significantly better than SPA at localizing four or more sources. Moreover, MIA was better than SIA and SPA at identifying the true source locations when signal characteristics were at their poorest. Source waveform reconstructions were similar between MIA and SIA but were significantly better than those for SPA. Based on our findings, we conclude that multi-source scalar beamformers (MIA and SIA) are an improvement over scalar beamformers for localizing EEG. Importantly, our new search method, MIA, had a better localization performance, localization precision, and source waveform reconstruction as compared to SIA or SPA. We therefore recommend its use for improved source localization and waveform reconstruction of ERPs.

Topic Area: METHODS: Neuroimaging

Quantification for spatial variability of white matter hyperintensities

Poster E97, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Jin-Ju Yang[1], Jong-Min Lee*[1], Hee Jin Kim[2], Sang Won Seo[2]; [1]Hanyang University, Seoul, Korea, [2]Samsung Medical Center, Sungkyunkwan University School of Medicine, Seoul, Korea

White matter hyperintensities (WMH) are typically detected on fluid-attenuated inversion recovery (FLAIR) or T2 weighted images and are commonly observed in older adults. Although volume of WMH has been used widely in many previous studies to identify white matter damage, little is known about the impact of spatial variability of WMH. In this study, we assessed for the first time to quantify the spatial distribution of WMH using information theory. WMH volume was segmented on FLAIR image and white matter brain was parcellated into 58 regions of interest (ROIs) with lobes and deep white matter tract labels. We calculated entropy of information using the probability that voxel of WMH is in the ROIs. We thoroughly selected 153 of normal cognitive elder (NC) and 201 subjective mild impairment (SMI) having a WMH. Histogram of WMH entropy (NC, 3.58, 0.31 (mean, standard deviation); SMI, 4.23, 0.28) was showed more separable between NC and SMI group comparing to those of WMH volume (NC, 11547.82, 5621.93; SMI, 18865.95, 11263.69). Although group difference was statistically observed both WMH volume ($F=54.27$; $P<0.0001$) and WMH entropy ($F=432.97$; $P<0.0001$), the age interaction effect for group difference was only detected in WMH entropy ($F=4.98$; $P=0.026$). These findings provide direct evidence for better understanding how variability of white matter injury differs in NC and SMI, since WMH are pathologically heterogeneous, ranging from subtle alterations to severe axonal and myelin loss and may be related to one of a variety of different region-specific neuroanatomical mechanisms.

Topic Area: METHODS: Neuroimaging

fMRI Task Comparison for Pre-surgical Language Mapping in Neurosurgical Patients

Poster E98, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Prashin Unadkat[1], Luca Fumagalli[1], Laura Rigolo[1], Alexandra Golby[1], Yanmei Tie[1]; [1]Brigham and Women's Hospital, Harvard Medical School

Functional MRI (fMRI) based on blood-oxygen-level dependent (BOLD) signal is a brain mapping technique that has been used in pre-surgical planning of patients with brain lesions to understand the relationship between the eloquent cortex and brain lesion. Language function is particularly difficult to map due to the complex nature of language network. To compare the different language tasks used at our institution, we analyzed fMRI data from patients with brain tumors and epilepsy who underwent all three language paradigms: antonym generation (AG), sentence completion (SC), and auditory naming (AN). A total of 51 patients met these criteria and were included in this study. We calculated the Dice coefficient to evaluate the degree of overlap between the language maps for all three tasks using the same t-score that was utilized for clinical interpretation. The Dice coefficients (mean +/- SD) for the AG and SC, AG and AN, and SC and AN tasks were 0.291 +/- 0.132, 0.24 +/- 0.111, and 0.304 +/- 0.122 respectively. These results showed fair overlap between the t-maps for all three paradigms, suggesting that individual tasks activate different cortical areas for language function. Therefore, multiple language tasks maybe required to map all cortical areas related to language to increase the sensitivity of language fMRI for pre-surgical planning. Further research is needed to assess the effect of patients' task performance and lesion (location, tumor grade and size) on the resulting language maps so that these factors can be taken into account when optimizing clinical language fMRI.

Topic Area: METHODS: Neuroimaging

Distinct spatiotemporal patterns of resting state neuronal synchrony in Alzheimer's disease spectrum

Poster E99, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Kamalini G Ranasinghe[1], Leighton B Hinkley[2], Alexander J Beagle[1], Alice La[1], Danielle Mizuiri[2], Susanne Honma[2], John F Houde[3], Bruce L Miller[1], Keith A Vossel[1,4], Srikantan Nagarajan[2]; [1]University of California San Francisco, Memory and Aging Center, [2]University of California San Francisco, Biomagnetic Imaging Laboratory, [3]University of California San Francisco, Speech Neuroscience Laboratory, [4]Gladstone Institute of Neurological Disease

Alzheimer's disease (AD) is characterized by progressive loss of memory and other cognitive functions. There are three main phenotypic clinical presentations of AD including amnestic/dysexecutive (Amn/dys), logopenic variant primary progressive aphasia (lvPPA), and posterior cortical atrophy (PCA). Structural and functional neuroimaging studies have implicated unique anatomic involvements in each variant. Resting-state brain oscillations represent coordinated activity in large groups of neurons and hence provide a tool to quantify spontaneous neuronal activity and functional network integrity of neural circuits. We hypothesized that resting state brain oscillations will show unique deficits in each variant of AD. We examined Amn/dys (n=30), lvPPA (n=15) and PCA (n=13) patients using magnetoencephalogrpahy, compared to a control group (n=20). Each patient underwent a complete clinical evaluation including a battery of neuropsychological tests. We examined the global resting-state functional connectivity patterns within delta-theta (2-8Hz), alpha (8-12Hz), and beta (12-30Hz) frequency oscillations, in each patient group, compared to age-matched controls. We found that each AD variant shows distinct anatomic patterns of reduced functional connectivity within alpha and beta band oscillations. In contrast, within delta-theta band, all three variants showed spatially nonspecific patterns of hypersynchorny. The current results demonstrate the first evidence of direct neuronal activity patterns recorded in a comprehensive evaluation of the three AD variants. Unique spatial distributions of hyposynchony within alpha and beta bands, and distinctive temporal patterns of increased and decreased synchronizations indicate that network failure in each syndrome is driven by diverse cellular and molecular mechanisms.

Topic Area: METHODS: Neuroimaging

Residual relationships between motion and BOLD activity remain after preprocessing and can inflate functional connectivity estimates

Poster E100, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Lisa Byrge[1], Daniel P. Kennedy[1]; [1]Indiana University

Head motion is problematic for the BOLD signal – particularly for techniques such as functional connectivity MRI (fcMRI), where findings can be spuriously influenced by movement differences. Yet current preprocessing practices might not fully eliminate residual motion influences. Here we present a new method for assessing residual movement-linked BOLD artifact, by quantifying the relationship between movement severity and subsequent BOLD activity. We analyzed resting-state fMRI scans from Indiana University (2 16min scans, TR=813ms, N=53) and the Human Connectome Project (2 14min scans, TR=720ms, N=75). Datasets were preprocessed nearly identically using state-of-the-art cleanup methods (ICA-FIX); alternative preprocessing methods (including/excluding global signal regression) were also examined. We found that movements were systematically linked with structured and prolonged changes in the BOLD signal that depend on the severity of the preceding motion. Nearly all motions (including remarkably small movements below typical censoring thresholds) were associated with structured BOLD changes extending 30s later. Effect sizes of motion-linked BOLD changes were largest approximately 6s and 20s following motion. These patterns were replicated in 4 independent sessions across scanners and preprocessing methods (but not in four different null models). These interactions are not yet addressed by state-of-the-art preprocessing methods, as they persist much later than typical censoring/"scrubbing". They produce artifactually increased functional connectivity estimates in the epochs following movements, even in strictly censored data. Our results suggest caution in interpreting different patterns of functional connectivity between individuals or groups whose head motion differs, until these interactions between motion and BOLD are fully understood and addressed.

Topic Area: METHODS: Neuroimaging

NITRC's Triad of Services: Software, Data, Compute

Poster E101, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Christian Haselgrove[1], David Kenney[2], Nina Preuss[3], Robert Buccigrossi[3], Matt Travers[3], Albert Crowley[3], Giorgio Ascoli[1], Steven Bressler[1], Arnaud Delorme[1], Karl Helmer[1], Li Shen[1]; [1]Neuromorphometrics, Inc, [2]David N Kennedy Consulting, [3]Turner Consulting Group

The Neuroimaging Informatics Tools and Resources Clearinghouse (NITRC) is a neuroinformatics knowledge environment for MR, PET/SPECT, CT, EEG/MEG, optical imaging, clinical neuroinformatics, computational neuroscience, and imaging genomics tools and resources. NITRC's mission is to foster a user-friendly knowledge environment for the neuroinformatics community. By continuing to identify existing software tools and resources, NITRC's goal is to support researchers dedicated to enhancing, adopting, distributing, and contributing to the evolution of neuroimaging analysis tools and resources. Located at www.nitrc.org, the Resource Registry (NITRC-R) promotes software tools and resources, vocabularies, test data, and databases, extending the impact of previously funded contributions. NITRC-R gives researchers greater and more efficient access to the tools and resources they need by categorizing and organizing existing tools and resources, facilitating interactions between researchers and developers, and promoting better usability through enhanced documentation and tutorials. As of 10/2016, 877 public resources are listed on NITRC-R. The NITRC Image Repository (NITRC-IR) makes 8,285 imaging sessions publicly available at no charge, and the NITRC Computational Environment (NITRC-CE) provides computation services downloadable to your machine or via commercial cloud providers such as Amazon Web Services and Microsoft Azure. NITRC is now an established knowledge environment for the neuroimaging community and is a trusted source for the identification of resources in this global community. We encourage the neuroinformatics community to continue providing valuable resources, design and content feedback, and to utilize these resources in support of data sharing requirements, software dissemination, and cost-effective computational performance.

Topic Area: METHODS: Neuroimaging

Spread of Activity Following TMS is correlated with Intrinsic Resting Connectivity with the Target Region: A concurrent TMS-fMRI study

Poster E102, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Colin Hawco[1], Aristotle Voineskos[1], Jennifer Steeves[2], Erin Dickie[1], Joseph Viviano[1], Jeff Daskalakis[1]; [1]Centre for Addiction and Mental Health, [2]York University

Transcranial magnetic stimulation (TMS) modulates activity to brain regions distal to the site of simulation. Efforts are currently underway to develop biomarkers of the TMS response, such as resting state fMRI (rsfMRI). However, no studies thus far have directly related the spread of activity following TMS to resting state connectivity. In twenty-two participants rsfMRI scans were acquired, followed by concurrent TMS-fMRI over the left dorsolateral prefrontal cortex. Participants received a TMS pulse either at resting motor or 40% motor threshold. Seed-based resting connectivity was performed with the target site using the rsfMRI scan, and a GLM was performed on TMS-fMRI to show the spread of activity following TMS. Across the whole cortex, there was a relationship between TMS included cortical changes and resting connectivity ($t=2.39$, $p = 0.026$). At the individual level, twelve participants showed a positive correlation and five showed a negative correlation between TMS-fMRI and rsfMRI. This variability was driven by the TMS-fMRI data as opposed to rsfMRI, and highlights the importance of considering individual responses when considering such relationships. A group analysis was also performed, with group-level correlations between TMS-fMRI and rsfMRI in superior and medial frontal cortex and left insula, and a negative correlation with the posterior cingulate. This is the first study to directly show the relationship between the immediate effects of a TMS pulse and rsfMRI, which appears to be more prominent in participants who have more of a 'typical' spread of activity following a TMS pulse.

Topic Area: METHODS: Neuroimaging

Dopamine D2/3 receptor binding with [11C]raclopride in extrastriatal regions show good to excellent six month test-retest reliability

Poster E103, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Lars Jonasson[1], Nina Karalija[1], Jan Axelsson[1], Katrine Riklund[1], Lars Nyberg[1], CJ Boraxbekk[1,2]; [1]Umeå University, Sweden, [2]Copenhagen University Hospital Hvidovre, Denmark

It has previously been assumed that binding of the reversible ligand [11C]raclopride to human dopamine D2/3 receptors (D2/3R) in extrastriatal areas can not be measured reliably. Recently, Alakurtti and colleagues (2015) showed good 5-weeks test-retest reliability with [11C]raclopride in extrastriatal regions using the dedicated brain positron emission tomograph (PET), Siemens ECAT HRRT. Here we present evidence that reliable measurements of [11C]raclopride in extrastriatal regions can be achieved also using a PET/CT scanner for whole-body acquisition, and with data reconstructed using a high-resolution ordered-subsets maximization algorithm. A control sample from an intervention study, n = 28, 64-78 years, were scanned twice, 6 months in-between scans. Intraclass correlation coefficients (ICC) in striatal regions were excellent; limbic, associative, and sensorimotor striatum (0.91-0.94) with a test-retest variability (VAR) between 3.8 and 4.6%. Reliability in extrastriatal regions were good to excellent, albeit more variable, with thalamus, hippocampus, dorsolateral prefrontal cortex, inferior frontal gyrus, superior frontal gyrus and anterior cingulate cortex showing ICCs between 0.89-0.91, and VAR (4.1-18.6%), and orbitofrontal cortex and amygdala both showing an ICC of 0.69 and VAR (8.7-9.6%). The present data indicates that reliable estimates of D2/3R can be achieved in extrastriatal regions using [11C]raclopride. This is an important finding as [11C]raclopride is a common ligand used to image D2/3R, and that dedicated brain PET/CT scanners are not necessary to measure reliably in extrastriatal regions. Our results converge with other recent findings to suggest that extrastriatal D2/3R can be investigated with [11C]raclopride.

Topic Area: METHODS: Neuroimaging

Face and place selectivity develop in tandem with the visual field representations along the VTC in children

Poster E104, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Golijeh Golarai[1], Alina Liberman[1], Kalanit Grill-Spector[1]; [1]Stanford University

In adults face-selective regions across the ventral temporal cortex (VTC) overlap with representations of central visual field, and place-selective regions with peripheral representations, perhaps due to the habitual patterns of viewing faces with central and places with peripheral vision. We previously reported the slow and differential development of category selective regions, whereby parahippocampal place selective regions (PPA) become adult-like by the teens, but face-selective regions in the fusiform gyrus (FFA) develop more slowely into adulthood. However, the developmental time course of center-periphery representations in VTC and their spatial relation to the developing category selective regions are unknown. Thus, we examined the development of center-periphery organization in the FFA and PPA in children (ages 8 - 10 , n = 12), adolescents (ages 12 -16, n = 13) and adults (ages 18 - 40, n= 12). During fMRI, subjects fixated on a central point while viewing faces and places, presented either centrally spanning 3°, or peripherally within a 12°-24° ring. Using a localizer experiment we also identified the FFA and PPA in each subject. After validating fixation performance, we found an age related increase during childhood in the peripheral bias of the left PPA and foveal bias of the FFA bilaterally, that

reached adult levels during the teens. Thus, development of category selectivity and eccentricity bias overlap temporally and spatially during childhood, but face selectivity continues to develop during the teens, even after local foveal bias becomes adult like.

Topic Area: PERCEPTION & ACTION: Development & aging

Rapid visual categorization reveals disrupted ventral stream processing in early Alzheimer's disease

Poster E105, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Leslie Y. Lai[1], Elena K. Festa[1], Thomas Serre[1], Brian R. Ott[2], William C. Heindel[1]; [1]Brown University, [2]Alpert Medical School of Brown University

Previous studies showed intact performance on standard object perception tests in early Alzheimer's disease (AD) despite loss of connectivity within the ventral stream. Here we examined whether this disruption produced deficits on rapid categorization tasks imposing high demands on the visual system. Groups of healthy young, healthy elderly, and amnestic mild cognitive impairment (aMCI) patients performed two rapid categorization tasks. Exp.1 used a go/no-go task in which participants pressed a button as quickly as possible whenever an image contained an animal. Stimulus duration was adjusted on no-mask trials to equate performance across subjects using a staircase procedure, and a mask followed each image (SOA range: 21ms–63ms) on all remaining trials. Exp.2 used a forced-choice saccadic task in which participants were shown two images simultaneously, and made saccades as quickly as possible toward the image containing an animal. In Exp.1, young and elderly controls performed above chance on mask and no-mask trials (no-mask better than mask), with aMCI patients impaired only under masked conditions. In Exp.2, all groups performed better on trials with highly discriminable distractors. While performance also improved on trials with longer saccade latencies allowing greater recurrent processing, aMCI patients showed less improvement with low discriminable distractors. Results suggest that visual ventral stream processing is preserved in normal aging, but that aMCI patients' performance may reflect subtle disruptions of cortico-cortical projections associated with preclinical AD. These findings serve as a critical first step in the development of a sensitive tool for early detection of neurocognitive changes in AD.

Topic Area: PERCEPTION & ACTION: Development & aging

Discrimination of Magnitudes within Different Dimensions: A Developmental Trajectory Outline

Poster E106, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Shai Itamar[1], Avishai Henik[1,2]; [1]Department of Psychology and the Zlotowski Center for Neuroscience, Ben-Gurion University of the Negev, Beer-Sheva, Israel, [2]Department of Cognitive and Brain Sciences, Ben-Gurion University of the Negev, Beer-Sheva, Israel

According to the approximate number system (ANS) theory, non-symbolic magnitude dimensions are represented in a noisy manner that results in an approximation of a given magnitude. Moreover, in the ANS, discriminability of magnitudes complies with Weber's law so that in a magnitude comparison task, the relationship between the magnitude ratio and reaction time (RT) should be linear. The assumption that discriminability of all magnitudes complies with Weber's law was questioned. It was found that in a magnitude comparison task, the relationship between discriminability and size ratio is not always linear. Namely, this relationship is modulated by the type of the stimuli. While physical magnitude comparison results in a curve-linear fit, symbolic magnitude comparison results in a linear fit. In this study, we explored the developmental changes that occur in the ability to discriminate magnitudes in young children (1st, 3rd and 5th graders). We employed a power function to describe the relationship between magnitude ratio and RT in different magnitude comparison tasks (symbolic, continuous and discrete). Results indicated that for physical comparison, the function exponent (b-value) was the highest, though it slightly decreased from the 3rd to the 5th grade. For discrete comparison, the function exponent increased with age. For symbolic comparison, the function exponent remained slightly increased from the 1st to the 3rd grade. These results support previous findings indicating that the relationship between discriminability and magnitude ratio is not always linear. Moreover, the results indicate that the different magnitude dimensions undergo different developmental trajectories regarding their representation and discrimination.

Topic Area: PERCEPTION & ACTION: Development & aging

Intercultural differences in the acquisition of cognitive skills related to reading readiness

Poster E107, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Pilar Sellés[1], Liz C. Ysla[2], Vicenta Avila[3], Tomás Martinez[3], Eva Rosa[1]; [1]Universidad Católica de Valencia, [2]IESPP CREA, Perú, [3]Universidad de Valencia

This paper deals with the cognitive skills related to the early reading acquisition (visual discrimination and auditory sequential memory) in two countries that share language but with great social and cultural differences. Our main objective in this study was to establish whether there were differences in the degree of acquisition of these skills between Spanish and Peruvian five years old children. This has been applied, related to these skills, to two samples of Spanish (118 children) and Peruvian (128 children), who have been matched, as far as possible, in their SES level. The results show that there are significant differences in the degree of acquisition of

Visual Discrimination between these two samples. Spanish (M = 18.36, SD = 4.46) and Peruvian (M 13.85, SD = 5.97), t(244) = 6.670, p ≤ .001, CI.95 -3.18, -5.85. Furthermore, Cohen's effect size value (d = .95) suggested a large practical significance. However, there was no statistically significant difference between Spanish children (M = 26.60, SD = 6.18) and Peruvian children (26.02, SD = 5.34), t(245) = .781 p = .052, CI.95 -8.72, 2.18, in Auditory Sequential Memory. Therefore, we fail to reject the null hypothesis that there is no difference in science scores between both. Moreover, Cohen's effect size value (d = .10) suggested low practical significance. Despite these results in both variables, the main predictor in a regression study was the country of origin, explaining a higher percentage of variance that other variables such as age differences, in months, or gender of children.

Topic Area: PERCEPTION & ACTION: Development & aging

The "temporal synchrony" method for identifying multisensory brain regions using fMRI

Poster E108, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

W. Dale Stevens[1], Stephanie M. Lavoie[1], Ryan A. Stevenson[2], Morgan D. Barense[3], Mark T. Wallace[4], James M. Bebko[1]; [1]York University, [2]University of Western Ontario, [3]University of Toronto, [4]Vanderbilt University

Multisensory perception is integral to cognitive, language, and social development and functioning. The posterior superior temporal sulcus (pSTS) plays a critical role in auditory-visual (AV) integration. Several criteria used for identifying putative AV-multisensory regions with fMRI include higher activation for AV-multisensory stimuli than the 1) mean activation for unisensory auditory and visual stimuli ("mean" method); 2) maximum activation for unisensory auditory and visual stimuli ("max" method); 3) summed activation for unisensory auditory and visual stimuli ("super-additivity" method). Only the super-additivity method accounts for known population-level neural responses of multisensory neurons; however, it has not proven to be empirically tenable, as previous work failed to reliably identify pSTS regions using this method. A known property of multisensory neurons is a greater response to temporally synchronous than asynchronous stimuli. Here, a novel "temporal synchrony" method, identifying brain regions that show higher activation for temporally synchronous than asynchronous AV-multisensory stimuli, was compared to previous methods using fMRI with 17 healthy young adults. Participants were presented with video clips of temporally synchronous and asynchronous social-linguistic, social non-linguistic, and non-social/non-linguistic stimuli. Collapsed across content conditions, the temporal synchrony method identified a pSTS region in more participants than all previous methods. Within individually-defined pSTS regions across participants, the temporal synchrony criterion was met in all individual content conditions, while the super-additivity criterion was not met in any. Our results demonstrate that the temporal synchrony method is more theoretically valid and empirically tenable than previously used methods. We recommend its application in future studies of multisensory perception.

Topic Area: PERCEPTION & ACTION: Multisensory

Changes in EEG and movement kinematics accompany sensorimotor learning in immersive virtual reality

Poster E109, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Greg Appelbaum[1], Jillian Clements[2], Hrishikesh Rao[2], Rajan Khanna[1], David Zielinski[2], Yvonne Lu[1], Kelly Vittetoe[1], Nicholas Potter[2], Regis Kopper[2], Marc Sommer[2]; [1]Duke University School of Medicine, [2]Duke University

Simulation technologies have gained increasing use in training scenarios because they offer flexible, realistic and quantitative control of the environment. These technologies can also be used in conjunction with neurophysiological monitoring to quantify human performance. In the present study we fuse these elements through a sensorimotor training regimen, modeled after Olympic Trap Shooting standards, and conducted in fully immersive virtual reality as whole-head electroencephalography (EEG) was recorded. During this training, 17 participants performed 7 blocks of 50 trials each, with the goal of shooting a flying target that simulated the physics of an arcing clay pigeon. In addition to 16-channel EEG, end-point precision and head/hand movement kinematics were monitored with 3D tracking. Results indicated systematic changes in movement kinematics that underlie a 19% improvement in shot accuracy across the population. While reaction times and shot response times did not change over the course of practice, individuals exhibited longer, slower and more precise ballistic hand movements, which afforded shorter refinement phases, leading to better shooting accuracy. Analysis of head tracking and horizontal EOG revealed systematic reductions in movements over blocks, indicating greater orienting efficiency. EEG analyses revealed visual evoked potentials over the occipital cortex that index sensory processing for the ipsilateral and contralataral launch conditions, prior to the onset of eye movements while shot-locked ERPs exhibited central distributions peaking around 400 ms that distinguish hits from misses in the task. These findings illustrate kinematic and electrophysiological changes that accompany sensorimotor learning and point to an increased sensorimotor efficiency underlying lea

Topic Area: PERCEPTION & ACTION: Multisensory

Locus of hunger and amygdala activation to a sweet taste in Hispanic young adults

Poster E110, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Jacquelyn Szajer[1], Aaron Jacobson[2], Claire Murphy[1,2]; [1]SDSU/UC San Diego Joint Doctoral Program in Clinical Psychology, [2]San Diego State University

Hispanic ethnic groups have been shown to consume higher amounts of sugar-sweetened foods and to have a higher risk for health conditions associated with high dietary sugar levels (e.g., diabetes, fatty liver disease, metabolic syndrome), both of which are associated with changes in brain activation and greater risk for cognitive decline in aging. Taste is a determinant of food preference and palatability, and an important predictor of diet. Research has shown differences in brain response to visual food cues among Hispanics, but little research exists on differences in response to taste. We examined differences in fMRI activation during hedonic evaluation of a sweet taste (sucrose) in a hunger state between 16 Hispanic and 16 non-Hispanic young adults, using a 3T-GE-MR-750 scanner. Taste stimuli were administered orally and rated for pleasantness on a general Labeled Magnitude Scale. The Three Factor Eating Questionnaire (TFEQ) was administered to assess hunger and eating behavior. Hispanics had significantly lower left amygdala activation ($p = .028$) and significantly lower scores on TFEQ Scale3 (Locus of Hunger) than non-Hispanics ($p = .001$). Within-group exploratory correlations revealed a significant direct correlation between Locus of Hunger and left amygdala activation, but only in the Hispanic group ($p = .01$). Ethnic differences in brain activation to rewarding tastes have important implications for diet and eating behavior, especially considering the increased risk for insulin-related dysfunction among Hispanic populations, and associated increased risk for cognitive decline and Alzheimer's disease in aging. Supported by NIH grant #AG004085-26 from the NIA to CM.

Topic Area: PERCEPTION & ACTION: Multisensory

Exploring the synchronization features of the sensorimotor integration of speech

Poster E111, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

M Florencia Assaneo[1], David Poeppel[1,2]; [1]New York University, Psychology Department, [2]Max Planck Institute

Despite the long history of exploring the causes and consequences of the sensorimotor integration of speech, few experiments have tested in a principled manner how the link between motor and auditory areas may be mechanistically achieved. Here, we identify a basic architectural constraint of the auditory-motor circuitry for speech by exploring the synchronization properties of this system. An MEG protocol was developed to investigate the synchronization between the phases of the slow oscillations (2-7 Hz) in motor and auditory cortices. The experiment consisted in two main blocks. In the first one, a functional source localization protocol was employed to uncover each subject's speech-motor and auditory cortical regions. In the second, subjects were instructed to passively listening to a set of audio trials composed by strings of syllables synthesized at fixed rates. The MEG signals originating in the previously localized areas were extracted and evaluated for synchronization. The results showed that the coupling between motor and auditory brain activity increases as the heard syllable rate approaches to 4.5 Hz. Interestingly, the mean syllable rate across languages occurs at about the same frequency. Finally, numeric simulations revealed that a simple neural model (a standard Wilson-Cowan model for the motor cortex driven by auditory input) replicates the synchronization features between motor and auditory cortices.

Topic Area: PERCEPTION & ACTION: Multisensory

A Colorful Advantage in Iconic Memory

Poster E112, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Radhika Gosavi[1], Edward Hubbard[1]; [1]University of Wisconsin-Madison

Synesthesia is a condition in which stimulation of one sensory modality evokes experiences in a second, unstimulated modality (Simner & Hubbard, 2013). In grapheme-color synesthesia, which is experienced by 1-2% of adults, synesthetes reliably, automatically experience specific colors when viewing black-and-white graphemes. Previous case-studies have identified synesthetes with spectacular memory (Luria, 1968; Smilek et al., 2001) and group studies have found advantages for synesthetes compared to nonsynesthetes in long-term memory (Rothen et al., 2012) but have not addressed whether these advantages begin in earlier memory stages. We investigated the effect of grapheme-color synesthesia on the capacity and duration of iconic memory by testing 20 synesthetes and 20 nonsynesthetes on the Partial Report Paradigm (Sperling, 1963). We presented a letter array followed, after a variable delay, by a tone that cued participants to recall the appropriate row of the array. A repeated measures ANOVA revealed significant effects of delay ($p<0.001$) and group ($p=0.007$), but no delay*group interaction ($p=0.399$). Accuracy was significantly higher for the synesthetes across all delays. Furthermore, the synesthetes' accuracy after a 500ms delay (41.4%) was almost identical to the non-synesthetes' with no delay (42.9%)! This advantage at the earliest stage of memory implies that synesthetic experiences have perceptual underpinnings, and an enhancement in multiple memory stages. Future studies should examine the neural basis of this advantage, particularly in early visual areas, which have been shown to be involved in grapheme-color synesthesia (Hubbard et al., 2011; Gosavi et al., CNS 2016) and iconic memory processes (Sergent et al., 2011).

Topic Area: PERCEPTION & ACTION: Multisensory

The influence of interoceptive and exteroceptive attention on somatosensory alpha power and tactile perception

Poster E113, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Matt Craddock[1], Ellen Poliakoff[2], Wael El-deredy[2], Ekaterini Klepousniotou[1], Donna Lloyd[1]; [1]School of Psychology, University of Leeds, [2]School of Psychologogical Sciences, University of Manchester

Somatosensory and tactile sensations may originate externally (e.g. when touching something) or internally (e.g. heartbeats). We hypothesized that directing participants' attention to interoceptive signals might increase false reports of touch through confusion of internally-generated with externally-generated sensations. In contrast, directing attention to exteroceptive signals might reduce occurrences of such confusion. Top-down modulation of the power and spatial distribution of alpha oscillations in relevant cortical regions may be a mechanism for such changes. We previously found that low levels of prestimulus somatosensory alpha power (8-14 Hz) increased both true and false reports of touch in the Somatic Signal Detection Task (SSDT), while high levels decrease reports of touch. In the SSDT, near-threshold tactile stimuli are delivered alone or paired with light flashes, which increases hit and false alarm rates. We thus examined prestimulus alpha power using electroencephalography (EEG) while participants performed the SSDT. Participants also performed either tactile orientation discrimination (exteroceptive) or heartbeat counting (interoceptive) tasks prior to the SSDT. We found only small differences in performance on the SSDT following interoceptive and exteroceptive manipulations, although the typical increase was observed in reports of touch on trials with a light. Nevertheless, differences in prestimulus alpha power in line with previous results emerged when comparing trials on which a tactile stimulus was reported with trials on which no stimulus was reported. The spatial distribution of these differences differed after intero- and exteroceptive tasks, suggesting top-down modulation of alpha power was induced by these tasks but had little effect on SSDT performance

Topic Area: PERCEPTION & ACTION: Multisensory

The effect of cue-evoked expectation on different pain sensations

Poster E114, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Emily Hird[1,3], Deborah Talmi[1,2], Anthony Jones[1,3], Wael El-Deredy[1,3,4]; [1]University of Manchester, [2]University of Princeton, [3]Salford Royal NHS Foundation Trust, [4]Valparaiso University

Pain perception is influenced by expectations of its intensity , and it is well established that this correlates with changes in neural pain processing. However, our environment has various sources of pain, and different pain sources are perceived through different nociceptive pathways. It is not known whether different pain types are influenced by expectation in the same way, or whether changing the sensory properties of pain influences the effect of expectation. We present the results of an ERP study comparing the modulation by cue-evoked expectation of electric pain and laser pain. Fourteen participants received laser and electric stimulation, signalled by a cue. Cues indicated the likely intensity of the upcoming pain. We measured Event-Related Potentials (ERPs) to medium pain stimulation after a cue signalling high or low pain. Subjective pain ratings and corresponding pain-evoked ERPs increased in amplitude after presentation of a high intensity cue, and reduced in intensity after presentation of a low intensity cue. Crucially, statistical analysis showed this modulation to be equal in response to both laser and electric pain. High pain cue elicited a greater anticipatory neural signal than low pain cue across pain types. We show that modulation of pain and anticipatory signalling by expectancy is not changed by pain sensation.

Topic Area: PERCEPTION & ACTION: Multisensory

Redefining Color in Synesthesia

Poster E115, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Madeleine Gorges[1], Arturo Hernandez[1], David Eagleman[2]; [1]University of Houston, [2]Stanford University

For a person with grapheme-color synesthesia, written characters automatically trigger the sensation of specific colors. The extent to which synesthesia is an enhancement of normal cross-modal abilities is a topic of debate. Part of this debate may stem from a misunderstanding of synesthetes' color experience. Several studies simplify synesthetes' colors down to the 11 basic color terms and look for meaningful associations between letters and those basic colors. However, if a synesthete experiences a particular grapheme as "red with greeny-blue flecks" (Rich, Bradshaw, & Mattingley, 2005), perhaps their letter-color link is not a normal semantic association. The goal of the current study was to determine whether synesthetes' colors can be reasonably described using only the 11 basic color terms. We used data from an online test (Eagleman, Kagan, Nelson, Sagaram, & Sarma, 2007) that allows synesthetes to choose from about 16.7 million colors. Non-synesthete participants viewed the synesthetes' colors as well as standard basic colors ("Color Dictionary," 2016) and selected the best basic color label, if any. They also rated how well the color matched their chosen color label. Analyses revealed that participants chose the "other" option significantly more for synesthetes' colors compared to the basic colors and they rated the synesthetes' colors as worse exemplars of the basic color labels. This distinction between synesthetes' colors and basic colors suggests that simplified color tasks eliminate important idiosyncrasies in the synesthetes' experiences, potentially leading to misguided hypotheses about the neural mechanisms behind synesthesia and normal cross-modal abilities.

Topic Area: PERCEPTION & ACTION: Multisensory

Integration of visual and motor object features in human cortex

Poster E116, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Ariana M. Familiar[1], Heath Matheson[1], Sharon L. Thompson-Schill[1]; [1]University of Pennsylvania

To accomplish object recognition, we must remember the shared features of thousands of objects, as well as each object's unique combination of features. While theories differ on how exactly the brain does this, many agree that featural information is integrated in at least one cortical region, or "convergence zone", which acts as a semantic representation area that links object features across different information types. Moreover, it has been posited that anterior temporal lobe (ATL) acts as

a “hub” that associates object features across all modalities, as it is reciprocally connected to modality-specific cortical regions and patients with damage to this area have shown deficits in remembering object information across modalities (Patterson et al., 2007). Our lab recently found evidence that the left ATL encodes integrated shape and color information for objects uniquely defined by these features (fruits/vegetables; Coutanche & Thompson-Schill, 2014), suggesting ATL acts as a convergence zone for these visual object features. However, whether ATL encodes object information from different modalities had not been established. We used fMRI and MVPA to examine whether ATL acts as an area of convergence for object features across sensory-motor modalities. Using a whole-brain searchlight analysis, we found activity patterns during a memory retrieval task in a region within the left ATL could successfully classify objects defined by different combinations of visual and motor features, but not on the basis of either constituent feature. These results suggest left ATL encodes integrated object features across visual and motor modalities, which correspond to an object’s identity.

Topic Area: PERCEPTION & ACTION: Multisensory

The Race May Be Over: Behavior and Neurophysiology Show Modality “Switch-Costs” Give Rise to Apparent Redundant Target Effect

Poster E117, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Luke Shaw[1], Eric Nicholas[1], Matthew Braiman[1], Kamy Wakim[1], Ciara Molloy[1], Sophie Molholm[2], John Foxe[1,2]; [1]University of Rochester, [2]Albert Einstein College of Medicine

The facilitation of reaction times (RT) to a multisensory stimulus is a widely reported phenomenon in the field of multisensory integration. We show that a “modal switch cost” in RTs arises on the successive presentation of orthogonal unisensory stimuli, which greatly impacts standard experimental designs with blocks of randomly interleaved unisensory and multisensory stimuli. This switch cost accounts for much of the apparent RT facilitation to multisensory stimuli. Neurotypical adult (n=30) participants performed a simple reaction time task to audio and/or visual stimuli presented in a block-wise manner. Blocks were composed of sequential presentations of one of two unisensory stimuli (50 ms pure tone, or 50 ms circle on a monitor), a multisensory stimulus (the tone and circle simultaneously), or the two unisensory and multisensory stimuli intermixed. Behavioral data indicates increased RT latencies to unisensory stimuli immediately preceded by stimuli from the orthogonal modality. This effect is greatly reduced when unisensory stimuli are preceded by the multisensory stimulus or a stimulus of the same modality. RTs to the multisensory stimulus are not affected by this precedent effect, resulting in the comparative “speeding” of responses to multisensory stimuli in the mixed blocks. A complementary electrophysiological study (n=15) shows differences in evoked response potentials (ERPs) in line with behavioral findings. ERPs demonstrate unique physiology corresponding to the observed reaction time modality switch cost with differences in early sensory processing on presentation of orthogonal stimuli.

Topic Area: PERCEPTION & ACTION: Multisensory

Oscillatory brain correlates of the hypnotically-induced out-of-body experience

Poster E118, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Abraham Goldstein[1], Maor Zeev-Wolf[1], Yair Dor-Ziderman[1], Eitan G Abramowitz[2]; [1]Bar-Ilan University, [2]Hadassah Medical Center and Hebrew University

One of the most challenging questions regarding the nature and neural basis of consciousness concerns its being an embodied phenomenon, that is, feeling located within the body and viewing the world from that spatial perspective. Current theories in neurophysiology highlight the active role of multisensory and sensorimotor integration in supporting self-location and self-perspective, and propose the right temporal-parietal-junction (rTPJ) as a key area for such function. The theories are based mainly on findings from two experimental paradigms: manipulation of bottom-up multisensory information integration regarding one’s body location (full-body illusion), or direct and invasive manipulation disrupting brain activity at the TPJ. In this study we take a different approach by using hypnotic suggestion – a non-invasive top-down technique - to manipulate subjective experience of self-location. We tested 18 right-handed neurotypical participants and recorded their brain activity using magnetoencephalography (MEG) while hypnotically manipulating their subjective experience of self-location. Spectral analyses were conducted on recordings of spontaneous brain activity before and during induction of an out-of-body experience by a trained psychiatrist. The results indicate high correlations between power at alpha and high-gamma frequency-bands and the degree of perceived change in self-location. Regions exhibiting such correlations include temporal-occipital regions, the right TPJ, as well as frontal and midline regions. These findings are in line with an oscillatory-based predictive coding framework.

Topic Area: PERCEPTION & ACTION: Multisensory

How we transmit memories to other brains: constructing shared neural representations via communication

Poster E119, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Asieh Zadbood[1,2], Janice Chen[1,2], Yuan Chang Leong[3], Kenneth Norman[1,2], Uri Hasson[1,2]; [1]Princeton Neuroscience Institute, Princeton University, Princeton, NJ, 08544, USA., [2]Department of Psychology, Princeton University, Princeton, NJ, 08544, USA., [3]Department of Psychology, Stanford University, Stanford, CA, 94305, USA.

It is striking that humans are able to encode and later verbally share their memories of an episode with listeners, who are in turn able to imagine (mentally construct) details of the episode which they have not personally experienced. However, it is unknown how strongly the neural patterns elicited by imagining specific episodes resemble the neural states elicited during the original encoding of those episodes. In the current study, using fMRI and a natural communication task, we traced how neural patterns associated with specific scenes depicted in a movie are encoded, verbally recalled, and then transferred to a group of naive listeners who construct the scenes of the movie in their imagination. By comparing neural patterns across the three conditions, we report, for the first time, that event-specific neural patterns are observed in the default mode network (DMN) and shared across the encoding, reinstatement (spoken recall), and new construction (imagination) of the same real-life episode. This study uncovers the intimate correspondences between memory encoding and imagination, and highlights the essential role that our common language plays in the process of transmitting one's experiences to other brains.

Topic Area: PERCEPTION & ACTION: Multisensory

The human brain's navigation network when navigating without vision

Poster E120, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Shachar Maidenbaum[1], Daniel-Robert Chebat[2], Amir Amedi[1]; [1]Hebrew University of Jerusalem, [2]Ariel University

While human navigation is not considered to rely on vision, vision is considered the dominant sense which we use for navigation. Indeed, many nodes of the human brain's navigation network lay in visual regions. But what happens when we are deprived of vision, such as when blindfolded or blind? Will these same 'visual' regions still be recruited for navigation? Are these regions simply entrance ports for visual input, or do they perform modality-independent spatial computations? We explored this via 3 groups who interactively navigated virtual Hebb-Williams mazes during fMRI neuroimaging. Group 1 navigated visually, while groups 2 and 3, congenitally-blind and briefly-blindfolded respectively, underwent an auditory navigation training regimen with the EyeCane (developed in our lab), and were scanned both before and after training. Between neuroimaging sessions all subjects successfully completed these mazes both in the real-world and virtually. We found that before training the subjects who navigated non-visually didn't recruitment these regions for navigation. After training both Blind and blindfolded subjects recruited V1, Precuneus and the three scene-selective regions, but negative BOLD in the hippocampus and entorhinal cortex. These results demonstrate that the human virtual navigation network is robust to both lifelong visual-deprivation and to brief blindfolding. Their ability to be recruited for navigating via a novel sensory modality within hours demonstrates the strength of cross-modal and task-specific plasticity, even in the earliest retinotopic areas. We suggest this relies on task-based computations and on existing connectivity infrastructures which can be swiftly recruited for the same task under new conditions.

Topic Area: PERCEPTION & ACTION: Multisensory

Perceptual uncertainty of long-range apparent motion and the neural correlates underlying the resolution of this uncertainty in favor of the motion interpretation.

Poster E121, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Yasuhiro Sakamoto[1], Yoshihito Shigihara[2], Michael Wibral[3], Hideyuki Hoshi[1], David Poeppel[1,4], Winfried Menninghaus[1]; [1]Max Planck Institute for Empirical Aesthetics, [2]University College London, [3]Goethe University Frankfurt, [4]New York University

As early as 1912, Max Wertheimer described apparent motion: two shapes presented consecutively with an ISI under 30 ms are perceived as simultaneous; apparent motion is perceived if the ISI is 60—200 ms. In the 30—60 ms time-window, though, there is perceptual uncertainty: identical stimuli are varyingly perceived as moving or simultaneous. To investigate why this ambiguity arises, we measured neural activity using a 275 channel MEG system. 27 participants (mean age 30.6) judged 600 critical stimuli within the ISI-range 30—60 ms and reported their percept (simultaneous vs. left-to-right motion). Visually evoked M50, M100, M150 and M180 post-onset peaks were evident in the event-related fields from occipital sensors. Waveforms and sources (dipole modeling) over the visual cortex for both response-types were very similar until 200 ms. Between 250 and 300 ms, ERFs were significantly higher for the motion response-type than the simultaneous response-type in the right occipital region. Time frequency analysis was done using Morlet wavelet. Spectral estimation including 7 cycles on a fixed time-window of 50 ms from -100 to 400 ms was performed. We found a significant beta-band activation between 250 and 300 ms when participants perceived the stimuli as simultaneous. The results suggest that the perception of apparent motion is constructed subsequent to the initial cascade of visual responses, after ~250 ms. The first of the two stimulus components (i.e., the object on the left) appears to play an important role in the apparent motion decision, as evidenced by the significant effect in the right occipital cortex.

Topic Area: PERCEPTION & ACTION: Vision

The Conversion across Magnitude and Rank Forms of Numerical Representation

Poster E122, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Mei-Jing Lin[1], Erik Chihhung Chang[1]; [1]National Central University, Taiwan

The current FMRI study aimed to examine the conversion between the magnitude and rank forms of numerical representation and the corresponding neural mechanisms. Two groups of participants performed visual parity judgments by making spatial and non-spatial responses before receiving hypnotic suggestions that either manipulated magnitude or rank representations, respectively. The behavioral results showed a significant interaction between the type of suggestion and

response under the manipulated magnitude condition, indicating that seeing a number line easily elicits the magnitude representation, yet thinking of the magnitude of numbers does not directly elicit the spatial numerical mapping. The linkage between numbers and spatial response was correlated with the activation in the right superior frontal area and left angular gyrus under the manipulated magnitude suggestion, and in the right dorsolateral prefrontal cortex under the manipulated rank suggestion. Conversely, the linkage between numbers and non-spatial response was correlated with the activation in the left ventral intraparietal area under the manipulated magnitude suggestion, and in the right intraparietal sulcus, left ventrolateral prefrontal cortex and left posterior intraparietal sulcus under the manipulated rank suggestion. These findings indicate that: (1) even though the rank and magnitude forms of a number are often associated, they may share distinct features; (2) the magnitude form of numerical representation is stronger than the rank form and is more likely the default concept representation. Taken together, we suggest that how numbers are represented depends on both task demands and individual differences in the cortical mapping between response and numerical forms.

Topic Area: PERCEPTION & ACTION: Vision

Tagging the neurophysiological mechanisms of competition between task-relevant and concurrent emotionally arousing task-irrelevant visual information using simultaneously recorded electrocortical and hemodynamic signals

Poster E123, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Nathan Petro[1], L. Forest Gruss[1], Siyang Yin[1], Mingzhou Ding[1], Andreas Keil[1]; [1]University of Florida

Task-irrelevant emotional stimuli lead to decreased performance on concurrent visually cued task-relevant stimuli, suggesting that emotionally arousing information attracts attention at the cost of less emotional yet task-relevant stimuli. This cost is associated with attenuated electrocortical potentials evoked by task-relevant visual cues. However, not well understood are the precise neurophysiological networks which underlie cost-related changes in visuocortical activity and the resolution of competition to maintain attention toward task-relevant visual information. The current project recorded electroencephalography during simultaneous functional magnetic resonance imaging, to co-register temporally precise evoked electrocortical potentials with the exquisite spatial resolution of hemodynamic changes. Participants were instructed to report instances of coherent among otherwise incoherent motion of a random-dot kinematogram, which flickered on-and-off at a rate of 4.6 Hz for a duration of 11.61 seconds to drive a steady-state visual evoked potential (ssVEP), a measure of continuous visuocortical engagement, while a concurrent and spatially overlapping background picture depicting scenes varying in emotional valence was presented and flickered on-and-off at 6 Hz, driving a separate ssVEP. These two ssVEPs, when transformed into the frequency domain and estimated on a single trial basis, can separately index the visuocortical processing of the task-relevant and -irrelevant stimuli. These estimates were used to construct predictive models of whole-brain BOLD activity. Ongoing analyses indicate that task-relevant ssVEPs predict BOLD in circumscribed visual and anterior cortical sites, whereas task-irrelevant pictures predict activation in more widespread visual and temporal cortex. Future analyses aim to identify how these regions interact toward resolving competition costs.

Topic Area: PERCEPTION & ACTION: Vision

Hemifield-split fMRI repetition effects using chimeric faces

Poster E124, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Matthew Harrison[1], Zhiheng Zhou[1], Lars Strother[1]; [1]University of Nevada, Reno

We used an fMRI repetition suppression paradigm to examine the effects of repeating versus changing an entire face or only half of it. Observers viewed chimeric faces split vertically at midline, under four conditions. Faces either (1) repeated in full, (2) changed in full, (3) changed in the right visual hemifield (RVF) and concurrently repeated to the left (LVF), or (4) repeated in the RVF and changed in the LVF. We observed widespread reduced fMRI responses (suppression) in ventral visual cortex as a result of full face and half-face repetitions. We observed maximal repetition suppression effects in bilateral face-selective areas—i.e. fusiform and occipital face areas (FFA and OFA respectively)—which we identified using a conventional independent localizer experiment; repetition suppression also occurred in other regions including retinotopic cortex (e.g. V4v). Bilateral FFA showed similar fMRI responses to half-face changes as whole-face changes, consistent with holistic processing with respect to hemifield-split face halves. Right and left OFA showed markedly different fMRI response patterns however. Right OFA showed similar fMRI responses to whole-face changes and contralateral half-face changes, but showed relatively reduced fMRI responses to ipsilateral half-face changes. Left OFA showed a reduced fMRI response to both contralateral and ipsilateral half-face changes compared to whole-face changes. Our results suggest that whereas anterior face areas (e.g. the FFA) in each hemisphere represent each half of a face equivalently, more posterior areas (e.g. the OFA) show different patterns of contralateral half-face sensitivity that may reflect differences in whole-face representation.

Topic Area: PERCEPTION & ACTION: Vision

Repetition enhancement for partially repeated words in left occipitotemporal cortex

Poster E125, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Zhiheng Zhou[1], Carol Whitney[2], Lars Strother[1]; [1]Department of Psychology, University of Nevada, Reno, [2]Independent Researcher

A “visual word form area” (VWFA) in left occipitotemporal cortex is often implicated in the neural representation of whole words. We used a rapid event-related fMRI to investigate the effects of partial word repetition on neural responses in the VWFA. Specifically, we presented observers with three- and four-letter word pairs. During each word-pair event, the words changed either in part or in full such that three-letter words (e.g. POT) were followed by words containing the same letters (e.g. SPOT or POTS) or by a word that shared no letters. Words were presented to either the right (RVF) or to the left (LVF) of fixation, or a combination of locations within a word-pair event. Results from a previous fMRI study (Strother et al., 2016) that employed partial word changes led us to expect repetition suppression in the VWFA and more posterior regions in the left hemisphere. Surprisingly, we instead observed “repetition enhancement” for word pairs with partially repeated letters (POT-SPOT), even when successive locations of paired words differed within an event. We did not, however, observe enhancement for word pairs limited to the LVF. We propose that the observed repetition enhancement in the VWFA reflects reactivation of letters shared between two words, which requires that at least one of the words in a pair projects contralaterally to the VWFA.

Topic Area: PERCEPTION & ACTION: Vision

Representation of object affordances in the posterior parietal lobe

Poster E126, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Chenxiao Guan[1], Quanjing Chen[1], Colleen L. Schneider[1], Bradford Z. Mahon[1]; [1]University of Rochester, USA

When we see an object and plan to grasp it, both the ventral and dorsal visual processing pathways are engaged and involved in generating the appropriate action to the object. While the ventral visual stream is associated with high-level visual processing and object recognition, the dorsal visual stream supports the extraction of volumetric properties of objects necessary to plan appropriate actions. Here, we used multivoxel pattern analyses over functional MRI data to test whether the left posterior parietal cortex and the fusiform gyrus represent object affordances. Participants viewed elongated manipulable objects rotating around their center of mass in depth. We hypothesized that if a region carries information about object affordances, it should be able to discriminate the direction which a tool is pointing, and specifically should distinguish a given orientation of a tool from the 180 degree rotation of the same tool (i.e., the handle of an object from its ‘business end’). Region of interest (ROI) analyses showed that the posterior parietal lobe could distinguish tool orientation when offset by 180 degrees, but not when offset by 45 degrees. In contrast, responses in the fusiform gyrus could distinguish between orientations that differed by 45 degrees, but not by 180 degrees. These findings suggest that the posterior parietal lobe may play a critical role in the representation of object affordances.

Topic Area: PERCEPTION & ACTION: Vision

Using EEG markers to investigate relations between negotiation styles and cognitive workload

Poster E127, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Suzana Daher[1], Jadielson Moura[1], Ana Paula Costa[1]; [1]Universidade Federal de Pernambuco

In conflict resolution, individual mental workload focuses on creating resolution strategies for maximizing the negotiation outcomes. Those strategies are influenced by the individual negotiation styles, i.e. assertiveness and cooperativeness. Several studies have used pupillary response to measure mental workload in a variety of conflict tasks bringing interesting findings, however identify the existence of a significant difference between negotiation styles and the intensity of cognitive effort during negotiation conflict situations under a selected strategy is currently unclear. Here, we investigate the interconnections between the visual pathway and pupillary response relative to cognitive effort for solve a negotiation conflict task e by measuring pupil sizes. For that, forty (n=40) young adult participants performed a simulated conflict task in a negotiation support system called NegPlace. Participant groups were set up in accordance with the resolution strategies adopted in the simulated conflict. Both eye-tracking data and recorded participants’ pupil size (gathering the degree of pupil change) were captured while participants were interacting with the information system. We observed that participants’ groups exhibited significant differences in pupillary variation, which indicating that assertiveness strategies require greater cognitive effort than cooperativeness strategies. These results suggest that the level of cognitive processing required for virtual conflict resolution vary from strategies adopted.

Topic Area: THINKING: Decision making

Do adolescents take more risks? It might depend on the development of statistical learning

Poster E128, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Noémi Éltető[1], Karolina Janacsek[1,2], Andrea Kóbor[3], Ádám Takács[1], Dezső Nemeth[1,2]; [1]Eötvos Loránd University, Budapest, Hungary, [2]Brain, Memory and Language Lab, Hungarian Academy of Sciences, Budapest, Hungary, [3]Brain Imaging Centre, Hungarian Academy of Sciences, Budapest, Hungary

Previous research has suggested that the altered interplay of outcome evaluation and impulse control is responsible for the increased risk-taking often observed in adolescence. Importantly, learning and adaptation could also play a role in sequential risk-taking. While explicit learning abilities steadily improve with development,

implicit learning is decreased at the onset of puberty. Here we aimed to investigate how the co-occurring ontogenetic changes in implicit statistical learning and risk-taking behavior might be related. We tested a total of 180 participants aged from 8 to 24. We measured statistical learning ability by a probabilistic learning task, namely the Alternating Serial Reaction Time (ASRT) Task, and risk-taking by the Balloon Analogue Risk Task (BART). On average, participants showed a risk-averse pattern, leading to a sub-optimal performance on the BART. Our results show no age differences in risk-taking. However, the relationship between statistical learning and risk-taking was significantly different across age groups. Those pre-adolescents who had better statistical learning ability took more risks. This relationship was reversed at the onset of puberty: young adolescents with inferior statistical learning ability were the more risk-taking, thus achieving higher scores. This result might be explained by a strategic switch caused by cognitive development. In sum, we suggest that the developmental decrease of statistical learning ability contributes to how individuals can adapt to risky situations.

Topic Area: THINKING: Decision making

Goal-directed decision making incidentally recruits reinforcement learning mechanisms

Poster E129, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Nora C Harhen[1], Anne GE Collins[1]; [1]University of California, Berkeley

In everyday life, learning is more often motivated by the desire to reach a self-chosen goal than by external reinforcement. Theoretical work suggests that treating the attainment of a (sub-)goal as a pseudo-reward is is an effective way to learn complex behaviors, which may require going through many intermediary, value-neutral sub-goals before leading to reward. There has been indirect evidence for pseudo-rewards when reaching subgoals in EEG and fMRI, but as of yet, few studies have directly compared the reinforcing effects of goals vs. rewards on value learning. We hypothesize that reaching a goal is valuable, in and of itself, and similarly to external reward, reinforces choices leading up to it. In a new behavioral protocol, participants learned to select between pairs of boxes that contained different value-neutral outcomes with differing reliability. In reward trials, participants were told that outcomes were worth either one or zero points; in contrast, goal trial outcomes brought no points, but one outcome was selected by the participant as their desired goal. We probed participants' box preferences during a test phase in extinction. Participants' choices revealed similar preferences within reward and goal boxes of different reliabilities, indicating that reaching a goal did reinforce the previous choice as rewards do. Furthermore, they preferred boxes leading to self-chosen goals over those leading to externally-rewarding outcomes with the same reliability. Taken together, these results support our hypothesis that reaching a goal generates a reinforcing pseudo-reward, and that goal-directed choice leverages mechanisms of habitual value learning.

Topic Area: THINKING: Decision making

Oxytocinergic modulation of human adaptive communication and broadband neuronal dynamics

Poster E130, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Arjen Stolk[1], Idil Kokal[2], Miriam de Boer[2], Robert Oostenveld[2], Ivan Toni[2]; [1]Helen Wills Neuroscience Institute, UC Berkeley, [2]Donders Institute, Radboud University Nijmegen

Oxytocin is a neuromodulator thought to influence human social and affiliative behavior. Yet, to date, the neurophysiological mechanism by which oxytocin may do this remains largely unknown. This study addresses this issue by exploring the neurocognitive consequences of oxytocin administration during human adaptive communication. Fifty-eight males participated in a randomized, double-blind, placebo-controlled experiment involving the intranasal administration of oxytocin (24 IU). The participants were asked to communicate non-verbally with two addressees, an adult or a child, in an experimentally controlled interactive setting. In reality, a confederate blindly performed the role of both adult and child addressee, such that the two addressees were matched in their level of understanding and differed only in terms of the communicator's prior beliefs. We used magnetoencephalography (MEG) to capture the neuronal dynamics evoked during the live communicative interaction and contrasted neuronal activity evoked after oxytocin administration with that of placebo controls. Oxytocin tonically up-regulated broadband neuronal activity in a right-lateralized fronto-temporal circuit previously found to support human adaptive non-verbal communication in a state-dependent manner (Stolk et al., PNAS 2013). Communicators with stronger broadband fronto-temporal activity adjusted more readily their signals to what the addressees actually understood during the interaction, and were less biased by their prior beliefs about the abilities of those addressees. These findings point to a fundamental neuronal mechanism through which oxytocin influences how we adapt our social behavior, in line with previous work linking tonic up-regulation of broadband activity with on-line communicative alignment between interlocutors (Stolk et al., TiCS 2016).

Topic Area: THINKING: Decision making

Influence of other's choice behavior on observational learning

Poster E131, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Nadège Bault[1], Tobias Larsen[1], Mehdi Khamassi[2], Luca Polonio[1], Alexander Vostroknutov[1], Giorgio Coricelli[1,3]; [1]Center for Mind/Brain Sciences (Cimec), Trento, Italy, [2]Institute for Intelligent Systems and Robotics, CNRS, Paris, France, [3]University of Southern California, Los Angeles, USA

When making decisions in an uncertain environment, individuals may learn by observing the choice behavior of others. The goal of this study was to investigate whether we discriminately imitate other individuals based on their choice behavior, in order to optimize our own learning. We tested the prediction that learning from observation relies on two signals: the reward prediction error derived from direct experience and a prediction error related to the value of imitation. We measured brain activity of 30 participants using functional MRI while they made decisions in a repeated two-armed bandit task, with varying reward probabilities. In some trials, the participants observed the choice of one of two individuals before making their own choice. One observed individual was switching options more often than the other. We found that the type of observee influenced the observer participants both in their ability to choose the best option and in the probability that they would switch options. We tested a model of choice in which a value of imitation was incorporated in a standard Q-learning model. The value of imitation increased with successful imitation and with unsuccessful anti-imitation and was updated using an imitation prediction error. Activity of the striatum was positively modulated both by the reward and the imitation prediction errors. During the choice phase, the striatum and dorsolateral prefrontal cortex showed a parametric modulation by the chosen and imitation aggregated value. This mechanism supports optimal imitation (choosing whom and when to imitate) in social environments.

Topic Area: THINKING: Decision making

Anxiety differences in reducing reliance on pre-existing biases by learning from outcome feedback

Poster E132, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Cristina G. Wilson[1], Paul M. Whitney[1], John Hinson[1]; [1]Washington State University

Previous research has examined two information processing biases that are characteristic of people with high trait anxiety: (1) increased likelihood that ambiguous stimuli will be interpreted as affectively negative, and (2) greater attention towards threat-related stimuli. Traditionally, the effects of these biases have been studied independently. The goal of the present study was to evaluate the joint influence of biases on risky decisions and to determine whether high trait anxious individuals could use feedback to overcome their pre-existing biases. We developed an ambiguous risk gambling task similar to the Iowa Gambling Task, but with a framing manipulation on each trial to bias people toward gambling or not gambling. In addition to assessments of advantageous decision making, we tested for acquisition of knowledge about choice outcomes through knowledge probes. Skin conductance response (SCR) was measured during the task to assess affective reactions to choices and outcomes. Both high (n = 78) and low (n = 76) trait anxious individuals learned to make better choices over time, thereby reducing the impact of bias, but low trait anxiety individuals showed greater improvement. Knowledge probes and SCR data showed that the poorer decision making by high trait anxious individuals was not attributable to poorer knowledge or altered affective responsiveness. Rather, anxiety differences in performance reflected differences in how task information was weighted. High trait anxious individuals gave less weight to new knowledge gained from feedback and instead relied more strongly on pre-existing biases to make choices.

Topic Area: THINKING: Decision making

Pupillometry and Frontal Theta Reflect Decision Threshold Increases During Evidence Accumulation

Poster E133, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Daniel Barto[1], James F. Cavanagh[1]; [1]University of New Mexico

The process of making a decision during uncertainty requires cognitive control resources that are not apparent during easy decisions. For instance, a decision during uncertainty requires an accumulation of sensory evidence culminating in a discrete choice determined by a decision threshold. While much is known about mechanisms that resolve uncertainty in sensory accumulation, much less is known about the resolution of uncertainty by decision threshold adjustment. Pupil dilation, previously implicated in a variety of cognitive and affective states, has been shown to index decision threshold adjustment during selection of valued options. In this study, pupil dilation was collected while subjects performed a sensory discrimination task. Subjects were required to indicate the coherent directional movement of a group of dots against a background of random dot movement. Conflict was operationalized by varying the angle of dot movement, creating high (e.g. 11:55 vs. 12:05 on a clock) and low (e.g. 10:00 vs. 2:00) conflict conditions. Hierarchical Drift Diffusion Modelling indicated that the decision threshold (and not the evidence accumulation rate) was selectively altered by this manipulation. In conditions of high conflict, there was a significant increase in pupil dilation change from baseline as compared to conditions of low conflict. Additionally, time frequency decomposition of EEG waveforms revealed frontal theta and delta activity in conditions of high conflict compared to conditions of low conflict. These results indicate that pupil dilation and EEG can predict decision threshold adjustment in the presence of noisy sensory evidence.

Topic Area: THINKING: Decision making

Feedback blunting due to sleep deprivation is affected by dopaminergic genotype

Poster E134, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Hans Van Dongen[1], John Hinson[1], Paul Whitney[1], Brieann Satterfield[1], Michelle Schmidt[1], Jonathan Wisor[1]; [1]Washington State University

Sleep deprivation (SD) degrades dynamic decision making that requires flexible updating of decision-relevant information based on choice outcome feedback and reduces physiologic responsivity to feedback. Dopamine is a key neurotransmitter in neural pathways supporting learning and motivation and is likely to be involved in decision making degraded by SD. We investigated whether dynamic decision making during SD is affected by the Val158Met polymorphism of the Catechol-O-Methyltransferase (COMT) gene. Healthy subjects participated in a controlled laboratory study of SD. At baseline and again 24 h later during SD or well-rested control, subjects performed a go/no-go reversal learning (GNGr) task that required subjects to learn the stimulus-response mapping from feedback. About two-thirds of the way through the task, the stimulus-response mapping was reversed unexpectedly, which required subjects to learn the new stimulus-response mapping from choice outcome feedback. GNGr performance was quantified by discriminability (d') between go and no-go stimuli before and after stimulus-response reversal. GNGr performance did not differ by genotype at baseline. However, compared to subjects heterozygous or homozygous for the Met allele, subjects homozygous for the Val allele had significantly worse GNGr performance during SD. Moreover, their GNGr performance during SD after stimulus-response reversal was no better than chance. Thus, SD exposed a substantial vulnerability in dynamic decision making in individuals with the Val/Val genotype. This finding corroborates the idea that a dopaminergic pathway is involved in the SD-induced impairments in decision making that requires flexible updating of decision-relevant information and the reduced physiologic responsivity to feedback from choice outcomes.

Topic Area: THINKING: Decision making

Arousal-induced changes in functional brain networks during exploration and exploitation

Poster E135, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Nathan Tardiff[1], Danielle S. Bassett[1], Sharon L. Thompson-Schill[1]; [1]University of Pennsylvania

There is growing interest in how large-scale changes in functional brain networks support cognition. Neuromodulatory actions of norepinephrine (NE) may help facilitate these changes. To date, the relationship between NE and functional connectivity has not been assessed within the context of a task with an established relationship between NE-associated arousal and behavior. Here we probed the relationship between NE and network dynamics within an exploration/exploitation task that is known to induce changes in NE activity as measured by pupil diameter. Subjects underwent current fMRI and pupillometry while completing two high volatility and two low volatility blocks of a bandit task. Manipulating the rate of change of the value of the options in the task was intended to induce greater block-level variations in arousal. We parcellated the brain into 264 regions, estimated functional connectivity via wavelet coherence, and used a dynamic community detection algorithm over sliding time windows to track changes in network architecture over time. Within both block types, explore trials were associated with larger pupil diameter than exploit trials. Overall, subjects also explored more in high volatility blocks. Average baseline pupil diameter was also larger in high volatility blocks, though this difference did not reach significance in these preliminary data (N=9). In accordance with our predictions, block-wise changes in average baseline pupil diameter were negatively associated with average integration between functional networks. These data provide preliminary evidence that while task-focused states are facilitated by increased functional integration, exploratory states may be facilitated by less integration between functional networks.

Topic Area: THINKING: Decision making

An event-related potential and time-frequency study of cognitive dissonance-elicited attitude change

Poster E136, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Adam Burnett[1], Mario Liotti[1]; [1]Simon Fraser University

The psychological discomfort experienced during cognitive dissonance often motivates individuals to engage in dissonance-reducing attitude change. Despite the influence that cognitive dissonance theory has had in psychology over the last sixty years, the neural correlates of cognitive dissonance have only recently been investigated. We used electroencephalography (EEG) to explore cognitive dissonance-elicited attitude change in 37 undergraduate participants while they engaged in a free-choice task. Participants rated a number of food items on desirability both prior to and after choosing between either similarly-rated (dissonant) or disparately-rated (consonant) item pairs. Event-related potentials (ERPs) time-locked to stimulus onset revealed that re-evaluation of dissonant choice items relative to consonant choice items gave rise to more negative voltage amplitudes over fronto-parietal scalp between 550-650ms, and over left lateral anterior scalp between 375-500ms during trials containing dissonance-reducing attitude change relative to trials without dissonance-reducing attitude change. Left lateral anterior scalp voltage amplitude was also found to be negatively correlated with the magnitude of resulting attitude change. At times and scalp locations corresponding to the ERP effects, a time-frequency analysis revealed greater low alpha power (9-11 Hz) during attitude change-absent trials relative to attitude change-present trials, as well as greater theta frequency power (4-8 Hz) for attitude change-present trials relative to attitude change-absent trials. These finding are consistent with a model of cognitive dissonance in which cortical projections of ventral striatal activity reflect reward signal changes, and where left prefrontal cortex is recruited for down-regulation of negative emotional arousal produced by cognitive dissonance.

Topic Area: THINKING: Decision making

Mechanisms of Information Accumulation across Speed-Accuracy Tradeoff

Poster E137, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Christina M Merrick[1], Kate T Duberg[1], Anne GE Collins[1], Richard B Ivry[1]; [1]University of California Berkeley

Decisions that involve uncertainty (e.g. identifying someone in a rainstorm) require information to be accumulated over time. Sequential sampling models such as the diffusion decision model (DDM; Ratcliff 1978) assume accumulation of information to be a noisy process that results in a response after a decision threshold is reached. The decision threshold is modulated according to the level of caution employed. In the current study we used the random-dot motion task, manipulating the quality of information (i.e., dot coherence) and task instructions (i.e., emphasis on speed or accuracy) in a 2 x 2 design. Two versions were compared, one in which conditions varied in a block design and the other in which conditions varied on a trial-by-trial basis. We fit the behavioral results with a hierarchical Bayesian drift-diffusion model (Wiecki, Sofer & Frank, 2013) including three parameters: drift-rate, threshold and non-decision time. The parameter estimates were similar for the blocked and mixed designs, indicating that participants were able to flexibly switch between states associated with speed or accuracy. Model comparison (DIC) indicated that the best fits were obtained when all three parameters were allowed to vary. Drift-rate increased with dot coherence and the threshold was lower on speeded trials, replicating previous work (Ratcliff & McKoon, 2002). There was a significant interaction in drift-rate across the instruction manipulation, such that the increase in drift-rate with increasing coherence was greater in the accuracy condition compared to the speed condition. Current experiments are examining EEG correlates of these behavioral effects and model-based parameters.

Topic Area: THINKING: Decision making

Funding Opportunities at the National Science Foundation

Poster E138, Monday, March 27, 2:30 – 4:30 pm, Pacific Concourse

Alumit Ishai[1]; [1]National Science Foundation

This poster will provide an opportunity to learn about the National Science Foundation (NSF) two merit review criteria, Intellectual Merit and Broader Impacts, as well as various funding opportunities that exist for cognitive neuroscientists. An overview of a number of NSF programs and interdisciplinary competitions will be presented, including CAREER awards and standard research proposals in core programs such as Cognitive Neuroscience, Perception Action and Cognition, Developmental Sciences, Science of Learning and Social Psychology. Additionally, funding opportunities in the context of NSF Understanding the Brain, such as Integrative Strategies for Understanding Neural and Cognitive Systems (NCS), and Collaborative Research in Computational Neuroscience (CRCNS) will be presented.

Topic Area: OTHER

Reconstructing Changes in the Spatial Deployment of Attention According to Environmental Statistical Structure

Poster F1, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Anthony W. Sali[1], Tobias Egner[1]; [1]Duke University

Individuals adjust their readiness to shift spatial attention, referred to here as attentional flexibility, according to the statistical properties of the environment (e.g. Sali et al., 2015; JEP:LMC). However, the precise neural mechanisms underlying learned attentional flexibility remain unknown. To this end, we combined functional magnetic resonance imaging (fMRI) with a task requiring participants to hold or shift covert spatial attention among rapid serial visual presentation (RSVP) streams in response to embedded visual cues. Critically, the likelihood of receiving a shift or hold attention cue was predicted by RSVP stream location. As anticipated, the behavioral cost in target-detection RT associated with shifting relative to holding attention was largest in the context associated with frequent hold attention cues and decreased as a function of shift cue likelihood, documenting that attentional flexibility settings were sculpted by statistical task structure. To track the neural processes underlying this learned attentional flexibility, we trained an fMRI encoding model of spatial representation with data from a separate flashing checkerboard task. Inversion of the training weights allowed us to reconstruct maps of spatial selectivity throughout visual and parietal cortices for each location-defined context in the temporal epochs preceding and following each cue presentation. Using a sliding temporal window, we found that shift-cue likelihood systematically modulated the amplitude and spatial breadth of reconstructed representations across location-defined contexts. These results suggest that contextual learning of shift likelihood dynamically modulates spatial attentional priority settings in the visual brain.

Topic Area: ATTENTION: Spatial

Spatial attention reduces visual cortical 1/f neural noise

Poster F2, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Tam Tran[1], Adam Gazzaley[2], Bradley Voytek[1]; [1]University of California, San Diego, [2]University of California, San Francisco

Noise modulation, for instance the reduction of response variability, is a proposed mechanism by which selective attention improves perceptual processing. While this noise mechanism has been extensively examined in animal studies, methodological constraints have limited its applicability in human studies. In this EEG experiment, we leverage the recent finding that the slope of the 1/f electrophysiological power spectrum may index neural noise. Participants performed a perceptual discrimination task in which they were required to focus or divide their attention across narrow or broad areas of visual space. Using 1/f slope to index neural noise, we found that narrowly focused attention decreased pre-target noise in visual areas contralateral, but not ipsilateral to attended spatial locations. Importantly, pre-target noise was lowest in the most focused attention conditions, increasing monotonically with more divided attentional distribution. These findings suggest new possibilities by which the direct study of noise modulation, previously conducted only invasively, can extend to include human cognitive studies.

Topic Area: ATTENTION: Spatial

The effects of alpha-band electrical stimulation of a fronto-parietal network on spatial attention.

Poster F3, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Martine R. van Schouwenburg[1], Lynn Sörensen[1], Raza de Klerk[1], Leon C. Reteig[1], Heleen A. Slagter[1]; [1]Brain & Cognition, Department of Psychology, University of Amsterdam

Recent studies suggests that communication between distant brain regions might be facilitated through neuronal coherence, such that two regions that oscillate in-phase show increased information exchange, while two regions that oscillate out-of-phase are not able to communicate effectively. In a previous study using transcranial alternating current (tACS) stimulation, we found preliminary evidence that the fronto-parietal network, which has been shown to play a pivotal role in the top-down control of spatial attention, might communicate through coherence in the alpha-band (8-12 Hz). Specifically, simultaneous (in-phase) alpha-band stimulation over the right frontal and parietal cortex was associated with changes in performance and fronto-parietal coherence during a spatial attention task as compared to sham stimulation. In the current study, we aimed to test if the observed changes were specific for in-phase stimulation (0º phase difference) of the two regions or if similar results were obtained if the two regions received the same amount of stimulation but out-of-phase (180º phase difference). Participants were tested in three different sessions in which they received either in-phase, out-of-phase, or sham stimulation to the right frontal and parietal cortex. In contrast to our previous study, we found no effect of stimulation on behavior or coherence from either the in-phase or out-of-phase condition compared to sham. These results might challenge the reproducibility of tACS effects. We will highlight some of the differences in study design that may have contributed to the discrepancy in findings between the two studies and more generally, may determine the effectiveness of tACS.

Topic Area: ATTENTION: Spatial

Attentional bias to rapid affective picture presentations at 4 and 6 Hz

Poster F4, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Valeria Bekhtereva[1], Matthias M. Müller[1]; [1]University of Leipzig

Emotional stimuli are known to rapidly draw visual processing resources, even when they are task-irrelevant. Here we investigated the time-course of attentional resource bias from a primary visual task towards rapidly presented background streams of distractor-images which could switch from neutral to neutral or unpleasant content during the trial. Randomly moving squares flickering at 15 Hz were superimposed on image streams shown at 6 or 4 Hz (~167 or 250 ms per image). Subjects detected coherent motion in the flickering squares while ignoring the pictures. Steady-state visual evoked potentials (SSVEP), neural markers of attention allocation, were generated at the distinct frequencies of the task and picture streams, which allowed us to measure the temporal dynamics of the competition for processing resources in early visual cortex between the task and images. We found a decrease in SSVEP amplitudes at 15 Hz over several hundred milliseconds, signifying a withdrawal of attentional resources away from the task towards negative relative to neutral images. In parallel, background image streams shown at 4 and 6 Hz were also modulated as a function of emotional content. There were higher SSVEP amplitudes towards unpleasant vs neutral streams at 4 Hz, whereas the reverse SSVEP modulation was observed with 6 Hz streams. Taken together, our findings highlight the power of the SSVEP as a tool to investigating changes in visual cortex activity during rapid picture viewing, and also imply that temporal superposition of event-related potentials elicited by each individual image in a stream may drive SSVEP amplitude modulations.

Topic Area: ATTENTION: Spatial

Eye Movement Patterns During Scene Viewing Predict Clinical Individual Difference Measures

Poster F5, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Taylor R. Hayes[1], John M. Henderson[1,2]; [1]Center for Mind and Brain, University of California, Davis, [2]Department of Psychology, University of California, Davis

An understudied area is the degree to which clinical individual differences associated with attentional deficits influence real-world viewing behaviors. The present study investigated this issue by predicting individual differences in attention-deficit disorder, autism spectrum disorder, and dyslexia measures using eye movement scan patterns during real-world scene viewing. Forty participants completed a free-view memorization task for 40 real-world scenes while their eye movements were recorded. Three different area of interest grids were used to represent each observers' tendencies to shift their attention vertically, horizontally, and from central to peripheral scene regions. Successor Representation Scanpath Analysis (SRSA, Hayes, Petrov, & Sederberg, 2011) was used to extract the regularities in each participant's scan patterns across these 3 area of interest grids. SRSA quantifies regularities in scan patterns using temporal-difference learning to construct a fixed-size matrix called a successor representation (Dayan, 1993) that captures the underlying structure in temporally-extended scan patterns. A principal component analysis of participant successor representations was performed for each individual difference measure, and these components were then used to predict clinical individual difference scores. The best leave-one-out cross validation was achieved with the vertical area of interest grid which demonstrated significant prediction across all 3 clinical individual difference measures: attention-deficit disorder (r2=0.53), autism spectrum disorder (r2=0.33), and dyslexia (r2=0.23). These results suggest that individual differences in attention-deficit disorder, autism spectrum disorder, and dyslexia significantly influence vertical scan patterns when viewing real-world scenes. The results also suggest that scan patterns might provide useful diagnostic information about individual differences in attentional control.

Topic Area: ATTENTION: Spatial

The size of the focus of attention in touch: evidence from event related potentials

Poster F6, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Elena Gherri[1]; [1]University of Edinburgh

Processing efficiency in the visual domain decreases as the focus of attention becomes broader. A broader focus of attention requires increased cognitive resources which results in slower responses to targets as compared to tasks in which the focus of attention is narrower. No study to date has directly investigated whether analogous differences between a broad and a narrow focus of attention can be observed in touch. To investigate whether attentional modulations of tactile processing are modulated by the size of the attentional focus, event related potentials were recorded during two spatial cuing tasks in which the cue directed attention to two possible target locations on the same arm (broad task) or the exact target location (narrow task). ERP results revealed an earlier locus of tactile attention in the narrow as compared to the broad task during sensory specific stages of processing. At post-perceptual stages, stronger attentional modulations were present in the narrow as compared to the broad task. Behavioural results revealed that the narrow task was more demanding than the broad one. Taken together these results suggest that in the tactile domain focusing attention on narrower portion of the body surface is more demanding than spreading attention across a larger body area.

Topic Area: ATTENTION: Spatial

Alpha-Band Activity Tracks Updates to the Content of Spatial Working Memory

Poster F7, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Eren Gunseli[1], Joshua J. Foster[1], David W. Sutterer[1], Edward K. Vogel[1], Edward Awh[1]; [1]University of Chicago

Past work has established that the topography of alpha-band activity (8-12 Hz) tracks locations maintained in spatial working memory (WM). However, working memory is a flexible system in which representations can be updated to meet task demands. Here, we tested whether dynamic changes in alpha activity track updating of information in spatial WM. Subjects were shown a memory display for 250 ms that contained a colored circle inside one of five placeholders. After a retention interval of 500 ms an auditory cue instructed subjects to update the location held in memory. Following a second retention interval of 1500 ms participants used the mouse to click on the updated location. We used an inverted spatial encoding model to reconstruct the spatially-selective response profiles from the topographic distribution of alpha power. The location specificity of the estimated response profiles was quantified using a linear regression that approximates the slope of response profiles as a function of placeholder locations. Replicating previous findings, alpha-band activity successfully tracked the memory location during the initial retention interval. Importantly, it also tracked the transition to the updated location approximately 500 ms following the update cue during the second retention interval. Our results show that the topography of alpha-band activity tracks the content of an updated location in spatial working memory. These findings highlight a new approach for observing active updating of the contents of visual WM.

Topic Area: ATTENTION: Spatial

Towards a unified model of spatial neglect and its anatomical constituents

Poster F8, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Radek Ptak[1,2,3], Armin Schnider[1,2], Elena Pedrazzini[1]; [1]Medical school, Geneva University, Switzerland, [2]Division of neurorehabilitation, University Hospitals Geneva, Switzerland, [3]Faculty of psychology and educational sciences, Geneva University, Switzerland

Distinct cognitive processes are thought to underlie the heterogeneous nature of spatial neglect. Here we explore two hypothetical processes that are held responsible for the occurrence of deficits in distinct cognitive tasks: object-centered and space-based processing. Previous studies have observed that a bias favoring object-centered processing (such as in copying, reading or line bisection) results from damage to posterior inferior regions while spatial exploration reflects damage to more dorsal and anterior regions. Based on these findings, we tested a theoretical model of neglect that takes in account the underlying types of processing and relates them

to neuroanatomical predictors. 101 right-hemisphere damaged patients were examined with classic neuropsychological tests and participated in a structural MRI scanning session. Lesions were reconstructed and transferred into template space, and the percentage of damaged voxels within 4 regions of interest (ROIs: temporal-parietal junction, frontal eye field, middle frontal gyrus and intraparietal sulcus) was calculated. The relation between damage in the four ROIs with neglect measures was examined with a structural equation model by assuming two latent variables: object-centered processing (involved in line bisection and word errors in reading) and space-based processing (involved in cancellation tasks). The model was a significant predictor of the relations between variables. Damage to the intraparietal sulcus predicted object-centered, but not space-based processing, while damage to the temporal-parietal junction predicted space-based, but not object-centered processing. These data show that neglect reflects distinct object-centered and space-based deficits which result from superior parietal and inferior parietal damage, respectively.

Topic Area: ATTENTION: Spatial

Spatial expressions in German, English, Italian, Polish, and Persian

Poster F9, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Katarzyna Stoltmann[1,2], Fereshteh Modarresi[1]; [1]Zentrum für Allgemeine Sprachwissenschaft (ZAS), Berlin, Germany, [2]Humboldt-Universität zu Berlin, Germany

Spatial relations can be interpreted regarding three reference frames: absolute, relative, or intrinsic, depending on the situation. Native Speakers of English, German, Italian and Polish set the absolute perspective, when they reference to a geographic space. However, in everyday situations, they use either the relative or intrinsic reference frame for the interpretation and production of spatial relations (Levinson 2003). The relationships between the located object and the relatum in a spatial relation are expressed in these four languages using adpositions. The aim of the poster is to show results of a questionnare study with 561 participants indicating that the interpretation of the examined dimensional spatial expressions depends on the language and the situation. Significant differences in interpretation of `in front of' and `behind' were found between German and English native speakers. Italian native speakers deviated most frequently from the egocentric assignment of sides regarding the interpretation of `to the right of' and `to the left of'. They carried out a mental rotation of 180° during the interpretation (Perużyńska 2014). Additionally, we will present an ongoing study involving the use of mouse tracking software for interpretation of spatial relations in Persian and German.

Topic Area: ATTENTION: Spatial

The Modulation of Attentional Emotion Processing on the P300 Event-Related Potential in High-Anxiety and Low-Anxiety Individuals

Poster F10, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Jeremy Andrzejewski[1], Trenton Tulloss[1], Robert Torrence[1], Lucy Troup[1]; [1]Colorado State University

Varying levels of anxiety and associated anxiety disorders have been shown to modulate attention to emotion, in particular for negative emotional stimuli in the P300. This event-related potential component has been shown to be involved with allocating attentional resources to the emotional aspect of a stimulus. However, less research exists for more multi-level attentional paradigms, especially ones that investigate empathy. The purpose of this research was to investigate how emotionally-laden facial stimuli modulate the P300 in low and high anxiety groups. Out of 119 participants that completed the State-Trait Anxiety Inventory, two groups were formed. The top 20 percent were in the high anxiety group (n = 39) and the bottom 20 percent were in the low anxiety group (n = 25). The participants completed an emotion-attention task, which utilized three attentional levels: implicit, explicit, and empathic; the task also featured four facial expression emotions: neutral, happy, angry, and fearful. Six regions of interest, consistent with previous P300 emotion attention research, were used in the analysis. A significant main effect was shown in amplitude differences with the anxiety groups. Within-group comparisons suggested that a reduction in P300 amplitude was shown in the low anxiety group compared with the high anxiety group for negative emotions (angry and fearful) in the implicit and empathetic tasks. These results were consistent with past research indicating that anxiety is related to an increased allocation of attentional resources when presented with negative emotional stimuli and resulting empathic processing.

Topic Area: EMOTION & SOCIAL: Emotional responding

The Role of THC Concentration on the Processing of Emotional Faces

Poster F11, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Jacob Braunwalder[1], Julia Metlay[1], Robert Torrence[1], Lucy J Troup[1]; [1]Colorado State University

Cannabis has been a popular recreational substance since the 1970's. Today nearly 50% of Americans have tried Cannabis at least once with 7.3% using in the past month. Research regarding cannabis and the processing of emotional stimuli has produced mixed results depending on various factors. Most research has focused on acute administration of THC or the residual consumption of THC generally. However, the effects of consuming THC in high concentrations (i.e. cannabis concentrates and edibles) compared to consuming THC in low-to-moderate concentrations, like those found in the flower buds, on emotional processing have not been well studied. Previous emotional processing research has indicated that the N1 event-related potential component is a reliable marker for attending to emotional stimuli. This study looked for potential differences in the N1 amplitude during a facial emotion-attention task in those that primarily consume THC in high concentrations, those that consume in low concentrations, and non-cannabis users. To analyze differences in processing we utilized event related potentials. The paradigm consisted of three

tasks, implicit, explicit, and empathic processing of emotional faces with four expressions in each: neutral, happy, angry, and fearful. Results indicated that those who consumed THC in high concentrations have significantly attenuated N1 amplitudes in response to positive emotions (happy) than those who consumed in lower concentrations. Additionally, non-users had larger amplitudes as well though these results were not significant. These results in context with previous research suggest that higher concentrations of THC may dampen a person's response to positive emotionality.

Topic Area: EMOTION & SOCIAL: Emotional responding

Select Surface-Based Morphometry Predicts Autism Symptom Severity

Poster F12, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Hakeem Brooks[1], Taylor Wilson[1], David Anderson[1], Tracey A. Knaus[2], Helen Tager-Flusberg[3], Jeremy D. Cohen[1]; [1]Xavier University of Louisiana, [2]Louisiana State University Health Sciences Center-New Orleans, [3]Boston University School of Medicine

Autism Spectrum Disorder (ASD) is a neurodevelopmental disorder characterized by social and communicative deficits. Previous research has focused on unearthing physical brain changes that occur in the disorder using various surface based metrics. However, there exists conflict between the results and the implications of them. The current study attempts to add to the field in an attempt to reach a consensus. The current sample included 69 children with ASD. A multiple regression was performed using regional cortical thickness and area as predictors and ADOS Social and Communication Score as the outcome variables. It was found that increases in the thickness of the left pars triangularis (PT) and right superior temporal sulcus (STS) and increases in the area of the left STS, right rostral anterior cingulated (RAC) and frontal pole (FP) were associated with statistically significant increases in ADOS social scores. Increases in the thickness of the right fusiform gyrus and in the area of the left STS, right RAC, and right FP were associated with statistically significant increases in ADOS communication scores. The PT, STS, RAC and FP are known to be implicated in language functioning, social perception, and goal-directed behaviors respectively. Over development in these areas may indicate dysregulation of age-dependent biological mechanisms responsible for brain development in children with ASD. The interaction between these areas may also indicate that functional reorganization of the brain occurs as a compensatory mechanism for developmental differences in children with ASD.

Topic Area: EMOTION & SOCIAL: Emotional responding

Empathy and psychological pain: The influence of First-hand Experience

Poster F13, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Paria Yaghoubi Jami[1], Behzad Mansouri[1], Steve Thoma[1]; [1]The University of Alabama

Observing others in pain activates bilateral anterior Insula, rostral anterior cingulate cortex, brainstem and cerebellum (Singer et al, 2004) which could be slower when emphatic individuals are in an unfamiliar simulated condition (Lamm, 2010). Result of an ERP study showed an activity over central-parietal region especially in left hemisphere at 380ms after an increased activity in frontal lobe at 140ms. These findings support a newly proposed model of empathy composed of early emotional sharing followed by a late cognitive process (Fan & Han, 2008). Research findings also showed that the same pain matrix would be activated when a person is experiencing psychological pain (Gundel et al., 2003). What remains unaddressed is the empathic reaction of people to psychological pain experienced by someone else. This study explores the relationship between individuals' degree of familiarity with a potential psychological pain-inducing situation and their empathic reaction. 100 participants completed three Empathy questionnaires and rated a set of fifty pictures of strangers experiencing psychological and physical pain. They were asked to determine their level of pain, feeling, perspective taking, empathic concern toward that person, and willingness to help on a 5-point Likert scale. The analyses showed a significant role of individuals' past experience with their empathic concerns, personal distress, and pain judgment. The findings also suggest that individuals suffering from psychological pain are more willing to help others and might have a faster, more intense and automatic response in familiar conditions, while those without first-hand experience might have more cognitive empathic responses.

Topic Area: EMOTION & SOCIAL: Emotional responding

Does Prefrontal Cortex Activity Underlie Gender Differences in Emotion Regulation? Evidence from Transcranial Direct Current Stimulation

Poster F14, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

K. Elise Goubet[1], Evangelia G. Chrysikou[1]; [1]University of Kansas

Gender differences in emotion regulation (ER) is a topic that remains largely unexplored within the cognitive and affective neuroscience literature. Previous research suggests that men and women regulate their emotions differently, both with regards to the strategies they use to regulate emotional responses and the neural regions associated with such regulation. For example, during a cognitive reappraisal task men exhibit lower increases in prefrontal cortex activity and greater decreases in amygdala activity than women. Interestingly, gender differences do not necessarily characterize the effectiveness of ER processes. This suggests that men and women may engage in ER following different strategies that involve different neural circuits. However, the precise neural mechanisms underlying these differences are not fully understood. In this study, we examined gender differences in ER by using anodal (excitatory), cathodal (inhibitory), or sham transcranial direct current stimulation (tDCS) over the left dorsolateral prefrontal cortex (dlPFC) to investigate the effects of increased or decreased dlPFC excitability on cognitive reappraisal as measured

by subjective emotional arousal ratings and skin conductance responses. Our results from both measures confirm past findings on gender differences in ER; they further suggest that these effects have their origins in baseline differences in dlPFC activity between males and females, which can be causally manipulated with tDCS. We discuss the implications of these results for theories of emotion regulation and dlPFC function.

Topic Area: EMOTION & SOCIAL: Emotional responding

Does immediate versus diffuse threat evoke dissociable high-resolution functional imaging activation profiles from amygdala and bed-nucleus of the stria terminalis?

Poster F15, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Lindsay Knight[1], Farah Naaz[1], Brooke Siers[1], Brendan Depue[1]; [1]University of Louisville

Older models of threat processing have been highly influential, and have suggested differential engagement of the amygdala and the bed nucleus of the stria terminalis (BNST); with immediate threat evoking a phasic response in the amygdala, while diffuse threat leads to a sustained response in the BNST. However, recent work has presented contradictory results, suggesting similar activation profiles for both the amygdala and BNST. To explore whether immediate and diffuse threat are functionally dissociable processes, twenty participants were scanned using high-resolution fMRI (1.5mmX3) while presenting human screams and fearful faces during two different conditions: unpredictable vs. immediate on-set time, as well as differing levels of probability vs. certainty in the diffuse vs. immediate threat conditions, respectively. Results show that the immediate vs. diffuse threat evoked higher activation in bilateral amygdala, specifically in the central nuclei group of the amygdala. Conversely, diffuse vs. immediate threat evoked higher activation in the bilateral BNST. Additionally, the comparison between diffuse vs. immediate threat revealed dorsomedial frontal activations. Secondarily, we conducted ROI analyses for the amygdala and BNST to extract finite impulse response time-series for each region. The time-series for both the amygdala and BNST indicated a relatively quick and short latency response for the immediate threat condition. While conversely, both the amygdala and BNST exhibited a longer to peak and sustained time series for the diffuse threat condition. Our results indicate that the amygdala and BNST show similar, rather than dissociable activation profiles.

Topic Area: EMOTION & SOCIAL: Emotional responding

Watching joint actions in dance synchronizes brain activity in expert and novice spectators

Poster F16, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Guido Orgs[1], Adrian Williams[2], Staci Vicary[1]; [1]Department of Psychology, Goldsmiths, University of London, [2]Division of Psychology, Department of Life Sciences, Brunel University London

Performing joint actions is central to social interactions. Much research examined the psychological and neural mechanisms of performing joint actions, yet few studies have assessed the impact of watching joint actions on passive observers. Here, we investigated the perception of joint actions in dance using inter-subject correlations (ISCs) and fMRI. In dance, performers skillfully coordinate their movements to produce synchrony. We directly quantified movement synchrony among 10 dancers performing a 30-minute choreography, using wrist accelerometers and cross-recurrence analysis. Subsequently, 14 expert and 11 novice dancers passively watched a video recording of the choreography in the scanner. Whole brain ISCs across the entire performance revealed the strongest correlations in medio-temporal visual and primary auditory cortices. These correlations were stronger and more widespread among experts than novices, suggesting reduced variability in visual and auditory processing of the observed actions in expert observers. Only experts exhibited additional synchronization in the superior parietal cortex, in line with an involvement of the human action observation network in joint action perception. A time-windowed ISC analysis included continuous measures of group synchrony and acceleration to clarify whether visual, auditory or movement parameters best predicted synchronization among spectators. For both expert and novice spectators, dynamic ISCs were best predicted by group synchrony. Group acceleration and audio-visual content were less powerful predictors of ISCs. Our findings show that the human brain reconstructs socially relevant kinematic movement parameters from visual input. Watching synchronous movement in dance may be appealing because it signals successful cooperation between people.

Topic Area: EMOTION & SOCIAL: Emotional responding

Tracing the neural carryover effects of anger and their relation to chronic-stress symptoms

Poster F17, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Gadi Gilam[1,2], Adi Maron-Katz[3], Tamar Lin[1], Efrat Kliper[1], Eyal Fruchter[4], Ron Shamir[5,6], Talma Hendler[1,2,6,7]; [1]Tel Aviv Center for Brain Function, Wohl Institute for Advanced Imaging, Tel Aviv Sourasky Medical Center, Weizmann 6, Tel Aviv, 64239, Israel, [2]School of Psychological Sciences, Tel-Aviv University, P.O. Box 39040, Tel Aviv 69978, Israel, [3]Department of Psychiatry and Behavioral Sciences, Stanford University School of Medicine, Stanford, [4]Division of Mental Health, Israeli Defense Force Medical Corp, Tel Hashomer, Military Mail 02149, Israel, [5]Blavatnik School of Computer Science, Tel-Aviv

University, P.O. Box 39040, Tel Aviv 69978, Israel, [6]Sagol School of Neuroscience, Tel-Aviv University, P.O. Box 39040, Tel Aviv 69978, Israel, [7]Sackler Faculty of Medicine, Tel-Aviv University, P.O. Box 39040, Tel Aviv 69978, Israel

Coping with anger extends beyond provocation to a period during which people tend to engage in recovery from the emotional episode. Rumination is common during this period, possibly leading to more anger and aggression, all of which are features of PTSD symptomatology. We aimed to trace the carryover effects of anger on endogenous neural dynamics and examine their prospective relation to chronic-stress related PTSD symptoms. Forty-four young adults (29 soldiers, 15 civilians) underwent two resting-state fMRI scans before and after an interpersonal anger induction based on the Ultimatum Game (UG). A whole-brain data-driven analysis was performed to identify between session modulations in resting-state functional connectivity (rsFC). PTSD symptoms were assessed before and after combat-training, assumed to induce chronic-stress amongst soldiers. Increased rsFC between the right amygdala and right inferior frontal gyrus (IFG) following anger was associated with smaller right IFG volume and higher trait-anger level in all subjects, as well as predicted more symptoms among soldiers following combat-training. Moreover, higher global-rsFC of the amygdala at baseline predicted less reported anger and more monetary gain during the UG. Results provide a causal neural link between enhanced amygdala-IFG rsFC during recovery from anger and the development of chronic-stress symptoms a year later, possibly indicating trait vulnerability. This corresponds to studies evidencing altered amygdala-IFG connectivity among PTSD patients, together supporting a neural mechanism of maladaptive recovery from emotional turmoil, which may be associated with angry rumination. In contrast, amygdala global-rsFC marked predisposing capabilities to cope with an emotional turmoil such as anger provocation.

Topic Area: EMOTION & SOCIAL: Emotional responding

Boosting Self-Esteem Through Remembering Relaxed Experience Suppresses Envy and Resultant Schadenfreude as Measured with Fmri

Poster F18, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Shohei Yamazaki[1], Motoaki Sugiura[1], Kelssy H dos S Kawata[1], Yukako Sasaki[1], Rui Nouchi[1], Kohei Sakaki[1], Shigeyuki Ikeda[1], Ryuta Kawashima[1]; [1]Tohoku University

Envy and resultant schadenfreude are the source of various negative social behaviors. In previous studies, it was discovered that self-esteem is negatively correlated with envy and resultant schadenfreude and we hypothesized that boosting self-esteem suppressed envy and resultant schadenfreude. We measured the brain activity which was extracted by virtual scenario method as an index and examined our hypothesis. We employed 40 university students and divided them into an intervention group and a control group. We improved self-esteem of the former group members with a semi structured interview. This method was used in the precedent study. We had subjects remember a situation in which they felt relaxed in a past social experience about 5 minutes. We had a short conversation instead of improving self-esteem with the latter group members. We had them do an fMRI task which drew envy and schadenfreude using a virtual scenario used in precedent studies and the State Self-esteem Scale before (Pre phase) and after (Post phase) intervention. First of all, self-esteem increased only in the intervention group. In the Pre phase, we replicated envy and schadenfreude-related activation in the dorsal anterior cingulate and ventral striatum, respectively, reported in Takahashi et al (2009). These activations decreased in the Post phase only in the intervention group. We were able to show that the self-esteem intervention of five minutes could suppress envy and resultant schadenfreude.

Topic Area: EMOTION & SOCIAL: Emotional responding

Resting-state functional connectivity in large-scale brain networks predicts neuroticism and extraversion in novel individuals

Poster F19, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Wei-Ting Hsu[1], Monica D. Rosenberg[1], Dustin Scheinost[1], Emily S. Finn[1], R. Todd Constable[1], Marvin M. Chun[1]; [1]Yale University

The personality dimensions of neuroticism and extraversion are strongly associated with emotional experience. Previous studies reported fMRI activity correlates of these traits, but no study has used resting-state brain connectivity to predict these traits. Here, using a fully cross-validated approach, we predict novel individuals' neuroticism and extraversion from functional connectivity observed as they simply rested during fMRI scanning. To this end, we applied a novel technique, connectome-based predictive modeling (CPM; Finn et al. 2015; Rosenberg et al., 2016), to resting-state fMRI data and personality scores (self-reported NEO Five Factor Inventory) from 125 subjects of the Nathan Kline Institute Rockland sample. Using a predefined 268-node whole-brain functional atlas (Shen et al., 2012), we calculated for each individual a 268-by-268 "connectivity matrix," where each cell consisted of the functional time-course correlation ("edge") between one node and another. Within this full connectivity matrix, CPM identified functional connectivity networks whose strengths positively or negatively correlated with neuroticism and extraversion. The edges from these networks form a weight matrix that can be applied to a novel subject's connectivity matrix, and combined with a general linear model to generate a predicted personality score. Using leave-one-out cross validation, we then correlated predicted scores with observed scores, and found that CPM predicted neuroticism ($r=0.27$, $p<0.01$) and extraversion scores ($r=0.24$, $p<0.01$). CPM previously predicted fluid intelligence (Finn et al., 2015) and sustained attention (Rosenberg et al., 2016); this study extends the method to predict personality traits from resting state functional connectivity data.

Topic Area: EMOTION & SOCIAL: Emotional responding

The Sound and the Fury: Late Positive Potential is Sensitive to Sound Affect

Poster F20, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Darin Brown[1], James Cavanagh[1]; [1]University of New Mexico

Emotion is an emergent construct of multiple primitive sub-processes. EEG is uniquely sensitive to real-time neural computations, and thus is an excellent tool to study the construction of emotion. This series of studies aimed to probe the mechanistic contribution of the Late Positive Potential (LPP) to multi-modal emotion perception. Experiment 1 revealed valence differences in the P3 time range for visual images paired with sounds, and differences in the LPP time range for sounds alone. Experiment 2 manipulated this audio-visual enhancement by altering the valence pairings with congruent (e.g. positive audio + positive visual) or conflicting emotional pairs (e.g. positive audio + negative visual). Negative visual stimuli evoked larger early LPP amplitudes, regardless of sound pairing. However, time frequency analyses revealed significant midfrontal theta-band power differences between conflicting and congruent stimuli pairs suggesting very early (~500ms) realizations of thematic fidelity violations. Interestingly, LPP modulations were reflective of the congruency of the stimuli pairs. Together, these findings suggest that enhanced parietal activity for affective valence is not only dependent on visual processes. Furthermore, these findings suggest that altered neural activities for affective visual stimuli are enhanced by concurrent affective sounds, paving the way towards an understanding of the construction of multi-modal affective experience.

Topic Area: EMOTION & SOCIAL: Emotional responding

Sadness can be related to the approach motivation: Evidence from frontal alpha power asymmetry

Poster F21, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Kohei Fuseda[1], Ayano Matsubara[1], Jun'ichi Katayama[1,2]; [1]Kwansei Gakuin University, [2]Center for Applied Psychological Science (CAPS)

Frontal alpha power asymmetry is known to be associated with motivational states: Lower left-frontal alpha power reflects the approach motivation, whereas lower right-frontal power reflects the withdrawal motivation. This study investigated whether these motivational states are influenced by the relationship between the observer and the stimulus. We expected the asymmetry to be more distinctive when the observer has a close relationship to the stimulus. Twenty-four students who had owned a dog participated in this study. They were randomly assigned to either the sad (n=12) or joy (n=12) condition. Participants in sad and joy condition watched the two movies (7 min. each) of the stories of a dog's death or dog's playing scene, respectively. Electroencephalogram signals were recorded while they were watching the movie, after which they rated subjective sadness and enjoyment using 100 mm visual analog scales. Each subjective rating was significantly higher in the corresponding condition, indicating that mood induction was successful. Right-frontal alpha power was significantly higher than left-frontal power only in the sad condition, whereas no frontal asymmetry was observed in the joy condition. This asymmetry pattern is opposite to that found in previous studies. In this study, sadness was associated with the approach, rather than the withdrawal, motivation. Thus, dog lovers showed the approach motivation to the sad story about the dog. In conclusion, motivational states are changed by the relationship between the observer and the stimulus.

Topic Area: EMOTION & SOCIAL: Emotional responding

Resting connectivity between the amygdala and the ventral anterior cingulate cortex is associated with sympathetic reactivity to a trauma reminder

Poster F22, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Olena Kleshchova[1,2], Jenna Rieder[1,2], Mariann Weierich[1,2]; [1]Hunter College, The City University of New York, [2]The Graduate Center, The City University of New York

Trauma exposure is associated with sympathetic reactivity to affective information, including trauma-related cues, as well as to amygdala reactivity and abnormal functional connectivity during affective processing. However, we do not yet know if abnormal trauma-related amygdala connectivity persists in the absence of affective stimuli, nor if trauma-related connectivity is associated with sympathetic reactivity to trauma-related cues. Abnormal resting connectivity might be a stable marker of trauma exposure and vulnerability for PTSD symptoms. We hypothesized that trauma-related symptoms would be associated with sympathetic reactivity to a trauma reminder, indexed by salivary alpha-amylase (sAA). We also hypothesized that, compared to controls, trauma-exposed women would show greater resting amygdala connectivity with the salience network and weaker resting amygdala connectivity with prefrontal regulatory regions. Finally, we hypothesized that resting amygdala connectivity would be associated with sAA reactivity to a trauma reminder. Twenty-four trauma-exposed women and 20 no-trauma controls completed a resting-state fMRI scan and a clinical interview that covered traumatic events. To measure sAA reactivity to the trauma report/reminder, we collected saliva pre-interview and immediately post trauma report. Trauma-related symptoms were associated with sAA reactivity to the trauma reminder. Counter to our second hypothesis, trauma-exposed women showed greater resting connectivity between the amygdala and the ventral anterior cingulate cortex (vACC), a region implicated in affect regulation. Finally, resting amygdala-vACC connectivity was associated with sAA reactivity to the trauma reminder. These results suggest that greater resting cortico-limbic connectivity, linked to trauma-related symptoms and sympathetic hyperactivity, might be a stable marker of trauma exposure.

Topic Area: EMOTION & SOCIAL: Emotional responding

Face Processing at 100 ms: the Effects of Race and Configuration

Poster F23, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Clara Colombatto[1], Gregory McCarthy[1]; [1]Yale University, New Haven, CT, 06511, USA

Research about the neural basis of face recognition has investigated the timing and anatomical substrates of different stages of face processing. Scalp-recorded event-related potential (ERP) studies of face processing have focused upon the N170, an ERP with a peak latency of ~170 ms that has long been associated with the initial structural encoding of faces. However, several studies have reported earlier ERP differences related to face properties such as race and emotions, suggesting that face-specific processes might occur prior to N170. Here we examined the influence of face inversion and face race upon the timing of face-sensitive scalp-recorded ERPs by examining neural responses to upright and inverted line-drawn and luminance-matched Caucasian and African American faces in a sample of Caucasian participants. We found that the P100 ERP evoked by inverted faces was significantly larger than that evoked by upright faces. Inverse modeling of the inversion-effect difference waveform suggested possible neural sources in peri-calcarine extrastriate visual cortex and lateral occipito-temporal cortex. We also found that the inversion-effect difference wave was larger for Caucasian faces. These results are consistent with behavioral evidence that individuals process the faces of their own races more configurally than faces of other races. Taken together, the inversion and race effects observed in the current study suggest that configuration influences face processing by at least 100 ms, and the role of configuration on face processing is greater for own-race faces.

Topic Area: EMOTION & SOCIAL: Person perception

Implicit Associations Between Different Body Types and Foods in Women

Poster F24, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Rebecca Lopas[1], Natalie Ceballos[1], Roger Samson[1], Reiko Graham[1]; [1]Texas State University

Research on stereotypes has focused largely on race; however, overweight individuals are also targets of bias. One stereotype is that overweight individuals over-eat due to a lack of willpower. The current study used an associative priming task to determine whether heavier bodies are associated with high-calorie foods. Fifty-two female participants (Mage = 23.0 years) provided information about their body mass index (BMI) and completed a priming task that consisted of body primes (male and female, heavier and thinner) and food targets (savory and sweet, high- and low-calorie), and rated the calorie content of the targets. Mixed ANOVAs were conducted on reaction times and accuracy with prime body type (heavy vs. thin), prime gender (male vs. female), and target category (high- vs. low-calorie) as within-subjects variables, and BMI group (underweight/normal weight vs. overweight/obese) as a between-subjects variable. Overall, participants were more accurate at identifying high-calorie (HC) foods primed by heavier bodies and faster to identify HC foods primed by female bodies, especially heavier women. Furthermore, while HC foods were identified more quickly when primed by heavy bodies, only HC savory foods were identified more slowly when primed by thinner bodies. These results support the notion that in women, heavier bodies are associated with high-calorie foods, savory foods in particular. In addition, they suggest that women (especially heavier women) are more likely to make associations between same-sex body types and foods, converging with research showing that unlike ethnic and racial minorities, overweight individuals do not hold favorable attitudes towards their in-group.

Topic Area: EMOTION & SOCIAL: Person perception

Rhesus monkeys are able to discriminate facial identity and expression

Poster F25, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Molly Flessert[1], Jessica Taubert[1], Ning Liu[1], Leslie Ungerleider[1]; [1]Laboratory of Brain and Cognition, NIMH/NIH

Faces carry multiple signals: some are stable across time, such as an individual's identity, whereas others are subject to change, such as expression. These stable and changeable attributes appear to have opposing computational demands. A mechanism discriminating identity would need to distill information that remains constant in a face, whereas a mechanism responsible for distinguishing between expressions would benefit from increased sensitivity to change. This intuition aligns with most neural models for face perception, however, this is still a matter of intense debate. The main goal of our research is to determine the extent to which the signals conveyed by facial identity and expression are processed by independent mechanisms. To begin addressing this question, we designed an experiment to determine whether rhesus monkeys (Macaca mulatta) can extract both identity and expression cues from face stimuli. Using a two-alternative force-choice delayed match-to-sample task, we tested four subjects across two task conditions. The stimuli in both conditions were identical, the only difference was whether the task was to match identity or expression. We found that subjects were able to successfully select expression more often than identity on expression discrimination trials, as well as select identity more often than expression on identity trials. These results provide the first clear indication that monkeys are able to extract multiple signals from faces. Discrimination performance was also found to be modulated by oxytocin, a hormone often implemented in primate social cognition.

Topic Area: EMOTION & SOCIAL: Person perception

Race, Facial Expression, and Weapon Identification: An Associative Priming Study

Poster F26, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Arthur Barrera[1], Yesenia Padilla[1], Reiko Graham[1]; [1]Texas State University

Associative priming tasks have shown that Caucasians identify weapons faster and more accurately when they are preceded by African American faces, which is thought to occur because both African American faces and weapons are associated with threat. If this is correct, then other threat-related information (e.g., anger) should also moderate this effect. This study examined the effects of prime race and facial expression using a weapon identification task in 23 Caucasians (Mage = 22.5 years) at a racially-diverse University in Southwest Texas. The task consisted of Caucasian and African American face primes (neutral and angry expressions) and word targets (weapons or tools); participants were required to indicate whether they saw a weapon or a tool. Repeated-measures ANOVAs were conducted on reaction times and accuracy scores with prime race (Black vs. White), prime expression (angry vs. neutral), and target category (weapon vs. tool) as within-subjects variables. Overall, participants were more accurate at identifying targets (both weapons and tools) primed by African American faces, possibly due to a heightened state of vigilance evoked by these primes. Participants more accurately identified targets primed by neutral faces, possibly due to angry faces capturing attention. Consistent with previous research, participants were faster at identifying weapons vs. tools. While preliminary, results are inconsistent with a threat-based explanation for the weapon identification effect and suggest that geographical location may be an important factor in the replicability of studies involving racial biases. We are currently collecting data to examine these effects in other racial and ethnic minorities.

Topic Area: EMOTION & SOCIAL: Person perception

Modulating vicarious tactile perception: Performance-specific outcomes of transcranial current stimulation of primary somatosensory cortex on empathy for touch

Poster F27, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Natalie Bowling[1], Michael Banissy[1]; [1]Goldsmiths College, University of London

Passive observation of touch elicits vicarious neural representations similar to when we are touched on our own bodies, including activity in primary somatosensory cortex (SI). Vicarious tactile perception, conscious or unconscious, is associated with heightened empathy. Conscious experiences can be quantified using a visuotactile interference task, in which participants report the location of a tactile stimulus whilst viewing touch to another person. Observed touch is either spatially congruent or incongruent with the tactile stimulus. Increased reaction times on incongruent versus congruent trials are thought to reflect interference from competing tactile sensations. These congruency effects have previously been induced by increasing excitability of SI with transcranial direct current stimulation (tDCS). The present study aimed to identify whether individual variation in baseline task performance interacts with transcranial current stimulation (tCS) effects. In Experiment One, tDCS targeted at SI significantly increased congruency effects only for participants with lower effects at baseline. Experiment Two confirmed these performance-specific effects with transcranial random noise stimulation (tRNS) over SI. This experiment contained four versions of the task, in which participants observed touch to human hands in a first- or third-person perspective, dummy hands, or an object. Performance-specific tRNS effects were found on the first-person human and dummy hands tasks, but not the third-person human or object tasks, indicating that visual perspective may be more relevant than perception of animacy in modulating vicarious tactile perception. The results provide causal evidence for the role of SI in tactile empathy, and highlight the importance of individual differences in tCS research.

Topic Area: EMOTION & SOCIAL: Person perception

Contextual self-relevance and valence modulate face processing differently in those with high versus low subclinical social anxiety

Poster F28, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Sarah McCrackin[1], Roxane Itier[1]; [1]University of Waterloo

Individuals with high social anxiety (HSA) are more likely than those with low social anxiety (LSA) to interpret negatively-valenced stimuli as self-relevant. As fear of negative evaluation is thought to be one of the key components of HSA, this bias in self-referential processing is thought to contribute to its development and maintenance. Contextual self-relevance and valence have been shown to influence early face perception, so we hypothesised that these effects on face processing vary as function of subclinical social anxiety. The present study used electroencephalography (EEG) to examine these context effects in groups with self-reported HSA (n=28) and LSA (n=31). We also investigated if context would interact with another self-referential cue – whether the faces were looking at or away from the participants. Positive and negative sentences (valence manipulation) referring to the participant or to someone else (self-relevance manipulation) were used as primes for neutral faces with direct or averted gaze (gaze manipulation). Eye-tracking ensured that participants read the sentences and fixated on faces. Mean amplitude analyses of 100ms time-windows post-face presentation (50-750ms) tracked the time-course of effects. Self and other relevant contexts were distinguished at the neural level 100ms earlier in the HSA group than in the LSA group. Furthermore, while valence, gaze and self-relevance interacted to modulate face processing in both groups, the HSA group had a larger effect of self-relevance for negative trials, 350-450ms after face presentation. These results provide support for altered self-referential processing in HSA, and characterize these differences at the neural level.

Topic Area: EMOTION & SOCIAL: Person perception

Investigating the Neural Basis of Shared Preferences and Affiliation

Poster F29, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Harry Farmer[1], Antonia Hamilton[1]; [1]University College London

Similarity to the self is a key factor in our judgement of others with people showing greater feelings of affiliation towards those they perceive as being more similar to themselves. We aimed to investigate the neural basis of this phenomena using an fMRI. In this study participants were required to choose which of two paintings they preferred and then observed the choices of two confederates one of whom chose the same picture as them 75% of the time while the other only chose the same 25% of the time. Behaviourally we found that participants showed greater liking to the similar confederate compared to the dissimilar confederate replicating the previous evidence for a similarity liking link. Examination of BOLD activation showed that observing the different confederate's choice led to greater activation in both the ventrolateral prefrontal cortex, which is implicated in response switching and has previously been linked to social influence. The dissimilar confederate's choice also led to greater activation in the dorsomedial prefrontal cortex a region heavily implicated in processing information about others. In addition we found that viewing one's own chosen stimuli after seeing the choices of both confederates led to increased activation in regions involved in self processing and in social cognition including the temporal-parietal junction, the mid cingulate and the precuneus. Our findings suggest that the link between shared preference and affiliation involves brain areas that are involved in learning about other preferences and also regions involved in the processing of value similarity between self and others.

Topic Area: EMOTION & SOCIAL: Person perception

Neural representations of person types overlap with Theory of Mind regions

Poster F30, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Connor Lane[1], Giulia V Elli[1], Marina Bedny[1]; [1]Johns Hopkins University

We routinely try to predict people's behavior and mental states. When we do so, we consider the individual characteristics of the agent. I.e. how likely is this particular person to think and act in this way? We investigated the neural basis of this mental state reasoning using representational similarity analysis (RSA) . While undergoing fMRI, participants judged whether a person type (e.g. bride, veteran, toddler) was more likely, equally likely, or less likely than the average person to engage in a mental act (e.g. "nuns respect", "fools realize"). Thirty-one person types occurred in all possible pairings with thirty attitude verbs. Participants also completed a Theory of Mind (ToM) localizer where they read stories that required reasoning about beliefs (Dodell-Feder et al., 2010, NeuroImage). A separate group of Amazon Mechanical Turk participants judged the semantic similarity of person types to each other in all possible pairings, generating a people similarity space. An fMRI similarity space was generated by (1) averaging fMRI activity during judgments for each person type across all possible verbs, and (2) computing correlations between activity patterns for all person-types. We used searchlight RSA to compare the behavioral and fMRI similarity spaces. We show that semantic similarity between person types predicts fMRI pattern similarity within the ToM network. These results suggest that brain regions underlying ToM reasoning are sensitive to distinctions between person types.

Topic Area: EMOTION & SOCIAL: Person perception

Neural representations of face identity across photos, line drawings, and caricatures

Poster F31, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Constantin Rezlescu[1,2], Stefano Anzellotti[3], Alfonso Caramazza[1]; [1]Harvard University, [2]University College London, [3]MIT

Previous neuroimaging studies have identified brain areas involved in discrimination of face images (Kriegeskorte et al, 2007) or face identities across images varying in expression (Nestor et al, 2007) or viewpoint (Anzellotti et al, 2013). Stimuli used in these studies were real or computer-generated photographic images, so it is possible successful classification of identity was helped by specific combinations of lower-level features (e.g. a particular skin texture and color). We investigated if the standard face-selective brain areas (fusiform face area - FFA, occipital face area, superior temporal sulcus – STS, anterior temporal lobe) encode more abstract representations of face identity, not directly mappable to low-level features. To this end, we selected standardised photographs of three famous actors, varying in viewpoint (frontal, side, profile), and asked an artist to create sketched line drawings and caricatures based on those. The photographs, line drawings, and caricatures varied dramatically in their low-level features. Thirteen participants were scanned while performing an identity task based on these images. We trained linear support vector machine classifiers to discriminate between neural patterns in our regions of interest (ROIs) to specific identities based on two image types (e.g. photos and line drawings) and then tested how well these classifiers performed on the third, un-trained image type (e.g. caricatures). We found above chance classification accuracy in STS (9mm ROI) and FFA (6mm ROI). Our results suggest these areas contain more abstract information about face identity than previously shown. It is possible this information goes beyond visual properties.

Topic Area: EMOTION & SOCIAL: Person perception

Into the Dogs' Brain: How Do Their Brains Process Emotional Human Faces?

Poster F32, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Laura V. Cuaya[1], Raúl Hernández-Pérez[1], Luis Concha[1]; [1]Institute of Neurobiology, National Autonomous University of México

Dogs are a unique model to study face perception because dogs can extract useful information from dog and human faces. Our goals were to describe the cerebral correlate of the perception of 1) dog faces, 2) neutral human faces and 3) happy human faces. We acquired functional images (TR/TE = 1750/30 ms, 2x2x3 mm3

resolution, 110 volumes) of eight pet dogs trained to remain still. We acquired five independent runs for each experimental condition in a block design of (1) dog faces vs. objects, (2) neutral human faces vs. objects and, (3) happy vs. neutral human faces. We found that (1) dog face perception was related with the temporal and occipital cortex and the cerebellum. (2) human face perception involved the temporal and frontal cortex, the thalamus and the caudate. A conjunction analysis found a posterior-anterior pattern of cerebral response: occipital cortex to all stimuli, temporal cortex to all faces and frontal cortex only to human faces. The processing of happy human faces (3) involved the temporal and frontal cortex as well the caudate. All results are cluster corrected. Our findings highlight the importance of temporal cortex in face processing. The activity in the frontal cortex could be the brain correlate of the differential behavioral responses that dogs show towards human faces. The activity in the caudate suggests that dogs find human faces (particularly happy faces) as rewarding stimuli. We believe that this study contributes to a better understanding of the dog social cognition.

Topic Area: EMOTION & SOCIAL: Person perception

Source Localization Indicates Anterior Superior Temporal Gyrus Involvement in Nonlinguistic Structured Sequence Processing and Natural Language Processing

Poster F33, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Gretchen N.L. Smith[1], Gerardo E. Valdez[1], Anne M. Walk[2], John D. Purdy[3], Christopher M. Conway[1]; [1]Georgia State University, [2]University of Illinois, [3]Saint Louis University

Structured sequence processing (SSP) refers to the ability to acquire and process patterns of information from the environment (Cleeremans et al., 1998). SSP appears to support knowledge and use of grammatical language (Conway et al., 2010). However, few studies have empirically associated these two processes at a neural level (e.g., Christiansen et al., 2012). Additional neural evidence of a relation between SSP and language processing is needed, using different tasks and analysis techniques. The goal of this study was to examine the putative neural link between more purely non-linguistic SSP and natural language processing by analyzing the source location of electrophysiological responses elicited for each type of task. Healthy adult participants (N=32) completed a visual-spatial (non-linguistic) SSP task and a natural language reading (grammatical comprehension) task. Both tasks were designed to cause violations in expectations of items occurring serially (using an artificial grammar for the SSP task and natural syntax for the reading task). Event-related potentials were compared for trials containing violations versus those without violations. Source localization with sLORETA showed 1) increased bilateral activation at 300ms in anterior superior temporal gyrus (STG) for sequences in the SSP task containing a violation relative to non-violation sequences, and 2) increased bilateral activation at 600ms in the same anterior region of STG for sentences in the reading task containing a violation relative to non-violation sentences. The source localization of activity during the SSP and reading tasks revealed striking overlap, providing support for similar neural mechanisms underlying non-linguistic SSP and natural language processing.

Topic Area: EXECUTIVE PROCESSES: Other

The Reliability of Brain State Properties

Poster F34, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Derek M. Smith[1], Yiran Zhao[1], Behnaz Yousefi[1], Shella D. Keilholz[2], Eric H. Schumacher[1]; [1]Georgia Institute of Technology, [2]Emory University

Research employing dynamic functional connectivity methods supports the hypothesis that the composition of functional brain networks is dynamic and changes over time and information processing demands. However, before metrics of dynamic functional connectivity can be used to differentiate between individual abilities and task situations, the reliability of these measures must be better understood. In order to gain insights into the consistency of network dynamics, patterns of co-activation were obtained using K-means clustering of the images from the resting state scans of 100 unrelated Human Connectome Project subjects. The clustering procedure was applied separately to scans from two separate sessions. The primary goals were to assess: 1) the reliability of brain states across time; 2) the consistency of their frequency of occurrence; 3) and the consistency of their dynamics. Cluster centroids were similar between the two sessions. Frequency correlations between the first and second day reached values in the r = .5 range for most brain states. The general pattern of state transitions was similar between the two days as well. An increase in the frequency of occurrence across the course of the scan was found for two states on both days. In addition, associations between state properties and latent trait intelligence were explored. These findings highlight characteristics of brain states that are constant across time and demonstrated that dynamic connectivity measures can benefit differential research.

Topic Area: EXECUTIVE PROCESSES: Other

A role for the striatum in feedback contingency estimation during perceptual category learning

Poster F35, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Lauren E. Vucovich[1], F. Gregory Ashby[1]; [1]University of California, Santa Barbara

Recent research suggests that the effects of reward prediction error (RPE) on dopamine neuron firing may be modulated by feedback contingency – that is, by the correlation between response confidence and feedback valence. For example, when feedback is not contingent on behavior there is nothing to learn, and dopamine fluctuations carry no adaptive value. This degradation of feedback contingency has been shown to dramatically impair learning in a perceptual category-learning task (Ashby & Vucovich, 2016). Recent evidence implicates the striatum and prefrontal cortex as two potential mechanisms that make up a network responsible for contingency detection and computation. The current study indirectly tested the involvement of the striatum in contingency estimation by employing a feedback delay during a rule-based category learning task under both high- and low-contingency conditions. Due to the nature of synaptic plasticity in the striatum, delaying feedback by more than a few seconds should eliminate any striatal contribution to contingency estimation. In both feedback conditions, the optimal Bayesian classifier would receive positive feedback on 80% of the trials. In high-contingency conditions, the probability of positive feedback decreased with categorization difficulty, whereas in low-contingency conditions, the probability of positive feedback was independent of categorization difficulty. Overall, results showed a surprising interaction between contingency and feedback delay, with learning improving when contingency was low and deteriorating when contingency was high. These results suggest the striatum plays an important role in contingency estimation and they provide significant insight into the nature of that role.

Topic Area: EXECUTIVE PROCESSES: Other

Effect of deep brain stimulaton of the subthalamic nucleus in Parkinson's disease on verbal fluency

Poster F36, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Friederike Leimbach[1], Socorro Pieters[1], Catherine Cheung[1], Leonora Wilkinson[1], Donna Page[1], Catherine Jones[1], Ludwig Zinzro[1], Marwan Hariz[1], Tom Foltynie[1], Patricia Limousin[1], Marjan Jahanshahi[1]; [1]UCL Institute of Neurology

Verbal fluency involves a set of executive processes and rerieval of information from memory. Studies investigating the cognitive effects of subthalamic nucleus (STN) deep brain stimulation (DBS) have consistently revealed a decline of patients' verbal fluency after surgery (Combs et al., 2015). However, the exact mechanisms of these deficits remain to be investigated. The aim of this study was to investigate the effects of STN DBS on different aspects of verbal fluency. 19 patients with Parkinson's disease (PD) were assessed within a month prior to STN DBS surgery and 12-24 months after surgery with STN-DBS on and on medication on both occasions. Three verbal fluency tasks were completed: phonemic, semantic and alternating category. In addition to the number of words correctly generated, the size of the phonemic and semantic clusters and the number of phonemic and semantic switches were recorded. The results indicated significant post-surgical decline in phonemic, semantic and alternating category fluency. The number of phonemic switches was significantly reduced after surgery for both phonemic and semantic fluency tasks. This finding is consistent with previous observations of a positive correlation between the number of words generated and the measure of switching with increased gamma band activity in the local field potentials recorded from the implanted electrodes in the STN in PD patients while they performed phonemic and semantic fluency tasks (Anzak et al, 2011). The significant reduction of switching following surgery suggests that STN DBS alters functioning of fronto-striatal circuits involved in executive functions.

Topic Area: EXECUTIVE PROCESSES: Other

Inhibition and Updating Abilities Predict Dyslexia and Comorbid Dyslexia- Attention Deficit Hyperactivity Disorder in Children

Poster F37, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Caoilainn Doyle[1], Lorraine Boran[1], Alan Smeaton[1], Geraldine Scanlon[1]; [1]Dublin City University

Dyslexia and ADHD appear behaviorally distinct, yet, high comorbidity suggests shared neurocognitive underpinnings. Executive function (EF) is a candidate factor for explaining both, as it appears to be a trans-diagnostic factor differentially implicated in neuro-developmental conditions. Despite extensive research, it is unclear how EF is implicated in dyslexia and comorbid dyslexia-ADHD. Addressing methodological issues from previous EF profiling studies this study aims to examine EF in both conditions using Miyake's 3-factor model, and explore the predictive ability of EF for diagnoses of both conditions. Seventy one children (27 dyslexia, 15 comorbid, 28 control) aged 10-12 years completed a battery of executive function (inhibition, updating and switching) and reading measures. Applying a Bonferroni correction ($p<.004$), dyslexia and comorbid dyslexia-ADHD demonstrated significant impairments relative to controls on inhibition (dyslexia: $F(1,53)= 9.29$, $=9.29$, $p=.004$, $d=1.01$; comorbid: $F(1,40)=11.55$, $p=.002$, $d=1.49$) and reading (dyslexia: $F(1,54)=56.60$, $p=.000$, $d=2.0$; comorbid: $F(1,42)=59.58$, $p=.000$, $d=2.47$); and a trend ($p<.05$) for impairments on updating (dyslexia: $F(1,53)=5.68$, $p=.021$, $d=.86$; comorbid: $F(1,41)=8.49$, $p=.006$, $d=1.28$). Both groups (dyslexia and comorbid dyslexia-ADHD) did not significantly differ from each other on EF or reading measures. Inhibition and updating scores significantly predicted both conditions (dyslexia: $X2(2) =20.86$, $p<.001$, $R2=.42$ (Nagelkerke); comorbid: $X2(2) =24.10$, $p<.001$, $R2=.61$ (Nagelkerke)), demonstrating good classification (dyslexia: sensitivity: 77.8%, specificity: 78.6%; comorbid: sensitivity: 78.6%, specificity: 100%) and accuracy (dyslexia: AUC=.825, 95% CI: .72-.94; p=.000; comorbid: AUC=.901; 95% CI: .77-1.0; p=.000). Results suggest inhibition and updating are shared neurocognitive factors implicated in both conditions, and may be candidate factors for targeted intervention.

Topic Area: EXECUTIVE PROCESSES: Other

The unique neural signatures of cognitive flexibility and inhibitory control across various task contexts

Poster F38, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Raluca Petrican[1], Cheryl Grady[1,2]; [1]Rotman Research Institute, [2]University of Toronto

The neural mechanisms underlying dispositional variations in cognitive control are key to adaptive functioning, but remain poorly understood. To shed some light on this issue, we examined age- and state-related variations in the neural architecture associated with two cognitive control functions, mental flexibility and inhibitory control. We thus used whole-brain functional connectivity measures from a young to middle-aged sample (N= 359), collected during rest and tasks varying in cognitive load and motivational relevance. Reliable signatures of dispositional inhibition and flexibility were observed in systems involved in sustained control (cingulo-opercular [CON]), purposeful external attention (dorsal attention [DAN]), internal cognition (default mode, [DMN]) and top-down (frontoparietal [FPC]) versus bottom-up (salience [SAL]) control initiation. In the high motivational relevance condition, reliable neural signatures emerged only for inhibition, particularly among younger individuals. Superior inhibition predicted greater CON, DAN, DMN and SAL segregation and stronger perceptual-to-DAN connectivity, implying more efficient processing of motivationally relevant information and greater susceptibility for such information to influence behavior (via the SAL). Under high cognitive load, poorer performance due to reduced flexibility versus inhibition was linked to distinct connectivity patterns. Specifically, the former was typified by lower CON, DAN and FPC whole brain integration, especially among younger adults. Poorer cognitive performance due to reduced inhibition was related to stronger control (FPC, CON, SAL) connectivity with perceptual (visual) and motivational relevance (subcortical) systems. Our results highlight the distinct neural mechanisms through which flexibility versus inhibition impact cognitive performance and the bidirectional relationship between motivational and inhibitory processes in young adulthood.

Topic Area: EXECUTIVE PROCESSES: Other

Placebo Brain Stimulation Affects Feelings of Agency and Neural Responses to Errors

Poster F39, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Michiel van Elk[1], Suzanne Hoogeveen[2], Uffe Schjoedt[3]; [1]University of Amsterdam, [2]University of Amsterdam, [3]University of Arhus

The aim of this EEG study was to investigate whether belief in cognitive enhancement through neurostimulation can affect feelings of agency and neural markers of distress in response to errors. Participants were exposed to a placebo brain stimulation device while performing a Flanker task. The expectations regarding brain stimulation were manipulated by using a placebo condition (i.e., cognitive enhancement), a nocebo condition (i.e., cognitive impairment) and a control condition (i.e., no effect of brain stimulation). The placebo / nocebo manipulation affected subjective, but not objective performance (reaction times and error rates). An effect of our experimental manipulation on feelings of agency and the error related negativity (ERN) was found: participants attributed errors more often to the brain stimulation device in the nocebo condition compared to the control and the placebo condition. In addition, a stronger ERN was observed in the placebo compared to the control and the nocebo conditions. The amplitude of the ERN was related to feelings of agency, reflecting that a stronger tendency to attribute the error to the brain stimulation device was associated with a reduced ERN amplitude. These findings indicate that unfulfilled beliefs about cognitive enhancement cause personal distress and highlight the potential of placebo brain stimulation as a powerful technique in cognitive experimental research.

Topic Area: EXECUTIVE PROCESSES: Other

The influence of different feature repetition conditions on the sequential modulation of the Simon effect: An EEG study

Poster F40, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Katharina Hoppe[1], Kristina Küper[1], Edmund Wascher[1]; [1]Leibniz Research Centre for Working Environment and Human Factors (IfADo)

In stimulus-response compatibility tasks, subjects show a better performance when stimulus features and the required response are compatible. In the Simon task, for example, responses are faster when the task-irrelevant stimulus location corresponds to the response location compared to when they are non-corresponding. Interestingly, this Simon effect is reduced after non-corresponding trials, which is often described as a phenomenon of conflict adaptation. Due to inherent repetitions of task features, these sequential modulations are also explainable by feature integration and/or priming effects. For this reason, we investigated sequential modulations of the Simon effect while controlling for feature integration as well as for priming effects. By using a Simon task mapping four stimuli to two response keys, we created three subsets containing trials with different feature repetition conditions: 1) repetition of all task features, 2) repetition of response and irrelevant stimulus position, but an alternation of the relevant stimulus identity and 3) repetition of irrelevant stimulus location and an alternation of all task features. Overall, the data pattern shows a huge performance advantage for the first subset. While this might reflect underlying priming effects, this pattern does not display feature integration effects. Furthermore, within each subset sequential modulations of the Simon effect were found. Since subsequent stimuli were controlled for feature repetitions, conflict adaptation effects might explain this result best. In order to investigate differences between the subsets with respect to underlying cognitive control, response selection and priming processes, we analysed event-related potentials, i.e. N2, P3 and N2pc, of the EEG.

Topic Area: EXECUTIVE PROCESSES: Other

Decoding Free Choices: Influences of Unconscious Priming on Voluntary Actions

Poster F41, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Martyn Teuchies[1], Jelle Demanet[1], Nura Sidarus[2], Patrick Haggard[2], Michaël Stevens[1], David Wisniewski[1], Marcel Brass[1]; [1]Ghent University, [2]University College London

The ability to make voluntary, free choices is fundamental to what it means to be human. A key brain region that is involved in free choices is the rostral cingulate zone (RCZ), which is part of the medial frontal cortex. Previous research has shown that activity in this brain region can be modulated by bottom-up information while making free choices. The current study extends those findings, and shows, for the first time, that activation in the RCZ can also be modulated by subliminal information. We used a subliminal response priming paradigm to bias free and cued choices. Using univariate fMRI analyses we observed more activation in the RCZ when participants made a choice that went against the prime's suggestion, compared to when they chose according to the prime. This shows that the RCZ plays an important role in overcoming externally-triggered conflict between different response options, even when the stimuli triggering this conflict are not consciously perceived. We also carried out a multi voxel pattern analysis (MVPA) to investigate which brain areas contained predictive information about the choice a participant would make. We used a whole brain searchlight analysis to decode whether participants were going to make a left or right response. Based on previous studies we then looked at the predictive information in predefined ROIs in the precuneus and the anterior medial frontal cortex. We could predict free choices above chance level from the pattern of brain activity in the precuneus but not in the anterior medial frontal cortex.

Topic Area: EXECUTIVE PROCESSES: Other

Learning of Adjacent and Non-adjacent Regularities in a Visuo-Syllabic Sequential Learning Task Using Event-Related fMRI

Poster F42, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Leyla Eghbalzad[1], Joanne Deocampo[1], Gretchen Smith[1], Gerardo Valdez[1], Sabrina Na[1], Tricia King[1], Christopher Conway[1]; [1]Georgia State University

The ability to learn sequential dependencies from the environment is important for language acquisition and skill development. Recent studies suggest there may be separate cognitive processes involved in learning adjacent versus non-adjacent dependencies, but the underlying neural correlates accompanying such learning are under-specified. We developed a novel visuo-syllabic sequential learning task, in which printed nonsense syllables were presented sequentially on the screen, generated from an artificial grammar that dictated adjacent and non-adjacent dependencies. Following exposure to grammatical sequences, sixteen healthy adults (age M=22.5, 9 females) used a keyboard to reproduce novel grammatical as well as ungrammatical sequences containing violations of the adjacent or non-adjacent dependencies. We used fMRI with a 3T scanner to evaluate BOLD activity while participants performed a familiarity judgment task in the scanner. The imaging analyses revealed significant bilateral activation of middle frontal gyrus (Brodmann areas [BA] 9 & 10) and left lateralized activation of precuneus and lingual gyrus (BA 7 & 18) for the ungrammatical compared to grammatical sequence contrast. Furthermore, increased activation in BA 7 & 18 correlated with participants' behavioral learning of adjacent dependencies (r_s= .50, $p<0.05$) whereas activation in BAs 9 &10 correlated with Digit Span Backwards (r_s= .58, $p<0.05$) and processing speed (r_s= .51, $p<0.05$). Results suggest that learning of structured sequences involves posterior perceptual and frontal brain regions, with posterior regions associated with adjacent-item pattern learning and frontal regions associated with working memory and processing speed, likely required to learn non-adjacent dependencies.

Topic Area: EXECUTIVE PROCESSES: Other

Neuroanatomical Substrates Underlying the Relationship Between Body Mass and Cognitive Functioning

Poster F43, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Leonard Faul[1], Kathryn M. Mattingly[1], Brendan E. Depue[1]; [1]University of Louisville

The human brain underlies the complex cognitive processes of the mind, however, this is dependent upon the physiological processes of the body in order to receive adequate energy, oxygen, and blood flow. Therefore, physical measurements such as body mass index (BMI) and indices of cognitive functioning, such as intelligence, may be related to certain brain features. Furthermore, an investigation of the neural components underlying these two behavioral measurements may provide better insight as to how they interact with one another. Current analyses assessed morphometric differences in cortical and subcortical grey matter regions, as well as indices of white matter integrity, in order to determine what combinations of neural variables predict BMI and intelligence (Wechsler Abbreviated Scale of Intelligence; WASI) with the best degree of accuracy. Data for eighty-five subjects was obtained from the Nathan Kline Institute. Results indicated a negative correlation between BMI and WASI scores. Cortical analyses revealed that increased BMI predicted decreased thickness in the left anterior cingulate cortex, known to be involved in cognitive control. Whereas, increased WASI scores predicted increased thickness and volume of prefrontal and parietal cortices, which reflect brain regions involved in the fronto-parietal attentional network. Subcortical analyses showed that increased BMI predicted increased volume in numerous structures, most notably the right amygdala. Increased WASI scores related to larger bilateral putamen volume. Increased BMI was also associated with reduced structural integrity in the right corticospinal tract. These results indicate that BMI and intelligence are behaviorally anticorrelated, yet mediated by separate neuroanatomical substrates.

Topic Area: EXECUTIVE PROCESSES: Other

Impulsivity and the Reward System: Negative and Positive Urgency are Associated with Neural Reward Sensitivity

Poster F44, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Michelle Rogers[1], Heather Soder[1], Geoffrey Potts[1]; [1]University of South Florida

Impulsivity is characterized by a propensity for risk-taking behavior and has been associated with neural reward sensitivity using Event-Related Potential (ERP) components thought to index reward system function: the Error and Feedback Related Negativities (ERN & FRN) and the Reward Positivity (RewP). Because impulsivity is a multidimensional construct, it is unknown if only some aspects of impulsivity are related to reward system function. This study examined the relationships between component constructs of impulsivity by relating different subscales of the UPPS-P self-report impulsivity assessment instrument – Positive and Negative Urgency (PU and NU), (Lack Of) Premeditation (LOPre), (Lack Of) Perseverance (LOPer), and Sensation Seeking (SS) Scale – to the reward-related ERPs in three different tasks: a passive reward prediction task with predicted and unpredicted rewards and non-rewards, a reward motivated flanker task, and the Balloon Analogue Risk Task. NU and PU had significant but weak associations with the reward-related ERPs across tasks and conditions, with NU predicting more positivity (enhanced RewP and/or reduced ERN/FRN) and PU predicting more negativity (reduced RewP and/or enhanced ERN/FRN). Generally it appears NU is associated with a greater reward response and PU with a greater punishment response. LOPre, LOPer, and SS had stronger, more task and condition specific associations, indicating that SS was associated with positive outcomes and LOPre with more negative outcomes. This suggests that different aspects of impulsivity are differentially associated with reward and punishment sensitivity.

Topic Area: EXECUTIVE PROCESSES: Other

Pre- and Post-treatment Effects on Resting-State Functional Connectivity in Women Diagnosed with Breast Cancer

Poster F45, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Omid Kardan[1], Scott Peltier[2], Bratislav Misic[3], Mary Askren[4], Misook Jung[5], Nathan Churchill[6], Patricia Reuter-Lorentz[2], Bernadine Cimprich[2], Marc Berman[1]; [1]University of Chicago, [2]University of Michigan, [3]Montreal Neurological Institute, [4]University of Washington Seattle, [5]Chungnam National University, [6]Keenan Research Centre of the Li Ka Shing Knowledge Institute, St. Michael's Hospital

Previous studies have linked distress, worry, and fatigue associated with cancer diagnosis to decreased functional connectivity and reduced Hurst exponent (H) of the BOLD signal, a measure of scale-free brain dynamics, in brain regions associated with attention and memory. Additionally, chemotherapy patients are reported to have higher spatial variance in executive network fMRI activation than non-chemotherapy (only radiation and/or endocrine therapy) and healthy controls when performing working memory tasks. In this study we investigated functional connectivity in patients treated with (n = 18) or without (n = 22) chemotherapy for localized breast cancer and healthy aged-matched controls (n = 22) during rest (eyes open). fMRI data collection occurred at three time points: diagnosis (M0, pre-adjuvant treatment), at least 1 month (M1), and 7 months (M7) after treatment, chemotherapy/radiation therapy. We used Preprocessing Optimization Toolkit (PRONTO) to preprocess the resting-state data, and then divided the brain into 116 regions using Automated Anatomical Labeling (AAL). Our analysis used Partial Least Squares (PLS) to compare the functional connectivity of the regions among the three time points for each group. Compared to healthy controls, we found a global increase in functional connectivity comparing M1 and M7 for both patient groups, with the radiotherapy group having more wide-spread increase in functional connectivity than the chemotherapy group. Possible reasons for the increases in patients' resting-state functional connectivity over time such as diminished anxiety/worry is discussed.

Topic Area: EXECUTIVE PROCESSES: Other

Alpha-Band Power: Relevance to Visual Short-Term Memory Maintenance and Ongoing Visual Sensory Processing.

Poster F46, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Andrew Heinz[1], Jeffrey Johnson[1]; [1]North Dakota State University

Studies exploring the role of neural oscillations in cognition have revealed sustained increases in alpha-band power (ABP) during the delay period of visual short-term memory (STM) tasks. There have been various proposals regarding the functional relevance of these increases, including the inhibition of task-irrelevant processes, and the active retention of information in STM. The present study attempts to reconcile these alternatives by recording EEG while participants performed a delayed recall task in which they were required to maintain the orientation of a single Gabor patch across a delay. In the primary experiment, a second task-irrelevant Gabor was presented mid-way through the delay. We then used a forward encoding model to derive orientation-specific channel tuning functions (CTFs). We reasoned that, if the distributed pattern of delay-period ABP reflects the mnemonic information supporting recall in this task, item identity should be decodable from this distributed pattern both prior to and following the presentation of the distractor. Additionally, if this pattern reflects inhibition of task-irrelevant visual processing, the magnitude of the global distractor-evoked response (GMFP) should differ as a function of CTF amplitude and dispersion. Our results were consistent with both of these hypotheses; item identity was decodable throughout the retention interval, whether a distractor was presented or not, and decoding ability was predictive of the distractor evoked response. These findings provide further evidence suggesting that delay-period ABP supports STM maintenance by selectively inhibiting task-irrelevant features along the task-relevant dimension.

Topic Area: EXECUTIVE PROCESSES: Working memory

Rapid synaptic plasticity as a substrate for working memory maintenance

Poster F47, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Eelke Spaak[1], Christos Constantinidis[2], John Duncan[1,5], Timothy Buschman[3], Earl Miller[4], Mark Stokes[1]; [1]University of Oxford, [2]Wake Forest University, [3]Princeton University, [4]Massachusetts Institute of Technology, [5]University of Cambridge

Recent theoretical models suggest that rapid, temporary changes in effective synaptic connectivity could play a crucial role in maintaining information in working memory. Short-term synaptic plasticity could thus provide a neurophysiological basis for WM maintenance in an 'activity-silent' form, which is energy-efficient and robust to interference. Despite theoretical appeal, directly testing such models remains difficult, as it requires the simultaneous recording of large numbers of neurons and their connectivity strengths. The latter is particularly hard to estimate in populations of sparsely firing PFC neurons. We now overcome these challenges by pooling data from a large archive of experiments involving simultaneous recordings from multiple neurons of non-human primate PFC. We have developed a novel, powerful method for the detection of synaptic connectivity from such large data sets, based on Bayesian inference for stochastic point processes. We demonstrate that our method has both a high sensitivity and specificity in recovering effective connectivity patterns. We leverage this novel method and the large amount of data to directly test the hypothesis of synaptic WM maintenance. Our results indicate an important role for rapid synaptic plasticity in the maintenance of WM, thus extending classical persistent-firing based models.

Topic Area: EXECUTIVE PROCESSES: Working memory

Synchronous Beta Rhythms of Frontoparietal Networks Support Only Behaviorally Relevant Representations

Poster F48, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Evan G. Antzoulatos[1,2], Earl K. Miller[1]; [1]Massachusetts Institute of Technology, [2]University of California, Davis

Categorization has been associated with distributed networks of the primate brain, including the prefrontal (PFC) and posterior parietal cortices (PPC). Although category-selective spiking in PFC and PPC has been established, the frequency-dependent dynamic interactions of frontoparietal networks are largely unexplored. We trained nonhuman primates to perform a delayed-match-to-spatial-category task while recording spikes and local field potentials from the PFC and PPC with multiple electrodes. We found category-selective beta- and delta-band synchrony between and within the areas. However, in addition to the categories, delta synchrony and spiking activity also reflected irrelevant stimulus dimensions. By contrast, beta synchrony only conveyed information about the task-relevant categories. Further, category-selective PFC neurons were synchronized with PPC beta oscillations, while neurons that carried irrelevant information were not. These results suggest that long-range beta-band synchrony could act as a filter that only supports neural representations of the variables relevant to the task at hand.

Topic Area: EXECUTIVE PROCESSES: Working memory

Exploring Grey and White Matter Correlates of Verbal Working Memory Using Structural Imaging

Poster F49, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Maria Ivanova[1,2], Olga Dragoy[1,3], Svetlana Kuptsova[1,4], Akinina Yulia[1,5], Petryshevskii Alexey[4], Fedina Oksana[4], Dronkers Nina[1,2,6]; [1]National Research University Higher School of Economics, Moscow, Russia, [2]Center for Aphasia and Related Disorders, VA Northern California Health Care System, Martinez, California, USA, [3]Moscow Research Institute of Psychiatry, Moscow, Russia, [4]Center for Speech Pathology and Neurorehabilitation, Moscow, Russia, [5]University of Groningen, Groningen, The Netherlands, [6]University of California, Davis, California, USA

We investigated the neural substrate of verbal working memory (WM) with a contemporary method of lesion analysis – voxel-based lesion symptom mapping (VLSM) – and analysis of integrity of fiber pathways as revealed by diffusion-tensor imaging. We administered two most common verbal WM tasks – complex listening span and word 2-back – to individuals with left hemisphere stroke (n=41). Lesions were traced manually in native space based on T1 (1 mm isovoxel), T2, FLAIR images, and then registered to the MNI template for VLSM analysis. The fractional anisotropy (FA) metric derived from diffusion-weighted images (bval=1000, dir=20, 2 repetitions, 2.7 mm isovoxel) was used to evaluate integrity of major left hemisphere white matter tracts. Results of the VLSM analyses revealed that critical regions for successful performance on the complex span task were in the inferior and middle frontal gyri, while for the 2-back task they were in the superior and middle temporal gyri. Correlational analyses of mean FA from tracts with WM measures revealed significant relationship between temporal tracts and performance only for the complex listening span task. Thus, the two tasks depend on the structural integrity of different, non-overlapping frontal and temporal grey and white matter brain regions, suggesting distinct neural and cognitive mechanisms triggered by the two tasks. The present study demonstrated that the substrate for verbal WM has been misrepresented in the past due to an over-reliance on functional neuroimaging data, and that the mechanisms of each task have been unjustly ignored in the interpretation of observed findings.

Topic Area: EXECUTIVE PROCESSES: Working memory

Superior Longitudinal Fasciculus and Working Memory Functions Post Stroke: A Diffusion Tensor Imaging Study

Poster F50, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Parminder Kaur[1], Alexandra L. Borstad[1], Petra Schmalbrock[2], Nick Hohman[1], Deborah S. Nichols-Larsen[1]; [1]School of Health and Rehabilitation Sciences, The Ohio State University, [2]Department of Radiology, College of Medicine, The Ohio State University

Objective: To study the: 1) structural connectivity changes in the superior longitudinal fasciculus (SLF) and inferior longitudinal fasciculus (ILF) poststroke and 2) relation of these networks' integrity to cognitive, somatosensory and manual dexterity function. Methods: 12 chronic post-stroke subjects and 12 age, gender and handedness matched controls were enrolled and evaluated on Paced Auditory Serial Addition Test (PASAT), Hand Active Sensation Test (HASTe), Brief Kinesthesia Test (BKT), Manual Form Perception Test (MFP) and Box and Block Test (BBT). Diffusion Tensor Imaging (DTI) data was collected for all subjects, and Tract-based spatial statistics (TBSS) were used to examine the DTI data. Fractional anisotropy (FA) and mean diffusivity (MD) of the left and right SLF and ILF were evaluated. Results: There was a significant difference between groups on SLF FA and SLF MD values and, across the whole group SLF MD correlated with the HASTe (r=-0.588, 0.002), MFP (r=0.572, 0.004), PASAT (r=-0.587, 0.005), and BKT (r= -0.510, 0.011) scores. Conclusion: SLF's altered white matter impacts working memory for cognitive, sensory discrimination and kinesthesia, which contributes to poorer recovery of hand dextrerity function.

Topic Area: EXECUTIVE PROCESSES: Working memory

Corticostriatal activity during task-free fMRI to predict cognitive control performance

Poster F51, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Alan Ceaser[1], Jong Yoon[1]; [1]Stanford University

A number of recent studies have shown that task-free Magnetic Resonance Imaging (MRI) can reveal reliable information about brain functioning during task performance. For example, Tavor et al. (2016) found that, using task-free resting state data, they could predict cortical activation during task-based functional MRI for a variety of cognitive domains. We were interested in investigating whether corticostriatal connectivity could be used to predict behavioral cognitive control performance. We recruited 18 individuals who underwent a 10 minute task-free MRI scan, followed by a computer test of cognitive control involving updating, interference control, and maintenance conditions. We used anatomical striatal seeds divided into tripartite divisions (associative, limbic, and motor) characterized by DiMartino et al. (2008). Correlation maps of the cortex using these seeds were created and were used in a regression model to determine what regions predicted task activity. We predict that task-free connectivity between the associative striatum seed and dorsolateral prefrontal cortex will predict activity during the updating condition. We also predict that connectivity between the associative striatum and the anterior cingulate and dorsolateral prefrontal cortex during task-free MRI will predict interference control activity. These findings will support other work suggesting that neural networks at rest are continuously interacting with each other, and that this activity can be leveraged to provide information about behavioral function.

Topic Area: EXECUTIVE PROCESSES: Working memory

Neural Mechanisms underlying the Precision of Visual Working Memory Representation

Poster F52, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Yijie Zhao[1], Yixuan Ku[1]; [1]East China Normal University, Shanghai, China

Working memory (WM) is a fundamental cognitive function but its capacity is severely limited. Furthermore, the quality of WM representation is restricted as well. This study aims to explore the neural mechanism underlying the precision of visual WM representation. Thirteen participants performed an orientation recall task (WM load with 1\2\4\6 bars) inside and outside an MRI scanner. Inside the MRI scanner, sample stimuli (bars) were presented for 0.5s and an 8s-delay followed. Participants were asked to recall the orientation of one of the bars (indicated on the screen) and used a mouse to adjust the bar to the orientation they remembered. Outside the MRI scanner, the sample and delay periods were 0.5s and 1s, respectively. The error angles between the response orientation and the original orientation were calculated and modeled to draw the precision for WM representation. Results showed that the BOLD signal of the parietal and frontal cortex increased with load during the delay period of WM, which is consistent with previous studies. Moreover, trials remembered with smaller error angles activated the middle occipital lobe, compared with those trials with larger error angles. The activity in the middle occipital lobe was further correlated with the precision calculated from the behavior experiment outside the scanner in the individual level, when WM load was below WM capacity. Keywords : working memory precision, recall task, fMRI, visual cortices

Topic Area: EXECUTIVE PROCESSES: Working memory

Delay-period functional connectivity between IPS and occipital cortex relates to the precision of visual working memory

Poster F53, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Qing Yu[1], Olivia Gosseries[1,2], Bradley Postle[1]; [1]University of Wisconsin-Madison, [2]University of Liege, Belgium

Previous studies on visual working memory (VWM) revealed the involvement of both the parietal and occipital cortex in memory maintenance. However, how the parietal (e.g., intraparietal sulcus) and occipital cortex interact during memory delay and how this interaction relates to behavior remain to be further examined. In the current study, we manipulated participants' memory load by manipulating the number and category of the to-be-remembered items. On each trial, participants remembered the direction of one group of moving dots (1M), or three directions of serially-presented moving dots (3M), or one motion direction and two different color circles (1M2C). At the end of each trial, participants recalled either the motion direction or the color of one of the items as instructed on a motion or color wheel. We computed the Beta Series Correlation (BSC) between IPS and occipital cortex as the functional connectivity measure, and examined how this connectivity relates to behavioral mnemonic precision across loads. Our results demonstrated that, increased functional connectivity between IPS and occipital cortex was correlated with decreased behavioral precision across loads (1M-1M2C-3M) for individual participants. This effect was mainly driven by the relationship between the 1M and 3M conditions, and was more prominent in the anterior part of IPS. Furthermore, significant correlation was only observed for the delay-period, but not for the sample-period connectivity. These results provided evidence for the behavioral relevance of the modulation of IPS on the occipital cortex during VWM delay.

Topic Area: EXECUTIVE PROCESSES: Working memory

Does the binding of a feature into a multidimensional object protect it from inferference in visual working memory?

Poster F54, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Muhammet Ikbal Sahan[1,2], Andrew Douglas Sheldon[1], Bradley Postle[1]; [1]Dept. of Psychiatry, University of Wisconsin-Madison, USA, [2]Dept. of Experimental Psychology, Ghent University, Belgium

Is the elemental unit of visual working memory (VWM) storage the feature or the object? To address this question, we leveraged the fact that behavioral and neural measures of the precision of single-feature stimuli drop monotonically with increasing load. Would this load effect be decreased if the features being tested were part of a multidimensional object? That is, does being bound to an object partly insulate a stimulus feature from within-category interference? To assess this, we tested subjects with two procedures. In the first, two multidimensional objects (colored dots drifting coherently in one direction) were presented as memoranda, followed by a retrospective cue instructing the subject to retain either one of the two objects, or one of the two features (i.e., the color or the direction of each stimulus). In the second procedure subjects were presented two unidimensional stimuli as memoranda (either two colors, two motion directions, or one color and one motion direction) and then probed. Thus, all conditions were at a load of two, with varied levels of "boundedness" and category homogeneity. Precision of VWM for color was lower than for motion, and color VWM was insensitive to either manipulation. The precision of VWM for motion, however, was highest in trials in which the second memorandum was a color, regardless of whether the two were bound into a single object or presented as two distinct items. These results suggest that interference between individual features, rather than objects, may be the most important factor in determining VWM capacity limitations.

Topic Area: EXECUTIVE PROCESSES: Working memory

Oscillatory dynamics differ between nonverbal/minimally-verbal children with ASD and controls during processing of a picture-word matching paradigm.

Poster F55, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Silvia Ortiz-Mantilla[1], Chiara Cantiani[2], Valerie L. Shafer[3], April A. Benasich[1]; [1]Center for Molecular and Behavioral Neuroscience, Rutgers University-Newark, NJ, USA, [2]Scientific Institute IRCCS Eugenio Medea, Bosisio Parini, Lecco, Italy, [3]The Graduate Center, City University of New York, New York, USA

When children with Autism Spectrum Disorder (ASD) are nonverbal (NV) or minimally-verbal (MV), it is a challenge to determine whether they perceive and comprehend incoming speech information. In a recent ERP study using a picture-word matching paradigm, 4- to 7-year-old MV/NV children with ASD showed relatively intact early sensory processing but abnormal lexical-semantic processing compared to age/gender-matched controls. In adults, processing of semantic incongruence, reflected by the N400 electrophysiological component, is thought to be supported by theta power increases in both match and mismatch conditions but gamma power increases have only been seen for matching information. However, whether similar oscillatory dynamics can index semantic processes in NV/MV children with ASD is unknown. To investigate the oscillatory underpinnings of these ERP responses, source generators were identified and time-frequency analyses were conducted in the 2-90Hz-frequency range within source space. At the perceptual level, 3 sources explained ~90% of variance, while a multi-dipole model explained most of the N400 variance. We found that control children, similar to adults, produced larger frontal gamma power to match than to mismatch conditions whereas ASD children, in general, demonstrated less theta and gamma power than controls for matches but increases in left frontal gamma power for the mismatch. These results align well with the theory that imbalances between inhibitory and excitatory oscillatory activity could be one factor that explains linguistic differences observed in ASD groups and further, may well advance our basic understanding of the neural mechanisms that support both typical and atypical semantic processing in children.

Topic Area: LANGUAGE: Development & aging

Disrupted Language Networks Following Childhood Poverty

Poster F56, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Suzanne Perkins[1], Shaun Ho[2], James Swain[2]; [1]University of Michigan, [2]Stony Brook University

Poverty is associated with deficits in brain regions necessary for typical language development, including deficits in the Wernicke's, hippocampus structural differences, and cognitive control region dysfunction. Other work has indicated less left-right asymmetry associated with childhood poverty. The goal of the present study is to examine phonological processing in adults from childhood poverty backgrounds to build a neurofunctional model of the brain basis of language delays associated with childhood poverty. Adults from the fourth wave of a longitudinal cohort with half below the U.S. poverty level (n = 24) and half above the poverty level (n = 27) were presented an event related speech/print phonological processing task during fMRI and behavior measures of language processing outside of the scanner. The childhood poverty group performed worse on behavioral measures of language processing (visual, $f(47) = 2.33$; spoken, $f(47) = 2.46$, $p < .05$). Controlling for behavioral language performance the control group exhibited increased Broca's/IFG function and coupling within the region, which supports our hypothesis that adults from mid SES backgrounds would show strength in language processing regions. The childhood poverty group showed greater coupling between ventral Broca's and the middle temporal gyrus below the Wernicke's, suggesting a reliance on the ventral language pathway, associated with sound-meaning correspondence and may suggest less automaticity with common words. Childhood poverty group exhibited connectivity between both the ventral Broca's and Wernicke's and the right IFG, a pattern similar to that seen in dyslexics.

Topic Area: LANGUAGE: Development & aging

Speech-evoked complex Auditory Brain Response (cABR) and Frequency Following Response (FFR) in the Neonatal Intensive Care Unit (NICU)

Poster F57, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Gabriella Musacchia[1,2], Jiong Hu[1], Matthew Fitzgerald[2], Meiling Tong[3]; [1]University of the Pacific, [2]Stanford Medical School, [3]Nanjing Maternity and Child Health Care Hospital

Abnormal development of the auditory system can have a profound effect on hearing and language outcomes. However, the incidence, severity and time course of central auditory system abnormalities (inclusive of bilirubin binding status, concurrent morbidities, etc.) in at-risk infants is not known. While the Automatic Auditory Brainstem Response (AABR), the current "gold standard" for universal hearing screening, is routinely used in neonatal intensive care units (NICUs) and used to assess peripheral auditory function, it is not designed to detect central auditory processing abnormalities. Potentially more useful measures are the complex ABR (cABR) and Frequency Following Response (FFR) which are similar in protocol to the AABR, but use speech stimuli that can capture more subtle aspects of central auditory system neuromaturation and injury. To determine neurological changes associated with infant health, we recorded cABRs to the speech syllable /da/ and FFRs to an /i/ syllable with a falling pitch contour at two time points in the NICU. Results showed that infants had significantly stronger onset responses of the cABR and more robust FFR encoding closer to their release date, compared to earlier in their NICU stay. Lower bilirubin binding levels were associated with more robust frequency following. The outcomes of this study, with continued data collection, may help identify the severity of covert neurodevelopmental deficits during early infancy that are amenable to early intervention.

Topic Area: LANGUAGE: Development & aging

Investigating the relationship between socioeconomic status, reading ability and white matter: A longitudinal investigation

Poster F58, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Stephanie Del Tufo[1], Laurie Cutting[1]; [1]Vanderbilt University

Socioeconomic Status (SES) encompasses a broad array of experiences, including an individual's (or parent's) economic and social resources. Notably, children in low SES environments have poorer reading ability (Hoff et al. 2013). This suggests an underlying link between SES and reading ability. Studies of SES and brain structure have focused largely on gray matter differences, yet higher SES was also found to be associated with increased white matter (WM) (Chiang et al. 2011). Greater WM integrity (indexed via Fractional Anisotropy; FA) of the superior longitudinal fasciculus (SLF) was associated with higher educational attainment (Noble et al. 2013), and higher reading ability (Vandermosten et al. 2012). Despite this common neurobiological link, studies have not yet examined the relationships between SES, reading ability, and the SLF. It is not clear if the link between SES and the SLF stems from the variance in SES that is linked to reading ability, or if SES is uniquely linked to the SLF beyond its relationship with reading ability. In the current study, we asked if SES predicted FA in the SLF after controlling for reading ability. This relationship was explored longitudinally (Visit 1: n=105; 7.43 years, & Visit 2: n=88; 8.43 years) via a mixed linear regression. After controlling for reading ability, we found that SES predicted FA bilaterally in the SLF ($p < .05$). This indicates that children in higher socioeconomic environments have greater FA in the SLF, regardless of reading ability. Furthermore, this suggests that SES has a unique relationship with WM integrity.

Topic Area: LANGUAGE: Development & aging

Biomarkers of Children's Standardized Academic Achievement Using Neuroelectric Measures of Language Processing

Poster F59, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Mark Scudder[1], Kara Federmeier[2], Eric Drollette[2], Lauren Raine[3], Shih-Chun Kao[2], Naiman Khan[2], Arthur Kramer[3], Charles Hillman[3]; [1]University of Pittsburgh, [2]University of Illinois at Urbana-Champaign, [3]Northeastern University, Boston, MA

The goal of the current study was to determine whether event-related brain potentials (ERPs) may serve as novel biomarkers of children's standardized scholastic achievement, and predict greater learning over the academic year. Elementary-aged children (8-9 years, n=119) were followed over one school year and completed a standardized academic battery at baseline and post-test. The N400 ERP component, representing the extraction of semantic/meaning information from long-term memory, was recorded using a visually-presented reading comprehension task. Children were asked if sentences contained a "mistake" (50% probability), which occurred when the meaning of a critical/target word did not fit the context of the sentence (semantic violation), or a word resulted in a grammatical error (word-order or syntactic violation). Hierarchical regression analyses at baseline revealed that larger N400 amplitudes for both types of violations were independently related to superior academic performance (R2 = .039 - .079), particularly for language-based tests (i.e., reading, fluency, and listening), which remained significant when adjusting for important demographics. After controlling for the variance in baseline academic performance, larger N400 amplitude at baseline also predicted greater improvements in reading composite and decoding fluency scores one year later (R2 = .036 - .056), yet this relationship was observed for semantic violations only. Accordingly, the current results suggest that a specific ERP component can provide a valuable biomarker of children's scholastic achievement, as well as predict greater improvements in performance. Such findings may have important implications for children's learning by helping identify children at risk for poorer academic performance in school.

Topic Area: LANGUAGE: Development & aging

Speeded phonological processing in children with Tourette syndrome

Poster F60, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Cristina Dye[1], Matthew Walenski[2], Stewart H. Mostofsky[3], Michael T. Ullman[4]; [1]Newcastle University, [2]Northwestern University, [3]Johns Hopkins University, [4]Georgetown University

Tourette syndrome (TS) is characterized by motor and vocal tics, and is associated with frontal/basal ganglia abnormalities. Whereas previous research has revealed various cognitive strengths in other neurodevelopmental disorders, less attention has been paid to potential strengths in TS. Additionally, there is very little evidence of strengths in the verbal domain in any neurodevelopmental disorder. One exception is a previous finding of faster production by children with TS than typically-developing (TD) children of rule-governed morphological forms that involve composition (e.g., "walked"). Here we examined whether this strength in morphology might extend to another key domain of language: phonology (sound structure). Thirteen children with TS (mean age 12) and 14 age-matched TD children were given a non-word repetition task, in which they repeated complex phonological sequences (e.g., "naichovabe"). Previous evidence suggests that this task taps rule-governed (de)composition. Whereas the groups did not differ in accuracy, the children with TS were significantly faster. The results were not explained by potentially confounding variables, including IQ. The findings are striking both because they parallel those found for morphology, and because this task is typically impaired in neurodevelopmental disorders. We suggest that the morphological and phonological speeding in TS, as well as various other speeded behaviors previously reported in the disorder, may be best explained by the same frontal/basal ganglia abnormalities that lead to tics – which are fast and at least partly voluntary. It remains to be seen whether these brain abnormalities also lead to speeded behaviors of other functions that depend on this circuitry.

Topic Area: LANGUAGE: Development & aging

Induced oscillations during speaking distinguish variants of primary progressive aphasia

Poster F61, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Leighton Hinkley[1], Megan Cahill-Thompson[1], Zachary Miller[2], Kamalini Ranasinghe[2], Bruce Miller[2], Keith Vossel[2], John Houde[1], Marilu Gorno-Tempini[2], Srikantan Nagarajan[1]; [1]University of California, San Francisco, Department of Radiology and Biomedical Imaging, [2]University of California, San Francisco, Memory and Aging Center

Primary progressive aphasia (PPA) is symptomatically characterized into three main subtypes: a non-fluent variant (nfvPPA) associated with apraxia of speech, a logopenic variant (lvPPA) with a loss of phonological abilities, and a semantic variant (svPPA) with loss of word conceptual knowledge. Each variant is also associated with atrophy in specific regions of the left hemisphere language network. Despite this, the neurophysiological mechanisms that serve these deficits are not clear. Here, we use MEG during linguistic tasks to investigate phases of speech encoding and preparation in these PPA variants and matched controls. MEG data was collected using a 275-channel whole head biomagnetometer (CTF) during a nonsense word repetition task. Data were reconstructed in source space using adaptive spatial filtering techniques following the auditory presentation of a nonsense word (speech encoding) and prior to the subject repeating the word (speech production). In the high-gamma band, MEG source space reconstructions localized to the left posterior superior temporal gyrus (STG) 75ms following stimulus presentation in the nfvPPA, svPPA and control groups but not the lvPPA group. In addition, an increase in high-gamma suppression bilaterally over the inferior frontal gyrus (IFG) 475ms following stimulus presentation and 475ms prior to the response was present in the lvPPA, svPPA and control groups but absent in the nfvPPA group. The temporal resolution

of MEG allows us to separately examine activation in these brain regions during different phases of the task in detail. The findings demonstrate that MEG imaging can provide distinct neurophysiological signatures across these aphasia variants.

Topic Area: LANGUAGE: Development & aging

Comprehension of code-mixed sentences in bilingual elders: An event-related potentials (ERP) study

Poster F62, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Chia-Hsuan Liao[1,2], Shiao-Hui Chan[2]; [1]University of Maryland, [2]National Taiwan Normal University

Code-mixing, switching languages back and forth in a sentence, is common in bilingual societies. Existing studies show that processing code-mixed sentences induces processing costs, which can be modulated by factors such as switching direction and language use (Moreno et al., 2008). However, previous studies mainly focused on performance in younger adults, leaving the performance in bilingual elders relatively untouched. To fill in the gap, the current ERP study recruited 24 healthy native Mandarin-Taiwanese bilinguals (mean age: 67), proficient in both languages but more dominant in Mandarin as assessed by pre-tests. Four sentential conditions were manipulated: non-switched Mandarin (MM), non-switched Taiwanese (TT), switched from Mandarin to Taiwanese (MT) and switched from Taiwanese to Mandarin (TM). The subjects had to listen to the stimuli and perform a word recognition task in 20% of the trials. The results revealed that, switching into a less dominant language (MT vs. MM) elicited N200, N400, and a sustained negativity, while switching into a more dominant one (TM vs. TT) did not. This finding is comparable to what we found in younger adults (Liao & Chan, 2016), indicating that language use might affect sentence processing in both younger and older adults, with switching in the dominant-to-nondominant direction taxing more cognitive resources than the other direction. However, while the LPC was present in younger adults regardless of switching directions, it was absent in the elderly, suggesting that the elderly might not predict an upcoming sentence structure as much as younger adults do and thus reanalysis is less prominent.

Topic Area: LANGUAGE: Development & aging

Text type matters during reading development: informational texts require specialized brain networks compared to stories

Poster F63, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Katherine Aboud[1], Stephen Bailey[1], Jonathan Scheff[1], Laurie Cutting[1]; [1]Vanderbilt University

Successful reading comprehension in elementary school is a key predictor of long-term educational outcomes, and requires adequate skill in both narrative and expository/informational reading (e.g. stories versus science/history texts). The Common Core State Standards of education have recently emphasized the importance of expository reading by encouraging its introduction in first grade (~7 years old), rather than later elementary school. While behavioral studies suggest that expository texts require additional cognitive processes, no studies to date have examined whether comprehension of different text genres requires overlapping or distinct neural systems. In the current study, we tested for the first time whether, neurobiologically, expository text is simply "more difficult" narrative, or requires the development/use of specialized brain networks. To address this question, we used functional MRI to examine third graders (mean age = 9.4; n = 35) with typical word-level reading ability and IQ as they read narrative and expository passages. We found that both genres required recruitment of bilateral language areas as well as fronto-parietal, domain-general regions. However, while narrative text relied on the use of higher-order areas in the default mode network, expository texts involved robust recruitment of the frontoparietal control network—a system necessary for working memory and organizing information. In a key finding, readers who struggled with expository relative to narrative comprehension demonstrated less neural distinction between genres, particularly in the left prefrontal cortex. Our results imply that successful reading comprehension requires neural specialization for different types of texts—findings which have broad interventional implications for struggling readers.

Topic Area: LANGUAGE: Development & aging

Advance Paternal Age Effects on Offspring Academic Ability: The Role of Thalamic Maturation Links APA and Reading

Poster F64, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Zhichao Xia[1,2], Cheng Wang[1], Maaike Vandermosten[1,3], Roeland Hancock[1], Fumiko Hoeft[1,4,5]; [1]University of California, San Francisco, [2]Beijing Normal University, [3]University of Leuven, [4]Yale University, [5]Keio University

Advanced paternal age (APA) is associated with higher risk for neuropsychiatric disorders. Recently, APA has also been associated with impaired cognitive function and poorer academic performance including reading. None of the prior studies however, have taken into consideration reading-related measures such as family reading history, preliterate cognitive skills, or brain measures, leaving the cognitive and neurological mechanisms underlying the APA effect in reading virtually unknown. We addressed these issues by examining the relations among APA, offspring reading performance and brain development in a longitudinal neuroimaging study following

51 beginning readers (mean age 5.58 years) until they became proficient readers three-school years later. We for the first time confirmed a unique contribution of APA on offspring reading outcomes, independent of family reading history, socioeconomic status, home environment and preliterate precursors. Moreover, we found grey matter maturation in localized region in the left thalamus (especially pulvinar nucleus) mediated the APA effect on reading. To further understand the functional significance of this finding, we (1) compared the APA-related cluster with both histological and connectivity-based brain atlases, (2) calculated resting-state functional connectivity and co-activation maps by using a large dataset implemented in Neurosynth, and (3) examined functional and structural connectivity maps with a sub-group of participants. The results collectively suggested that the brain network for visuospatial attention might be the likely cognitive phenotype associated with APA. To summarize, this study provides novel insights into the neurocognitive mechanism underlying how APA may impact reading acquisition, which is independent from other familial factors and reading precursors.

Topic Area: LANGUAGE: Development & aging

Frontal and Central Sleep Spindles are Correlated with Cognition and Language in Napping Infants

Poster F65, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Sue E. Peters[1], April A. Benasich[2]; [1]Behavioral and Neural Science Graduate Program, Rutgers University - Newark, NJ, [2]Center for Molecular and Behavioral Neuroscience, Rutgers University - Newark, NJ

Sleep spindles, as neurophysiologic components of brain maturation, may serve as early biomarkers for neurodevelopmental disorders. They have been linked to cognitive measures across the lifespan, but few infant studies have considered behavioral correlates, and none have combined concurrent behavioral measures with dense-array EEG (dEEG) during the first year of life. The present study aims to characterize sleep spindle neurophysiology and topography of typically developing infants at 3.5 and 6.5 months, using dEEG. Standardized tests designed to measure infant cognitive and language development were administered, prior to a daytime nap. Infant sleep dEEG data (124 channels) were collected and analyzed using Matlab toolboxes. Spectral analysis of NREM 2/3 sleep stages was completed on all channels. Topographical plots of both absolute and relative power were generated for individuals and averaged for 3.5 (N=20), and 6.5 (N=19) month cross-sectional age groups. Within the spindle frequency range (10-16Hz), three clusters of high power activity are visible within both age groups: frontal, left and right central. In the frontal cluster, both relative power and peak frequency increases between the two age groups (3-months: 12.8Hz and 6-months: 13.2Hz), with a positive correlation between cluster power at individual peak frequencies and the cognitive score. Within the right and left central clusters, peak power decreases between groups, with no change in peak frequency (left: 13.1Hz, right: 13.4Hz). The left central spindle cluster power is negatively correlated with the receptive language score. Spindle characteristics and topography follow a developmental trajectory, which appears to align with cognitive behavioral changes.

Topic Area: LANGUAGE: Development & aging

Bilingual Proficiency is Associated with Cortical Responses During Language Processing

Poster F66, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Rebecca Marks[1], Zhichao Xia[2], Roeland Hancock[2], Yuuko Uchikoshi[3], Ioulia Kovelman[1], Fumiko Hoeft[2]; [1]University of Michigan, [2]University of California, San Francisco, [3]University of California, Davis

How does immersion in more than one language impact a child's language and literacy development? Children learning two languages may spend less time practicing the use of each language, which can lead to delayed acquisition. However, combined bilingual exposure may offer linguistically-enriched experience that promotes advanced metalinguistic development. Prior research finds that monolingual children with a richer language environment have more left-lateralized neural responses to phonological awareness tasks. We hypothesize that bilingual experience will also yield a more left-lateralized organization for language, indicating targeted development of brain regions underlying language and reading acquisition. METHOD. Participants were bilingual kindergarteners attending Spanish-English or Chinese (Cantonese)-English schools. Children completed an auditory processing task and a phonological awareness task during fMRI imaging as well as standardized vocabulary measures in each of their languages. Children were within age-appropriate norms of English acquisition but varied widely in their knowledge of their other language. The vocabulary scores were combined across languages to create a continuum of scores indicating children's overall bilingual proficiency. RESULTS. Preliminary results (n=18, M=5.86 years) indicate that children with better combined bilingual ability showed more specialized cortical responses during language processing: they had greater left hemisphere activation along the brain regions typically associated with language and reading processes. Conversely, children with lower bilingual ability showed greater right hemisphere activation. These findings suggest that bilingualism does not delay but rather potentially enhances child brain development for language and literacy.

Topic Area: LANGUAGE: Other

An electrophysiological investigation of noisy channel sentences

Poster F67, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Veena Dwivedi[1], Victoria Witte[1], Janahan Selvanayagam[1], Edward Gibson[2]; [1]Brock University, [2]MIT

We used event-related brain potentials (ERPs) in order to investigate the interpretation of sentences that contained errors of deletion vs. errors of insertion. Noisy channel models propose that deletion errors are more likely to occur than insertions. As such, perceivers are more likely to revise sentences containing errors of deletion vs. insertion. This difference should result in empirical differences observed in behavioural and neural responses to these different error types. To this end, we investigated plausible (ditransitive) sentences such as (i) The aunt mailed the silly letter to her cherished niece by post as compared to sentences that deleted the preposition to, resulting in (double object) implausible sentences such as (ii) #The aunt mailed the silly letter_ her cherished niece by post. In addition, related plausible (double object) sentences such as (iii) The aunt mailed her cherished niece the silly letter by post were modified with the insertion of to resulting in an implausible (ditransitive) sentence such as (iv) The aunt mailed her cherished niece #to the silly letter by post. All sentences were followed by yes/no comprehension questions such as Did the cherished niece receive something?/Did the silly letter receive someone? Results confirmed that participants treat these errors differently. Deletion errors were responded to with significantly less accuracy than insertions (44% vs. 51%). Furthermore, whereas ERP waveforms for both error types, as compared to their controls, exhibited slow-going negativity, this difference was markedly greater for deletion error sentences, thereby extending current and previous behavioural results.

Topic Area: LANGUAGE: Syntax

Tracing the interplay between syntactic and lexical features: fMRI evidence from agreement comprehension.

Poster F68, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Ileana Quinones[1], Nicola Molinaro[1,2], Horacio Barber[3], Manuel Carreiras[1,2,4]; [1]Basque Center on Cognition, Brain and Language, Donostia, Spain, [2]IKERBASQUE. Basque Foundation for Science. Bilbao, Spain, [3]Universidad de La Laguna, Tenerife, Spain, [4]University of the Basque Country, UPV/EHU. Bilbao, Spain

In the current study, we combined fmri and DTI data to evaluate how formal and lexical cues impact on how the brain establishes grammatical relations. We used the Spanish gender agreement system, which makes it possible to manipulate two different factors: the agreement between different sentence constituents (i.e., by contrasting a congruent versus incongruent determiner-noun pairs) and the formal and/or lexical information embedded in the noun (i.e., by contrasting nouns with informative versus uninformative terminations). Our findings point out that a specific left-lateralized perisylvian circuit responds according to the agreement congruency. But, crucially, these data illustrated how our brain is sensitive to formal gender-to-ending cues during the computation of determiner-noun agreement relations. When the gender marking is informative, both formal and lexical information are used to establish grammatical relations. In contrast, when no formal cues are available, gender information is retrieved from the lexicon. These processes seem to be mediated by a functional coupling between the posterior part of the MTG/STG, the pars triangularis within the IFG and the hippocampus. In addition, parietal areas seem to be critical for the processing of opaque nouns: activity in these cortical regions could mediate the fronto-temporal loop thus enhancing the integration of different information sources. These results build upon the previous neuro-anatomical models proposed in the context of both gender processing and sentence comprehension. But, more importantly, they break down the deep-rooted idea that the left perisylvian circuit underpins sentence comprehension.

Topic Area: LANGUAGE: Syntax

An fMRI investigation of argument structure and syntactic selection

Poster F69, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

William Matchin[1], Chia-Hsuan Liao[2], Phoebe Gaston[2], Ellen Lau[2]; [1]UC San Diego, [2]University of Maryland

Neuroimaging research has identified several sentence-responsive brain regions in the left hemisphere, some of which are associated primarily with syntax and others with semantics. In order to narrow down the specific functions of these regions, we performed a functional magnetic resonance imaging (fMRI) study with a block design in which we compared lexically-matched verb phrases (VP; frightened the boy) and noun phrases (NP; the frightened boy). Previous research has hypothesized that the Angular Gyrus (AG) is involved in thematic or event-level processing; this hypothesis would predict that the AG would show more activation for VPs than NPs. We also tested a fundamental syntactic distinction: VPs contained two head-complement selection relations and no adjunction, while NPs contained one head-complement selection relation and one adjunction. Previous research has found increased activation in the pars triangularis of the inferior frontal gyrus (IFGtri) and the posterior superior temporal sulcus (pSTS) for syntactically hierarchical input, but has not indicated that this response is sensitive to different kinds of syntactic relations like head-complement selection vs. adjunction. Preliminary ROI analyses (N=20) found no differences in the activation between VPs and NPs in any semantic regions, including the AG, and that the pars triangularis and pSTS showed increased activation for VPs relative to NPs. These results argue against a thematic or event-level semantic function of the AG. With respect to IFGtri and pSTS, the increased activation for head-complement selection may indicate a role for syntactic prediction, as heads in English select for upcoming structure while adjuncts do not.

Topic Area: LANGUAGE: Syntax

A mechanism for the cortical computation of hierarchical linguistic structure

Poster F70, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Andrea E. Martin[1,2], Leonidas A. A. Doumas[1]; [1]University of Edinburgh, [2]Max Planck Institute for Psycholinguistics

To process language, the human brain must form hierarchical representations from a sequence of perceptual inputs distributed in time. What mechanism underlies this ability? One hypothesis is the brain repurposed an available neurobiological mechanism when hierarchical linguistic representation became an efficient solution to a computational problem posed to the organism. Under such an account, a single mechanism must have the capacity to perform multiple, functionally-related computations, e.g., detect the linguistic signal and perform other cognitive functions, while, ideally, oscillating like the human brain. We show that a computational model of analogy, built for an entirely different purpose - learning relational reasoning (Doumas, LAA et al. (2008) A theory of the discovery and predication of relational concepts. Psychological Review 115:1-43.) - can parse sentences, represent their meaning, and, crucially, exhibits oscillatory activation patterns that strongly resemble the cortical signals elicited by the same stimuli (Ding, N et al. (2016) Cortical tracking of hierarchical linguistic structures in connected speech. Nature Neuroscience 19(1):158-164). Such redundancy in the cortical and machine signals suggests a deep mechanistic alignment between representational structure building and 'cortical' oscillations. By inductive inference, this synergy indicates that the cortical signal reflects the generation of hierarchical linguistic structure - rather than mere tracking of it - just as the machine signal does. A single mechanism – using time to encode information within a layered neural network – generates the representational hierarchy that is crucial for human language, and offers a mechanistic linking hypothesis between linguistic representation and cortical computation.

Topic Area: LANGUAGE: Syntax

The spatio-temporal dynamics of language processing: combining computational linguistics and RSA with MEG data

Poster F71, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Barry Devereux[1], Billi Randall[1], William Marslen-Wilson[1], Lorraine Tyler[1]; [1]University of Cambridge

Understanding spoken sentences involves the incremental integration of the spoken words into a coherent representation of the utterance's structure and meaning. A number of factors have been proposed to influence the ease with which words can be integrated into the unfolding representation, including the syntactic complexity of the sentence and probabilistic lexical knowledge about the kinds of structures words tend to be used in. Reflecting these separate accounts, previous neurocognitive studies have often either manipulated syntactic complexity whilst eliminating lexical influences, or have manipulated lexical properties only in the context of simple grammatical structures. In this MEG study, we investigate how lexically-driven expectations and syntactic complexity interact over time by analysing how corpus-derived statistical models of lexico-syntactic information influence the multivariate spatiotemporal dynamics of long-distance structure building in the brain. Participants listened to sentences where a relative clause construction created a syntactically complex long-distance dependency. We manipulated the lexico-syntactic expectations associated with the verbs in the sentences, such that the complex syntactic structure was either expected or unexpected depending on properties of the verbs. In source-space MEG RSA analyses, we found early sensitivity to lexico-syntactic access in MTG, as well as later sensitivity to the unexpected long-distance dependency structures in bilateral STG and MTG. These results are important in demonstrating how specific lexical knowledge about verbs – modelled using corpus data – interacts with complex syntactic processing during spoken language comprehension, yielding a detailed picture of processes of incremental integration in sentence processing.

Topic Area: LANGUAGE: Syntax

Neural Consequences of Syntactic Surprisal during Reading

Poster F72, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Trevor Brothers[1], Matthew W. Lowder[1], John M. Henderson[1], Fernanda Ferreira[1], Matthew J. Traxler[1], Tamara Y. Swaab[1]; [1]University of California, Davis

While it is clear that readers can use semantic context to generate predictions for upcoming words, much less is known about abstract, syntactic predictions generated at the level of word categories. In the current study, we used a computational modelling approach, in which the syntactic expectedness (or surprisal) of each word in a text is calculated using a probabilistic incremental parser. By correlating these syntactic surprisal values with ongoing EEG, we can estimate when readers are first sensitive to subtle violations of syntactic expectation within natural (error-free) text. Twenty participants read short, two-sentence narratives for comprehension while EEG was recorded from the scalp. The syntactic surprisal of each word was calculated using a probabilistic context-free grammar (Roarke, et al., 2009), and this measure of syntactic difficulty was used to predict brain responses following word onset. In this analysis we also controlled for nine additional contextual and lexical variables known to influence neural responses during reading. Syntactic surprisal did not modulate the amplitude of the N400. Instead, words high in syntactic surprisal generated a late positivity (500-700ms) over frontal electrode sites. The topography of this syntactic surprisal effect was distinct from posterior "P600 effects", triggered by syntactic anomalies. This result suggests that readers are sensitive to subtle differences in syntactic predictability within natural texts, and that syntactic surprisal and syntactic violations may produce dissociable brain responses (Kaan & Swaab, 2003). We will discuss the potential relationship between syntactic surprisal effects and other late frontal positivities linked to violations of semantic expectancies.

Topic Area: LANGUAGE: Syntax

Behavioral and Neural Evidence for the Effects of Verb Bias and Syntactic Surprisal on Sentence Processing

Poster F73, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Kathryn Bousquet[1], Tamara Swaab[1], Debra Long[1]; [1]University of California, Davis

Verb bias, the frequency with which a verb appears in a given syntactic structure, can facilitate syntactic parsing. Previous behavioral studies have reported increased processing costs when verb bias is incongruent with the syntactically preferred structure of a sentence, such that syntactically complex structures (sentential clauses; SC) – are easier to read than simple structures (direct objects; DO) when the verb occurs more frequently with the complex SC structure (Wilson & Garnsey, 2009). However, these studies have assumed that the strength of a verb's bias is constant across contexts. In the current study, we manipulated DO/SC sentences to be temporarily ambiguous (e.g. the goalie confirmed/confessed the defeat with real heartbreak; the goalie confessed/confirmed the defeat was really heartbreaking) and modeled syntactic surprisal with the Roark parser (Roark, 2001) to examine the behavioral and neural effects of verb bias at the disambiguating region. In a self-paced reading experiment, we found significantly slower reading times in the disambiguating region when verb bias was incongruent with the syntactic structure. In addition, there was a significant effect of syntactic surprisal. In an auditory ERP experiment, we found a P600 to the critical disambiguating word when verb bias was incongruent for both DO and SC structures. Together, these results suggest that the initial syntactic parse is driven by verb bias rather than syntactic complexity. Furthermore, the syntactic surprisal effect suggests that verb bias changes incrementally with sentence context, and that sentence processing is influenced by the overall verb bias as well as a context-specific bias.

Topic Area: LANGUAGE: Syntax

Low expectations: An ERP investigation of cue-based anticipatory processing in low constraint sentences

Poster F74, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Kailen Shantz[1], Darren Tanner[1]; [1]University of Illinois at Urbana-Champaign

There is robust and growing evidence which strongly suggests that language comprehension employs predictive mechanisms, yet the conditions under which prediction does and does not occur remain unclear (cf. Huettig, 2015). To address this, we combined event-related potentials with a modified response cueing paradigm to investigate the time course of prediction in low constraint sentences where number marking or phonological information on verbs and determiners provide cues to the identity of impending nouns. We further examine how the reliability of cue-response mapping impacts prediction. We recorded EEG while native English speakers monitored low constraint sentences for nouns, and made responses with their left and right hands when a particular noun occurred in a sentence. We systematically varied within-subjects whether target nouns were preceded by an informative cue about the identity of the noun (e.g. the vs a/an or this/these). Between subjects, we also manipulated whether cues reliably mapped onto the same response hand. Preliminary inspection of the lateralized readiness potentials (LRPs) time-locked to the cue words suggest an LRP onsetting at approximately 250-300 ms post-stimulus onset when indefinite determiners provide an informative cue about the upcoming noun, but only for participants with a reliable cue-response mapping. LRP activity is not apparent in any other condition prior to the onset of the target words. These results suggest that not all possible cues may be used to generate expectations during language comprehension, and that prediction may be restricted to situations where it is easy to do.

Topic Area: LANGUAGE: Syntax

The neurobiology of prosody and sentence structure: a functional MRI study

Poster F75, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Arianna LaCroix[1], Lisa Johnson[1], Nicole Blumenstein[1], Sharmeen Maze[2], Leslie C. Baxter[2], Corianne Rogalsky[1]; [1]Arizona State University, [2]Keller Center for Imaging Innovation, Barrow Neurological Institute & St. Joseph's Hospital and Medical Center

Sentence comprehension requires the integration of syntactic and prosodic information, however there is no consensus regarding the neural resources supporting these processes. The present experiment explores how sentence comprehension networks are modulated by an increase in syntactic complexity with and without prosodic cues. Twenty cognitively normal, right-handed, native English speakers listened to sentences and noun lists, with half of each spoken with sentence prosody and half with word-list prosody (i.e. equal emphasis and timing for all words) during clustered-sparse sampling functional MRI (fMRI). Standard preprocessing and linear regression analyses were computed. Group-level contrasts replicate previous work: all sentences compared to all noun lists recruited left lateralized regions including anterior temporal regions (ATL), posterior superior temporal gyrus (pSTG), and Broca's area. Within this network, main effects of both syntax and prosody within the sentence stimuli were observed in the left pSTG, with the prosody cluster anterior to the sentence structure cluster. A main effect of prosody was also found in Broca's area and right pSTG. Pairwise comparisons suggest that the effect of sentence structure (i.e. noncanonical versus canonical sentences) within pSTG and Broca's area may be modulated by the presence of prosodic cues, as word-list prosody mitigates the increased activation observed for noncanonical compared to canonical sentences. Initial single-subject results indicate substantial individual variability regarding the relative sensitivity of the ATL, pSTG, and Broca's area to prosody and/or sentence structure. These preliminary results suggest that prosodic cues modulate the brain regions recruited during sentence comprehension, particularly as syntactic complexity increases.

Topic Area: LANGUAGE: Syntax

Electrophysiology of Prosodic and Lexical Influences on Sentence Processing in Broca's Aphasia

Poster F76, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Shannon Sheppard[1], Tracy Love[1,2], Katherine J. Midgley[1], Phillip J. Holcomb[1], Lewis P. Shapiro[1]; [1]San Diego State University, [2]University of California, San Diego

Event-related potentials (ERPs) were used to examine whether and how individuals with Broca's aphasia use lexical and prosodic cues to predict syntactic structure in sentences containing temporary syntactic ambiguities. Participants listened to sentences containing a temporary early (correct) / late (incorrect) closure ambiguity. Prosody was manipulated to either be congruent or incongruent with the early closure structure. The temporarily ambiguous NP was manipulated to be a plausible or an implausible continuation for the subordinate verb (e.g., While the band played the song/beer pleased all the customers.). Because an implausible NP (the beer) is an implausible continuation for the subordinate verb (played), the implausible NP may provide the parser with a cue that could aid in predicting upcoming syntactic structure even in sentences containing incongruent prosody. Fifteen individuals with aphasia and 20 age-matched controls participated. The individuals with aphasia were divided into groups of High and Low Comprehenders based on the severity of their comprehension deficit. Sentences with incongruent prosody and a plausibility cue resulted in an N400-P600 complex before the critical verb at the implausible NP (the beer) in the controls and High Comprehenders. In controls, incongruent prosody without a plausibility cue elicited an N400-P600 at the critical verb. A sustained positivity was revealed at both of these points in the Low Comprehenders. These results suggest that High Comprehenders have difficulty integrating prosodic cues with underlying syntactic structure when lexical information is not available to assist the parse. Low Comprehenders have difficulty integrating prosodic and lexical-semantic cues with syntactic structure.

Topic Area: LANGUAGE: Syntax

Age differences in event-related potential effects associated with strong and weak recollection

Poster F77, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Erin Horne[1], Joshua Koen[1], Nedra Hauck[1], Michael Rugg[1]; [1]University of Texas at Dallas

The present study investigated age differences in ERP correlates of strong and weak recollection. Young and older adults studied concrete nouns while answering one of two questions about each word (fit in a shoebox or manmade). During a subsequent recognition memory test, participants made item memory judgments to test words using the RKN procedure. For words receiving a 'Remember' (R) response, a source memory judgment (which study task?) was required. We contrasted ERPs elicited on R trials where source retrieval was correct ('strong recollection'), on R trials with incorrect source retrieval or a 'don't know' response ('weak recollection'), and on correct rejection trials. Young, but not older adults, displayed mid-frontal (300-500ms) and left parietal (500-800ms) retrieval success effects. These were graded (strong > weak recollection) at the parietal, but not the mid-frontal, electrodes. Young adults also demonstrated a late (1000-2000ms) posterior negative effect graded in the opposite direction (weak > strong). The retrieval success effects in older adults were dominated by a large, posteriorly maximum, negative-going wave. Unlike in young adults, the amplitude of this wave did not vary with recollection strength. Both young and older adults showed a positive-going ungraded right frontal recollection effect. The young adults' data replicate and extend prior reports that frontal and left parietal ERP retrieval effects are differentially sensitive to recollection strength. The findings also provide striking evidence for the differential engagement of mnemonic processes supporting recollection in young and older adults, particularly as no group differences were observed for source memory accuracy.

Topic Area: LONG-TERM MEMORY: Episodic

Sequencing Effects on the Retention of Generalized Knowledge and Source Memory

Poster F78, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Sharon Noh[1], Alison Preston[1]; [1]University of Texas at Austin

Though the goal of learning is enhanced long-term retention, most training programs are validated based on immediate performance and rarely tested following a delay. We used a category learning paradigm to assess the degree to which generalized knowledge and memory for detail is preserved as a function of training with different study schedules (blocked vs. interleaved) following a one-week delay. Participants were trained to identify paintings by different artists for which half of the artists were studied in a blocked schedule (i.e., all paintings of the artist were presented sequentially), and the remainder were learned in an interleaved schedule (i.e., paintings for multiple artists were intermixed). After training, participants completed a generalization task (identifying the artist of a novel painting) and a recognition task (identifying the source of a previously studied painting) that were administered immediately after training, as well as after a 1-week delay. A 2 (schedule) x 2 (delay) ANOVA was conducted to assess the effects of training schedule on generalization and source memory across time. For the source memory task, there was a main effect of delay such that significant performance declines were observed following a 1-week delay. For generalization, however, there was a schedule x delay interaction—interleaved training led to superior generalization performance (relative to blocked) immediately after training, but this difference was attenuated as the

blocked condition showed improved performance following a week delay. These results suggest that although memory for detail declines over time, generalized knowledge is preserved and in some cases, improved.

Topic Area: LONG-TERM MEMORY: Episodic

Relative order judgements of the past and the future

Poster F79, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Inder Singh[1], Marc Howard[1]; [1]Boston University

Several authors have suggested a deep symmetry in neural and psychological processes that underlie our ability to remember the past and make predictions about the future. However this connection has not resulted in a unified model for events in the past and predictions of the future. Further, there is thus far little quantitative data to suggest that this symmetry holds. Methodological differences between the behavioral paradigms used to test memory and those that test prediction are an obstacle to this integration. Thus, there is a need for novel behavioral paradigms to evaluate the ability to predict the future under carefully controlled experimental conditions that ideally mirror memory tasks. In this study we use temporal order judgment tasks for the past and for the future. The relatively well-studied Judgment of Recency (JOR) task measures order judgments for the past. We introduce a novel Judgment of Imminence (JOI) task to study temporal order judgments for the future. Our JOR study replicates very closely classic findings from Hacker (1980), but in a single session. The response time varies as a function of the distance to the more recent item and does not depend on the distance to the less recent item, thus suggesting a serial self-terminating process operating on a temporally ordered representation. As our JOI task closely parallels the design of the JOR task, we can directly compare judgments of the past and the future. Results suggest minimally a qualitative similarity between judgments of the past and the future.

Topic Area: LONG-TERM MEMORY: Episodic

Improving Memory by Biasing Awake Memory Reactivation

Poster F80, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Kylie H. Alm[1], Chi T. Ngo[1], Ingrid R. Olson[1]; [1]Temple University

Why are some memories easy to retrieve, while others are more difficult to access? Here, we asked whether you can bias memory replay, a process whereby newly learned information is reinforced by reinstating the neuronal patterns of activation that were present during learning, towards particular memory traces. The goal of this biasing is to strengthen some memory traces, making them more easily retrieved. To test this, participants were scanned during interleaved encoding and resting state runs. Throughout the encoding runs, participants learned triplets of images that were paired with semantically related sound cues. During two of the three 8.5-minute resting state runs, irrelevant sounds were played. During one key rest period, however, the sound cues learned in the preceding encoding period were played in an effort to increase reactivation of the associated visual images, e.g. targeted reactivation. Memory was tested after scanning and a 24-hour delay. Results revealed that items that underwent targeted reactivation during post-encoding rest periods were remembered better than untargeted items. For the fMRI data, representational similarity analyses were used to compare multi-voxel patterns of hippocampal activation across encoding and rest periods. Hippocampal patterns exhibited increased pattern similarity when comparing the critical encoding set to its subsequently cued sound rest period, relative to baseline rest. Furthermore, there was a positive relationship between this neural evidence of replay and the magnitude of the behavioral cueing effect, suggesting that preferential replay may be a mechanism by which specific memory traces can be selectively strengthened for enhanced subsequent memory retrieval.

Topic Area: LONG-TERM MEMORY: Episodic

Memory strengthening via multiple labilization-reconsolidation cycles: a replication study

Poster F81, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Enmanuelle Pardilla Delgado[1], Cecilia Forcato[2], Jessica D. Payne[1]; [1]University of Notre Dame, [2]Universidad de Quilmes

Memory consolidation was once thought to stabilize memories; that is, a memory was immune to alterations after the consolidation process had culminated. Currently this view has changed, as reactivating a memory can make it labile once again, which in turn makes it susceptible to modification by amnesic and enhancing agents. The process that occurs after this reactivation-dependent labilization is called 'reconsolidation', and it is thought that when several labilization-reconsolidation processes are induced, a memory is strengthened. The current study aimed to replicate an effect first reported in human declarative memory by Forcato and colleagues (2011), and to extend it to English-speaking subjects. On day 1, participants learned pairs of nonsense syllables. On day 2, through an 'interrupted memory test', memory was reactivated once (group 1), twice (group 2), or not at all (group 0). Memory, tested on day 3, was marginally different between the groups ($F(3,61)=2.6$, $p=.06$). Specifically, memory persisted more for group 2 than for group 0 ($p=.09$), which supports the idea that multiple reactivations strengthen a labile memory. Follow-up studies will probe this strengthening effect against the detrimental mnemonic effects of stress during retrieval.

Topic Area: LONG-TERM MEMORY: Episodic

Dynamic functional connectivity of overt and covert autobiographical memory retrieval

Poster F82, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Charles Ferris[1], Cory Inman[1], Andrew James[2], Stephan Hamann[1]; [1]Emory University, [2]University of Arkansas for Medical Sciences

Retrieval of autobiographical memories (AM) is a complex process that recruits dynamically changing networks of brain regions as processing shifts between memory search, access, and content elaboration. In prior fMRI work we have used graph analyses to characterize whole-brain changes in dynamic connectivity during AM retrieval, highlighting time-varying engagement of the hippocampus, PFC, and other regions. Here we used high temporal and spatial resolution fMRI, an optimized experimental design, and both covert and overt (spoken) retrieval to test theoretical accounts of dynamic AM retrieval processes. Motion minimization and post-processing was used to minimize speech artifact effects. During scanning, healthy adults retrieved unrehearsed AMs to cue words across an extended retrieval period, followed by ratings of vividness and emotion, with overt (spoken) retrieval during half of the runs. We identified regions active during different retrieval periods and used functional connectivity and graph theory analyses to examine dynamic changes in AM retrieval processes. Early, access-related processing activations were observed in the hippocampus, amygdala, mPFC, and PCC. Network connectivity changed substantially across AM retrieval, particularly for hippocampal-neocortical interactions. We observed dynamic changes in functional connectivity between the hippocampal region and fronto-parietal regions including the VLPFC and IPL. These results suggest that accessing and reconstructing autobiographical memories involves large-scale changes in functional connectivity that reflect the dynamic time-course of AM retrieval processes.

Topic Area: LONG-TERM MEMORY: Episodic

Neural correlates of true and false memory vividness

Poster F83, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Sarah Kark[1], Stephanie Sherman[1], Ryan Daley[1], Scott Slotnick[1], Elizabeth Kensinger[1]; [1]Boston College

Previous work has shown that activity in sensory processing regions can distinguish true from false memories. As with true memories, studies have shown that false memories can be endorsed with high subjective vividness (e.g., Dennis, Bowman, & Vandekar 2012). However, it is not known if activation in sensory processing regions tracks with the phenomenological sense of memory vividness for true memories to a greater extent than false memories. In the current fMRI study, participants studied line-drawings of photos followed by the complete colorful photo. After a 24-hour delay, participants were scanned while they completed a surprise recognition memory test. During test, participants were shown all of the previously studied line-drawings and an equal number of unstudied line-drawings. Participants made a button press to indicate if they thought the line-drawing was new (by pressing the 0 key) or—if they thought it was old—how vivid their memory was on a scale from 1-4. Parametric modulation analyses were conducted to examine how activity in sensory processing regions varied as a function of vividness (1-4 scale) during true and false memory. Regions of occipital-temporal cortex (e.g., lateral occipital cortex, fusiform cortex, and parahippocampal cortex) tracked with subjective memory vividness to a greater extent for true memories than for false memories. Of importance, the parahippocampal cortex activity likely reflected modulation of the parahippocampal place area (PPA). These findings suggest that activation in sensory processing regions can distinguish the phenomenological sense of memory vividness for veridical memories from the same sense for illusory memories.

Topic Area: LONG-TERM MEMORY: Episodic

Functional connectivity between the dorsomedial thalamus and the medial temporal lobe supports familiarity memory

Poster F84, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Alex Kafkas[1], Elizabeth Keene[1], Andrew Mayes[1], Daniela Montaldi[1]; [1]Memory Research Unit, Division of Neuroscience & Experimental Psychology, School of Biological Sciences, University of Manchester

An fMRI was conducted to explore the extent to which activity related to familiarity and recollection for different types of pictorial stimuli (objects, faces and scenes) is shared or distinct. In a mixed event-related/block design, we combined three types of pictorial stimuli and participants (n = 17) were asked to take familiarity and recollection decisions for previously studied and unstudied materials. The present analysis focused on extra-Medial Temporal Lobe (MTL) responses to isolate material-selective and non-material selective familiarity responses and to explore connectivity patterns within the isolated network. Material-selective and non-selective areas responding to familiarity were found in frontal, parietal, temporal and subcortical regions. Importantly, the dorsomedial thalamus showed a material-independent role selectively in familiarity-based recognition, whereas the anterior thalamus only responded to recollection. Material-selective regions within the thalamus that responded to familiarity for scenes (ventral posteromedial and pulvinar nuclei) and familiarity for faces (left ventrolateral thalamic nucleus) were also found. Moreover, connectivity analyses (psychophysiological interactions) showed increased connectivity between the dorsomedial thalamus and the parahippocampal and perirhinal cortices with increases in familiarity confidence. Finally, increased coupling between the ventrolateral thalamus and MTL regions (amygdala, perirhinal cortex) and the fusiform gyrus were found when weak (versus strong) familiarity feelings for faces were reported. This set of findings has important new implications for the role of the thalamic regions in recognition memory and illustrates that enhanced communication between the thalamus and selective MTL structures supports familiarity memory.

Topic Area: LONG-TERM MEMORY: Episodic

Functional dissociation and specialization of dentate gyrus and CA3 hippocampal subfields during episodic future thinking

Poster F85, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Paul F. Hill[1], Tobias Sweeney[1], Gabriel A. Devenyi[2,3], Mallar Chakravarty[2,3], Rachel A. Diana[1]; [1]Virginia Tech, [2]Douglas Mental Health University Institute, [3]McGill University

Neuroimaging work has demonstrated that the hippocampus is engaged when imagining future events. However, the functional contributions of distinct hippocampal subfields during the construction of hypothetical future events remain unknown. The aim of this study was to investigate the interaction between hippocampal subfield activity and qualitative future event features. Participants imagined future episodic events while undergoing high-resolution fMRI imaging and provided post-scan ratings of event detail, novelty, plausibility, and ease of construction. High-resolution structural images were delineated into hippocampal subfields using an automated segmentation protocol. Individual subject subfield masks were used to extract beta parameters from general linear model analyses and submitted to one-sample t-tests. We observed a significant negative relationship between activity in the right dentate gyrus (DG) and event plausibility during the initial event construction phase. in contrast, activity in the right CA3 subfield was negatively modulated by the level of detail during the subsequent elaboration phase as participants mentally expounded on the sensory and contextual details of an imagined event. These preliminary results provide novel mechanistic insights into the hippocampal circuitry involved with linking details from discrete experiences into an envisaged future event.

Topic Area: LONG-TERM MEMORY: Episodic

Mnemonic prediction errors modulate hippocampal connectivity patterns

Poster F86, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Oded Bein[1], Katherine Duncan[2], Lila Davachi[1]; [1]New York University, [2]University of Toronto

Prediction errors (PEs) play a critical role in learning. Recent work showed that activation in hippocampal region CA1 linearly tracked how many current items were in conflict with a learned representation - or the number of mnemonic PEs. To the extent that PEs modulate memory updating and retrieval processes, we examined how PEs influenced CA1 connectivity. Over several sessions, participants learned a list of rooms; each room had a name (e.g., “John’s bedroom”) and an image depicting that room (Duncan et al, 2012). While in the scanner, participants were cued to recall the learned rooms followed by an image of the room. Crucially, this image could either be identical to the learned one (no PE), or had 1-4 changes (low-high PE). Focusing on the input to CA1, we asked how CA1-entorhinal functional connectivity was modulated by PEs. The results suggest that CA1-entorhinal functional connectivity was lower in the no-PE condition compared to all other PE conditions with no difference observed between different levels of PE. Interestingly, preliminary analyses suggest that CA1- CA3 connectivity decreased linearly as PE increased. CA1-subiculum connectivity, potentially the output of CA1, reflected that of a U-shape, in which connectivity was maximal for mid-level PE, and low for both no-PE and high-PE conditions. These results suggest dissociations between CA1-entorhinal and CA1-CA3 connectivity in the processing of mnemonic PEs.

Topic Area: LONG-TERM MEMORY: Episodic

Attentional Focusing at Encoding Contributes to Subsequent Memory

Poster F87, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Benjamin R Geib[1], Roberto Cabeza[1], Marty G Woldorff[1]; [1]Duke University

It has long been known that attention is an important contributor to long-term memory. The specific effects of attention on each of the multiple perceptual and semantic operations that lead to subsequent memory are still unclear. In the event-related potentials (ERP) literature, subsequent memory has been typically associated with a positivity around 600-800 ms known as difference-due-to-memory (DM). However, attention enhances perceptual processes occurring before 600 ms and hence, it should promote encoding before the classic DM effect. In a novel ERP paradigm, we investigated early memory-enhancing effects of attention using lateralized attentional-orienting task which was then followed by a subsequent memory test. Our preliminary results suggest that, at encoding, both the initial attentional allocation toward the target (as indexed by the N2pc ERP component, latency 225-275 ms) and the subsequent extended discrimination of the target features (as indexed by the SPCN ERP component, latency 350-450 ms, and lateralized alpha-band EEG modulation, latency 300-600 ms) contribute to subsequent memory success. These results therefore suggest that prior to the traditional DM effect, there are earlier subsequent memory effects associated with attentional focusing.

Topic Area: LONG-TERM MEMORY: Episodic

Sleep relates to the pattern representation and behavioral stability of memories

Poster F88, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Emily Cowan[1], Anli Liu[2], Sanjeev Kothare[2], Orrin Devinsky[2], Lila Davachi[1]; [1]New York University, [2]NYU Langone School of Medicine

Sleep has been linked with successful memory consolidation, and evidence suggests particular features in the architecture of sleep may relate to sleep-dependent memory enhancements. Recent evidence has shown greater distribution of memory traces after a 24-hour delay, as measured by functional connectivity, is predictive of subsequent resistance to forgetting, indicating a specific role in memory stabilization. However, it remains unknown what aspects of sleep architecture are related to changes in the representation of memory traces, and the effect on subsequent behavioral measures of memory. To investigate this relationship, we designed a three-day experiment utilizing overnight polysomnography recordings, fMRI, and behavior. Subjects encoded lists of word-image pairs twice, either with an intervening period of overnight sleep (Sleep List), or a brief wakeful period (New List), such that the lists differed the opportunity for potential consolidation. During the re-study session, subjects were presented with the previously seen word-image pairs, and a new list of pairs (Single Study List) while in the scanner. Cued source recall was probed immediately following the scan and after a 24-hour delay, providing a measure of memory stability over time. Using a multivariate pattern similarity analysis, we examined the representations of the trials from each encoding list. Pattern separation was greater for subsequently remembered, compared to forgotten, pairs in the right hippocampus only in the Sleep List. By contrast, those trials showed more similar patterns in cortical regions. Additional analyses will focus on relating oscillatory signals during sleep with the neural patterns and behavioral expression of these memories.

Topic Area: LONG-TERM MEMORY: Episodic

The anterior prefrontal cortex and the hippocampus are negatively correlated during false memories

Poster F89, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Brittany M. Jeye[1], Jessica M. Karanian[1], Scott D. Slotnick[1]; [1]Boston College

False memories have been associated with activity in the anterior/dorsolateral prefrontal cortex (A/DLPFC) and the hippocampus. These regions are assumed to work in concert during false memories, which would predict a positive correlation between the magnitudes of activity in these regions across participants. However, the A/DLPFC may also inhibit the hippocampus (e.g., during retrieval-induced forgetting). If this occurred during false memories, it would predict a negative correlation between the magnitudes of activity in these regions. In the present fMRI study, we aimed to distinguish between these hypotheses. During encoding, participants viewed abstract shapes in the left or right visual field. During retrieval, old shapes were presented and participants classified each shape as previously in the “left” or “right” visual field followed by an “unsure”–“sure”–“very sure” confidence rating. The contrast of left-hits and left-misses produced two activations in the hippocampus and three activations in the A/DLPFC, which served as regions of interest for the correlation analysis. For each participant, activity associated with false memories (i.e., right-“left”-“very sure” responses) from the two hippocampal regions were plotted as a function of activity in each A/DLPFC region. Across participants, for one region of the anterior prefrontal cortex (APFC), there was a negative correlation between the magnitude of activity in the hippocampus and the magnitude of activity in this region ($p < .05$, Bonferroni corrected for multiple comparisons). This suggests that the APFC can inhibit the hippocampus during false memories and that participants engage either the APFC or the hippocampus during false memories.

Topic Area: LONG-TERM MEMORY: Episodic

Signed reward prediction errors drive declarative learning

Poster F90, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Esther De Loof[1], Kate Ergo[1], Lien Naert[1], Clio Janssens[1], Filip Van Opstal[2,3], Tom Verguts[1]; [1]Ghent University, Belgium, [2]Université Libre de Bruxelles, Belgium, [3]University of Amsterdam, Netherlands

Reward prediction errors (RPEs) are thought to drive learning. This has been firmly established in procedural learning paradigms (e.g., classical and operant conditioning). However, empirical evidence on whether RPEs drive declarative learning – a quintessentially human form of learning – remains surprisingly absent. In this study, we used a declarative learning paradigm in which RPEs were coupled to the acquisition of Dutch-Swahili word pairs. The occurrence of signed RPEs (SRPEs; “better-than-expected” signals) during declarative learning improved recognition performance in a follow-up recognition test, with increasingly positive RPEs leading to better recognition. In addition, we demonstrate that classic declarative memory mechanisms such as time-on-task fail to explain recognition performance. The beneficial effect of SRPEs on recognition performance was subsequently affirmed in an EEG replication study. Moreover, we found oscillatory (high-beta and high-alpha) signatures for SRPEs during reward feedback, similar to SRPE signatures found in earlier procedural learning paradigms. Importantly, these results offer a powerful reinterpretation of the testing effect, with key implications for education.

Topic Area: LONG-TERM MEMORY: Episodic

Impact of preparatory attention on subsequent memory: individual differences in cortical oscillations

Poster F91, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Anna Khazenzon[1], Shao Fang Wang[1], Stephanie Zhang[1], Alex Gonzalez[1], Stephanie Gagnon[1], Monica Thieu[1], Melina Uncapher[2], Anthony Wagner[1]; [1]Stanford University, [2]University of California, San Francisco

Successful encoding into episodic memory can be impaired by goal-irrelevant distractors, as well as by lapses in goal-directed attention. Individual differences in distractor filtering, both within and across subjects, may contribute to variable subsequent memory. Fluctuations in top-down goal-directed attention may have dual consequences: they may contribute to variable distractor filtering success, and may also reflect lapses of attention even in the absence of external distraction. Here, we tested these hypotheses by examining how subsequent memory for words varies with (a) the presence of external distraction (goal-irrelevant visual stimuli), and (b) EEG oscillatory measures of goal-directed preparatory attention; this neural measure provides a means of indexing attentional lapses that lead to diminished distractor filtering (when distractors are present) and diminished target stimulus encoding. High-density (128 channel) EEG was recorded during an incidental encoding task, during which participants made semantic judgments about words while ignoring infrequent peripheral images of faces or objects. A subsequent old/new recognition memory test of the target words revealed that word memory (d') was negatively impacted by the presence of external distractors. Spectral signatures of phasic fluctuations in top-down attention – pre-stimulus posterior alpha power– predicted subsequent retrieval success, suggesting that attentional lapses contribute to memory encoding failures. Moreover, this relationship was stronger on distractor-present trials, revealing the importance of preparatory top-down attention in target stimulus encoding in the presence of distraction. These data reveal a mechanism by which individual variability in preparatory attention impacts episodic encoding.

Topic Area: LONG-TERM MEMORY: Episodic

Stress Effects on Memory are Context Dependent

Poster F92, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Matthew Sazma[1], Andrew McCullough[1], Andy Yonelinas[1]; [1]UC Davis

Stress after learning has been shown to improve memory for prior information in a number of studies, however there are also studies that don't show this enhancement. In the current study, we directly manipulated both stress and context after learning to determine the significance of context for these stress effects. Results show a significant stress X context interaction, where participants in the same context showed a post-encoding stress enhancement of memory, but when context was changed between learning and stress there was an impairing effect on memory. The predominant hypothesis in the field asserts that post-learning stress enhances the consolidation processes through the release of cortisol. Analysis of the cortisol levels of participants show that even though both stress groups show similar cortisol increases, the memory effects go in opposite directions depending on the context that stress occurs in. These data suggest that current stress and consolidation theories need to be modified to account for stress needing to occur in the same context as the to-be-remembered items in order to see memory enhancements.

Topic Area: LONG-TERM MEMORY: Episodic

Hippocampus supports unconscious what-where-when memory formation: an fMRI study

Poster F93, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Else Schneider[1,2], Roland Wiest[3], Katharina Henke[1,2]; [1]University of Bern, Bern, Switzerland, [2]Centre for Cognition, Learning and Memory, University of Bern, Bern, Switzerland, [3]Institute of Diagnostic and Interventional Neuroradiology, University Hospital Bern, Bern, Switzerland

Episodic memory is widely believed to depend on conscious perception and conscious mentation. But there is growing evidence against this consciousness-centred view. Findings suggest that humans can learn and retrieve new semantic associations rapidly even if the information is presented subliminally, i.e. invisible to the conscious mind. Based on these findings, we investigated whether humans were able to unconsciously encode and later retrieve complex what-where-when associations (a proxy for episodic memory) by way of their hippocampus. Using fMRI we presented 36 distinct subliminal film clips displaying animals traversing a scene and hiding in a shelter for arbitrary time period to 24 participants. Another group of 24 participants performed the same fMRI experiment with conscious, supraliminal encoding of the film clips. After every third film clip, participants took a forced-choice memory task that targeted temporal and spatial aspects of the events displayed in the previous three film clips. Participants needed to give guess responses in the subliminal version and recollective responses in the supraliminal version of the experiment. Participants evidenced unconscious what-where-when memory by responding faster in correctly versus incorrectly answered test trials and by exhibiting activity increases in areas of the episodic memory system similar to participants in the supraliminal version of the experiment. These results suggest an unconscious form of episodic memory.

Topic Area: LONG-TERM MEMORY: Episodic

Episodic cueing reduces temporal discounting in individuals with damage to the ventromedial prefrontal cortex

Poster F94, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Flavia De Luca[1,2], Donna Kwan[3], Francesca Bianconi[2], Violetta Knyagnytska[2,3], Carl Craver[4], Elisa Ciaramelli[1,2], R. Shayna Rosenbaum[3,5]; [1]Università di Bologna, Italia, [2]Centro studi e ricerche in Neuroscienze Cognitive, Università di Bologna, Cesena, Italia, [3]York University, Toronto, Ontario, Canada, [4]Washington University, St. Louis, USA, [5]Rotman Research Institute, Baycrest, Toronto, Canada

Temporal discounting (TD) is the tendency to devalue rewards systematically as the time of their delivery is pushed ahead into the future. Patients with lesions to the ventromedial prefrontal cortex (vmPFC patients) have steep TD, suggesting that vmPFC might play a crucial role in the valuation of future rewards. vmPFC patients also have deficits imagining specific personal future events, raising the possibility of a common underlying impairment mediating vmPFC patients' impairment in episodic future thinking and steep TD. Here, we test whether promoting episodic simulation of future events during choice reduces TD in vmPFC patients. Eleven vmPFC patients and forty-one healthy controls underwent a TD task in two conditions: In the 'standard condition', subjects chose hypothetically between smaller, immediate monetary rewards and larger rewards available at different time delays. In the 'episodic-cueing' condition, participants performed the TD task after having simulated a personal event to occur at each of the delays. In both conditions, the TD task involved rewards of different magnitude. The results showed that controls, but not vmPFC patients, modulated TD depending on reward magnitude. Moreover, vmPFC patients showed steeper TD compared to controls for large rewards. vmPFC patients, however, benefited from episodic cueing as did controls, showing reduced TD in the episodic-cueing compared to the standard condition. Thus, although vmPFC patients' future simulations are poor in detail, they prove capable of modulating the value assigned to future rewards. Cues of the personal future may help activate (personal) semantic structures necessary and sufficient to drive future-oriented decision-making.

Topic Area: LONG-TERM MEMORY: Episodic

Modulation of oscillatory power and connectivity in the human posterior cingulate cortex supports the encoding and retrieval of episodic memories

Poster F95, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Bradley Lega[1], Michael Rugg[2], James Germi[1]; [1]University of Texas-Southwestern Medical Center, [2]Universwity of Texas at Dallas

The role of the posterior cingulate cortex in episodic memory has not been described using intracranial EEG. Existing evidence has led researchers to posit that the PCC supports mnemonic processes: it exhibits degeneration in memory disorders, and fMRI investigations have demonstrated memory–related activation during both encoding and retrieval of memory items. Using data gathered from 21 human participants who underwent stereo electroencephalography for seizure localization, we characterized oscillatory patterns in the posterior cingulate cortex during the encoding and retrieval of episodic memories. We describe for the first time a subsequent memory effect during item encoding characterized by increased gamma band oscillatory power and a low frequency power decrease. 14 participants had stereotactic electrodes located simultaneously in the hippocampus and PCC, and with these unique data we describe connectivity changes between these structures that predict successful item encoding and that precede item retrieval. Oscillatory power during retrieval matched the pattern we observed during encoding, with low frequency desynchronization and a gamma band power increase. We discuss our findings in light of existing theories of episodic memory processing, including the information via de–synchronization hypothesis and retrieved context theory, and examine how our data fit with existing theories for the functional role of the PCC. These include a postulated role for the PCC in modulating internally directed attention and for representing or integrating contextual information for memory items.

Topic Area: LONG-TERM MEMORY: Episodic

Task Evoked Dynamics in Whole Brain HMM Brain States

Poster F96, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Andrew Quinn[1], Eva Patai[1,4], Diego Vidarre[1,3], Anna Nobre[1,2], Mark Woolrich[1,3]; [1]Oxford Centre for Human Brain Activity, University of Oxford, [2]Department of Experimental Psychology, University of Oxford, [3]Oxford Centre for Functional MRI of the Brain,University of Oxford, [4]Institute of Behavioural Neuroscience, University College London.

Estimation of whole brain dynamics is critical for understanding how network interactions subserve rapid cognition, yet to robustly perform such estimation requires time-series much longer than the time-scale of cognitive dynamics of interest. Here we show that Hidden Markov Model (HMM) states can characterise rapid dynamics and efficiently utilise the whole dataset to generate robust estimates of whole brain networks. This is illustrated in the context of a long-term memory paradigm involving spatial and contextual associations. MEG data were collected from 16 participants. The data were then filtered from 3-40Hz and projected into source space using a LCMV beamformer before parcellation into 44 nodes and multivariate leakage correction (Colclough et al 2015). Alpha band power envelopes were used to infer a Gaussian-HMM (Baker et al 2014;Vidaurre et al 2016) to identify transient brain states characterised by patterns of power and/or functional connectivity. Spatial maps of the relative amplitude for each HMM state were computed using the partial correlation between the state time-courses and the amplitude envelopes. Critically, the HMM decomposition is performed without any knowledge of the task conditions or timings within the dataset. To identify task-evoked changes in the HMM states, the state time-courses were epoched, and the average fractional occupancy of each state (i.e. the proportion of trials for which each state is active) was computed across participants for each point in time. The HMM approach robustly identifies dynamic brain networks across large datasets, retaining both a rich description of on-going dynamics and task-evoked responses.

Topic Area: METHODS: Neuroimaging

Defining the Human Olfactory Network: A Functional Connectome Analysis

Poster F97, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Thomas Arnold[1], Yuqi You[1], Ivan de Araujo[2], Mingzhou Ding[3], Wen Li[1]; [1]Florida State University, [2]Yale University, [3]University of Florida

Olfaction is often neglected in research on human sensory perception, despite known relations to emotional regulation and homeostasis. Until recently, most human neuroanatomy has been inferred from rodent and monkey data; however, as noninvasive neuroimaging techniques and analytical methods have developed, researchers have begun to bridge the gap between animal models and the human brain. With the advent of resting-state functional magnetic resonance imaging (rs-fMRI) and introduction of network analysis to neuroscience, many intrinsic brain networks have been established. While these discoveries include sensory networks (visual, auditory, somatosensory), chemosensory networks have yet to be firmly established. While the neuroimaging work to date has established many homologous regions between animal models and humans in odor processing, several novel substrates have been implicated in human olfaction. It is necessary to explore how these novel substrates interact with phylogenetically conserved regions in human olfaction, and how they relate to the well-developed animal literature. Here we utilized the open-source Human Connectome Project (HCP) dataset to identify an olfactory network that is consistent across a large population sample. The established network largely confirms established connectivity from monkey and rodent research, while also implicating neocortical structures in the orbitofrontal cortex (OFC) that are unique to humans. We further characterized the network using Graph Theory analysis, including measures of small-world features and hub brain regions. Additionally, the network was applied to an independently collected dataset, where individual network strength and efficiency were significantly correlated with odor discrimination performance.

Topic Area: METHODS: Neuroimaging

Non-invasive Brain Imaging Biomarkers in Sudden Unexpected Death in Epilepsy Patients (SUDEP)

Poster F98, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Chaeyeon Kim[1], Justin Jangyoon Choi[1], Richard Lee[1]; [1]New York University

Sudden Unexpected Death in Epilepsy Patients (SUDEP), a phenomenon in which postmortem analysis does not reveal a structural or toxicological cause for death, is one of the leading causes of death in epilepsy patients. Regions of the brain that regulate autonomic functions have been thought to play a role in the onset of SUDEP. The purpose of this investigation was to compare SUDEP patients' MRIs with those of healthy and TLE patient controls to discover any significant biomarkers that might indicate a tendency to SUDEP. This investigation used fMRI scans to measure fALFF, ALFF, and VBM values and yielded results that confirmed the link between autonomic function and the incidence of SUDEP, reflecting findings from previous studies. Statistically significant z-scores indicated 1) enlarged pons, pallidum, and caudate regions and 2) lower functional activity in the putamen region. These brain regions have been found to be responsible for the regulation of cardiac and respiratory functions. In the future, these integrated methods can be employed to create tailored biomarkers for each patient, potentially saving countless lives from SUDEP. In summary, these results provide evidence that MRI biomarkers may be a useful clinical tool in the differential diagnosis of SUDEP patients and show potential for wider applicability to other neurological diseases.

Topic Area: METHODS: Neuroimaging

Minimizing researcher bias and improving statistical power in the analysis of Event-Related Potentials with condition inference random forests (cForest)

Poster F99, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Francesco Usai[1], Antoine Tremblay[1,2], Kiera O'Neil[1], Aaron J. Newman[1]; [1]Dalhousie University, [2]Saint Mary's University

In event-related potential (ERP) data analysis, two critical choices concern how to cut up the time and space (electrodes) continua into windows and regions of interest for analysis. Choosing time windows and electrodes of interest either a priori or "based on visual inspection" risks a lack of sensitivity to true effects, and/or false positives owing to researcher bias. Once possible solution to this problem is conditional inference random forests (cForest), a technique that considers the entire sensor topography through time as a function of other variables, in a single model. We applied cForest to analyse ERPs from a language task, and compared results with those of linear mixed-effects (LME) modelling. ERPs were recorded from 12 people prior to, immediately after, and 2 weeks after they learned vocabulary in a new language, in response to spoken words that matched or did not match a preceding picture. In both post-training sessions LME on mean amplitude from 300-500 ms revealed an expected N400 mismatch effect over central-parietal electrodes (with time window and electrodes selected a priori). Without any prespecification of time or electrodes of interest, cForest identified the same effects. Moreover, cForest revealed changes in the scalp topography of the N400 that varied over time, and with learning success. These results indicate that cForest can both replicates effects found via typical ERP analysis, and also reveal features of the data that other methods may not be sensitive to, in a way that eliminates researcher bias in selecting time windows or electrodes of interest.

Topic Area: METHODS: Neuroimaging

Associations between sleep duration and structural and functional brain MRI measures in the UK Biobank cohort

Poster F100, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Claire Sexton[1], Kai Spiegelhalder[2], Stephen Smith[1], Heidi Johansen-Berg[1], Debbie Lawlor[3], Martin Rutter[4], Simon Kyle[1]; [1]University of Oxford, [2]University of Freiburg, [3]University of Bristol, [4]University of Manchester

While both short and long sleep duration have consistently been shown to be associated with adverse cognitive outcomes, brain magnetic resonance imaging (MRI) studies have often been limited in size and yielded varied results. UK Biobank is a population-based study of 500,000 individuals; within this cohort, both short and long sleep duration have been associated with reduced performance in tests of reaction time, reasoning, and numeric, visual and prospective memory. Here, we report associations between sleep duration and 2,501 imaging-derived phenotypes (IDPs) spanning five modalities (T1-weighted MRI, susceptibility-weighted MRI, diffusion MRI, task functional MRI (fMRI) and resting fMRI) in the first release of neuroimaging data. Individuals reporting a diagnosis of a neurological illness or sleep disorder were excluded from analyses, resulting in a sample of 5,250 participants (mean age 62.2 ± 7.5 years, 53% female, sleep duration 7.2 ± 1.0 hours). All variables were first passed through a rank-based inverse Gaussian transformation and eight confounds (age, age2, sex, age x sex, age2 x sex, head motion during tfMRI, head motion during rfMRI, and headsize) regressed out. Correlation analyses were then performed between sleep duration squared and IDPs. For each modality, the significance level was set at 0.01 divided by the number of IDPs. No significant associations were detected between sleep duration and IDPs. Therefore, we did not find evidence to support a quadratic relationship between sleep duration and MRI measures of brain structure and function. Voxelwise analyses may provide more sensitive markers of the underlying causes of cognitive deficits.

Topic Area: METHODS: Neuroimaging

Semi-Automation of a Reliable Method for Measuring Human Insular Cortex

Poster F101, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Aliyah Jones[1], David Stephenson, M.S.[2], Allen L. Reiss, M.D.[3], Elliott Beaton, Ph.D.[2], Jeremy D. Cohen, Ph.D.[1]; [1]Xavier University of Louisiana, [2]University of New Orleans

Insular Cortex, a multimodal region with connectivity throughout the brain, has a role in numerous clinical disorders. Manual morphometry is the ideal means to measure volume of insular cortex, in order to capture subtle inter-subject variability, but is very time consuming. Automated image processing is far more efficient, but is susceptible to losing some of the anatomical variation across subjects. The goal of this study was to combine the accuracy of manual morphometry with the efficiency of an automated algorithm for obtaining measurements of human insular cortex using Advanced Normalization Tools (ANTs). Similar to the previously published protocol for hippocampus, landmarks were placed on insular cortex using MANGO, and ANTs was used to generate automated ROIs. Manual ROIs were used with the automated ROIs to create a correction algorithm that would improve the reliability over the fully automated ROIs. This segmentation adapter overlaps the automated ROI and the manual ROI and corrects the automated tracing (semi-automated). Manual ROIs were used from a previously analyzed sample in Fragile X Syndrome. Intra-class correlation coefficients (ICC) were used to test reliability. Results showed low reliability between manual tracings and ANTs automated tracings indicating that the automated approach alone is not enough. ICC between manual left and semi-automated left measurements was .784, and .864 between manual right and semi-automated right measurements. The semi-automated ROIs were found to be more accurate than just the automated ROIs, indicating this novel ANTs protocol may be a reliable tool for analyzing insular morphometry in larger subject samples.

Topic Area: METHODS: Neuroimaging

Identification of frontal-striatal circuits with simultaneous TMS-fMRI

Poster F102, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Christopher Muse-Fisher[1], Justin Riddle[1], Jason Scimeca[1], Mark D'Esposito[1]; [1]UC Berkeley

Transcranial Magnetic Stimulation (TMS) allows for direct stimulation of the human neocortex and has proven to be fundamental for causally testing hypotheses in cognitive neuroscience. It has yet to be shown that spreading activation from TMS is confined to anatomically specific circuits and whether cortical TMS can reliably activate connected subcortical structures. By administering TMS simultaneously with functional Magnetic Resonance Imaging (fMRI), the effect of cortical TMS on activity in subcortical structures can be quantified by varying the levels of TMS intensity. The basal ganglia are an ideal target because of their distinct anatomically defined circuits with neocortex, or “loops”. For sensorimotor processing, primary motor cortex (M1) forms a loop with the putamen, while dorsolateral prefrontal cortex (DLPFC) forms a loop with the caudate (Alexander et al. 1986). Strafella et al. (2001, 2003) demonstrated that following TMS to M1 or DLPFC, there is increased dopamine release in posterior putamen or dorsal caudate respectively, as measured by positron emission tomography. In our experiment, two separate groups of healthy human subjects participated in concurrent TMS and resting state fMRI while receiving TMS to either DLPFC or M1. We found that increasing TMS intensity to the DLPFC caused increasing BOLD signal in the dorsal caudate with no change in the posterior putamen. In contrast, TMS to M1 increased BOLD signal in the posterior putamen with no change in the dorsal caudate. These results demonstrate the use of simultaneous TMS-fMRI to target deep brain structures with known anatomical connectivity with cortical regions.

Topic Area: METHODS: Neuroimaging

Effects of age on extrastriatal dopamine D2 receptor availability are overestimated without partial volume correction

Poster F103, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Jennifer L. Crawford[1], Kendra L. Seaman[1], Aishwarya Vijay[1], David Matuskey[1], Evan D. Morris[1], Gregory R. Samanez-Larkin[1]; [1]Yale University

Prior studies have reported a marked decline in dopamine D2-like receptor availability across the adult life span in extrastriatal regions, however, almost none have accounted for age-related structural brain changes when quantifying dopamine receptor availability across adulthood. We used [11C] FLB 457, a high affinity D2/3 radioligand, to quantify dopamine receptor binding across frontal, parietal, temporal and occipital cortices, in addition to the hippocampus, amygdala, and thalamus. The positron emission tomography (PET) data were partial volume corrected (PVC) to account for age-related structural changes prior to binding potential estimation and then compared to the binding potentials obtained without using PVC. We found that the non-PVC data overestimated the negative association between age and D2-like receptors in every region studied, underscoring the importance of accounting for age-related morphological brain changes through the use of PVC in PET studies of dopamine receptor availability that have wide variation in participant age.

Topic Area: METHODS: Neuroimaging

An evaluation of fNIRS preprocessing techniques using concurrent fNIRS-fMRI measurements

Poster F104, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Aaron M. Piccirilli[1], S.M. Hadi Hosseini[1], Joseph M. Baker[1], Jennifer L. Bruno[1], Andrew Gundran[1], Zachary Stuart[1], Lene K. Harbott[1], J. Christian Gerdes[1], Allan L. Reiss[1]; [1]Stanford University

Functional near-infrared spectroscopy (fNIRS) is a noninvasive optical brain imaging technique that measures relative changes in oxygenated and deoxygenated hemoglobin (HbO, HbR) as a proxy for brain activity. It is considered a promising alternative to functional MRI (fMRI) because of its relative portability, cost-effectiveness, and motion-tolerance. However, fNIRS preprocessing methods are still developing. Here, we investigate different preprocessing methods by comparing the correlation between simultaneously-recorded fNIRS and fMRI timecourses. We measured brain activity in nineteen healthy adults during a visuomotor task using fMRI and twenty-one fNIRS channels spanning the prefrontal cortex. From these data, we generated spherical regions of interest (ROIs) centered on the cortical projections of each fNIRS channel and calculated a mean BOLD timecourse for each ROI. Finally, we correlated the resultant timecourses while varying motion-correction and channel removal methods. The results indicated that HbO was more highly correlated with the BOLD signal than HbR, regardless of preprocessing methods. Motion artifact removal using wavelet filtering improved correlations for HbO, but decreased correlations for HbR. Compared to not removing channels, all of the methods that we used to remove noisy channels improved correlations. The highest correlations came from rejecting channels based on qualitative examination of the data in the frequency domain, as well as thresholding on instrument gain and signal-to-noise ratio. Our findings suggest that wavelet filtering, a widely-used technique, may not be optimal for low-motion paradigms. Further, they emphasize the value of bad channel removal and an approach informed by frequency-domain analysis and instrumentation parameters.

Topic Area: METHODS: Neuroimaging

Language lateralization assessed by magnetoencephalography imaging using three different language tasks

Poster F105, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Elke De Witte[1], Leighton Hinkley[1], Danielle Mizuiri[1], Coleman Garrett[1], Susanne Honma[1], Heidi Kirsch[1], John Houde[1], Mitchel Berger[1], Sri Nagarajan[1]; [1]University of California, San Francisco

Introduction: Magnetoencephalography (MEG) is a valuable alternative to the Wada test for defining preoperative language lateralization in neurosurgical candidates. The goal of this study was to benchmark an existing preoperative MEG paradigm for language lateralization with excellent predictive value (verb generation) against new language tasks. Methods: In this study, a small cohort of 7 glioma patients underwent both the Wada test and MEG using a 275-channel whole-head biomagnetometer (CTF Systems) for verb generation (VG), non-word repetition (NWR) and picture naming (PN) in the preoperative phase. In a large cohort of 67 and 59 glioma patients MEG was conducted using respectively VG + NWR and VG + PN. MEG data was reconstructed in source space using an adaptive spatial filtering technique in Nutmeg (www.nitrc.org/projects/nutmeg). Optimized time windows and regions of interest for each task were determined by examining oscillations in the beta band (12-30Hz), which were concordant with the Wada data or VG laterality index (LI). Results: The following time windows showed the highest correlation with VG LI or the WADA data: -450 -250ms for PN response locked; -350 -150ms for NWR response locked and 650 850ms for NWR stimulus locked. Using these time windows we identified 83.34%, 87.5% and 100% concordance with the Wada test for respectively NWR, PN and the composite LI for all 3 language tasks. 80% of the large cohort data showed concordance with the VG LI. Conclusion: This study enables to define the optimal parameters for MEG laterality calculations in language tasks outside of verb generation.

Topic Area: METHODS: Neuroimaging

Anterior-Posterior Insular Cortex Bisection Plugin for Mango

Poster F106, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Zachary Laborde[1], David Stephenson[2], Allan L. Reiss[3], Elliott Beaton[2], Jeremy D. Cohen[1]; [1]Xavier University of Louisiana, [2]University of New Orleans, [3]Stanford School of Medicine

Insular Cortex, while being one of the most highly integrative regions of the brain, continues to be one the least understood. Previous studies have found cytoarchitectural subregions within insular cortex, each with unique patterns of connectivity with other brain regions. Taken together, along with more recent functional analyses, evidence suggests that each insular subregion performs a unique functional role. Using a simple geometric bisecting algorithm (i.e., the Cohen Bisect), these subregions can accurately be sized and located. However, this method has only been used in a discontinued brain imaging application known as BrainImageJava (BIJ). In order to continue research on the function and makeup of insular cortical subregions, a new Cohen Bisect plugin was created for the Multi-Image Analysis GUI (Mango). Manual insular regions-of-interest (ROIs) were created among a sample of Fragile X Syndrome, Developmental Delay and Typically Developing children. Using this open-sourced plugin, anterior and posterior insular gray-matter volumes were reliably measured and showed no degradation between the original total volume and the post-bisect totals. Additional previously analyzed insular ROIs were converted from BIJ to Mango, and the new Cohen Bisect plugin was used reliably to confirm previous statistical results. The new Cohen Bisect Plugin for Mango incorporates an established methodology into a novel tool for researchers to approximate insular functional subregions using structural MRI.

Topic Area: METHODS: Neuroimaging

Treatment induced plasticity of motor and language networks in patients with brain lesions

Poster F107, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Nina Sardesh[1], Lucia Bulubas[2], Tavish Traut[1], Danielle Mizuiri[1], Susanne Honma[1], Coleman Garrett[1], Avery Garrett[1], Mitchel Berger[1], Heidi Kersch[1], Phiroz Tarapore[1], Srikantan Nagarajan[1]; [1]University of California, San Francisco, [2]Technische Universitat Munchen, Munich, Germany

The goal of this work was to examine plasticity of motor and language networks in patients with brain lesions who undergo resective surgery followed by radiation and chemotherapy. Ninety-nine patients with grade II-IV lesions underwent preoperative mapping with language and motor tasks on two occasions up to eight years apart due to tumor recurrence. This study focuses on the comparison of preoperative magnetoencephalography brain activation profiles across multiple visits on a group level. The examine motor networks, we examined activation maps during movement preparation for left and right index finger. Spatial analysis of preparatory activity maps for RD2 and LD2 demonstrated increased beta desynchronization activity ipsilateral to the digit, regardless of tumor location. To assess language network engagement, we examine language laterality during an auditory verb generation task. Analysis of the shift in laterality index between scans demonstrated that tumors positioned ipsilaterally to the side of language dominance experienced a significantly greater shift when compared to tumors located in non-dominant hemisphere. Based on this study, neural activity in both motor and language networks appears to shift contralateral to the hemisphere containing the tumor.

Topic Area: METHODS: Neuroimaging

Deep learning techniques for decoding EEG signatures of viewing or refreshing face, scene, and word stimuli

Poster F108, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Jacob Williams[1], Ashok Samal[1], Matthew Johnson[1]; [1]University of Nebraska - Lincoln

Modern deep learning techniques have proven revolutionary in the classification of images, speech signals, and other data types, yet are rarely applied in the analysis of cognitive neuroscience datasets. Deep learning techniques are particularly effective in data with high temporal and spatial correlation, seemingly making them a natural fit for techniques such as fMRI and EEG. However, due to the tendency for deep learning techniques to overfit, thousands or even millions of samples are usually required for optimal results. Cognitive neuroscience datasets rarely reach that size; thus multivariate pattern analysis (MVPA) in neuroimaging typically employs simpler classification techniques, which conversely may ignore relevant features and underfit. We explored whether deep learning techniques could be fruitfully applied to EEG MVPA in a dataset previously analyzed with Sparse Multinomial Logistic Regression (SMLR). Participants in the study viewed and refreshed (thought back to) face, scene, or word pictures, and we classified the category either perceived or refreshed. We found that in individual-subject models (~200 samples per participant) analogous to typical MVPA approaches, deep learning techniques only matched SMLR after extensive regularization, data augmentation, and careful tuning. Furthermore, complicated architectures using convolutional or recurrent layers drastically overfitted even in the presence of regularization and data augmentation. However, when considering a universal (cross-subject) model containing several thousand samples, convolutional and recurrent architectures significantly outperformed both individual-subject and universal SMLR models for visual perception. These results suggest that deep learning techniques may significantly boost MVPA performance in neuroimaging studies when sufficient data are available.

Topic Area: METHODS: Neuroimaging

The National Adult Reading Test and Wechsler Test of Adult Reading as measures of premorbid IQ: Comparison and Restandardisation against the Wechsler Adult Intelligence Scale – Fourth Edition.

Poster F109, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Peter Bright[1], Ian van der Linde[1]; [1]Anglia Ruskin University, Cambridge

The National Adult Reading Test (NART; Nelson, 1982; NART–R; Nelson & Willison, 1991) and Wechsler Test of Adult Reading (WTAR; Wechsler, 2001) are widely adopted methods for estimating premorbid IQ in neurological patients. However, neither test has been standardised against the most recent revision of the Wechsler Adult Intelligence Scale (WAIS-IV; Wechsler, 2008). Our objective, therefore, was to produce reliable standardised estimates of WAIS-IV IQ from the NART and WTAR. Assessments were conducted on 92 neurologically healthy British participants (mean age 40 years; range 18-70; SD 16.78). Regression equations were extracted from the data and used to produce population estimates of WAIS-IV full-scale IQ (FSIQ) and constituent index scores. Strong NART/WAIS-IV and WTAR/WAIS-IV FSIQ correlations were observed with more moderate correlations observed between NART/WTAR error and WAIS-IV constituent index scores. Combining NART and WTAR data did not improve predictive accuracy. Demographically-based equations provided comparatively inaccurate estimates, and the combination of demographic data with NART/WTAR scores did not provide a more accurate measure of IQ than either test alone. Estimates were markedly discrepant with published WAIS-R/WAIS-III FSIQ estimates at the lower end of the performance distribution, and we therefore advise caution in the use of published WAIS and/or WAIS-R estimates for estimating premorbid WAIS-IV FSIQ, particularly for those with low scores. In conclusion, the present findings indicate that continued use of the NART or WTAR as important clinical tools for estimating premorbid levels of intellectual ability is justified, despite the availability of more recently developed measures.

Topic Area: METHODS: Other

fMRI-guided theta burst stimulation to the superior temporal cortex impairs sentence processing.

Poster F110, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Marina Bedny[1], Judy Kim[1], Gabriela Cantarero[2,3], Pablo Celnik[2]; [1]Johns Hopkins University, [2]Johns Hopkins School of Medicine, [3]Walter Reed Army Institute of Research

Sentence processing recruits regions in inferior frontal and lateral temporal cortices (e.g., Fedorenko et al., 2011). Here, we asked whether off-line, continuous theta burst stimulation (cTBS) to these areas disrupts sentence processing. Twelve participants underwent an fMRI scan while listening to sentences and answering true/false questions. Each sentences contained two actors, and questions asked about who did what to whom. In a control condition, participants performed a working memory task with lists of nonwords. Stimulation was delivered to the left inferior frontal cortex (IFC), left superior temporal cortex (STC), or vertex. Stimulation sites were identified based on individual-subject fMRI activation during sentence processing (sentences>nonwords). We measured sentence comprehension and non-word memory performance immediately before and after cTBS. In the baseline vertex condition, performance for sentences improved following stimulation (post-pre=9%). In contrast, performance for sentences did not improve after STC stimulation (post-pre=1%) (vertex vs. STC $t(11)=2.59$, $p<.05$), suggesting that STC stimulation extinguished within-session improvement. Effects of IFC stimulation on performance did not differ from the effects of vertex stimulation. Further, the effects of cTBS to IFC, STC, and vertex on nonwords performance did not differ. Our results suggest that cTBC to STC selectively impairs sentence processing, and that cTBS may have different effects on IFC and STC.

Topic Area: METHODS: Other

Edinburgh Handedness Inventory as a measure of motor imagery ability, not just handedness

Poster F111, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Christopher Madan[1,2], Christopher Donoff[2], Anthony Singhal[2]; [1]Boston College, [2]University of Alberta

The Edinburgh Handedness Inventory (EHI) has become a staple in the neuroimaging literature as a measure of handedness, due to the relationship between handedness and cerebral lateralization of language function. However, a large part of the literature has demonstrated that the EHI is not a unidimensional construct. Item analyses indicate that several questions of the EHI are either highly collinear, and thus do not contribute unique variance, or introduce measurement error. As a test of handedness, it is important to acknowledge that the EHI is a test of hand preference, rather than of skill in overt movements. Specifically, the EHI can be described as asking participants to imagine tool-related interactions, and make subjective judgments of how the participant would interact with the object. Here we demonstrate that in addition to indexing handedness, the EHI also serves as a measure of inter-individual ability in movement imagery. We suggest that questions demonstrating low consistency may be useful in measuring motor imagery ability, distinct from its ability to index handedness.

Topic Area: METHODS: Other

Accounting for nonlinearities in models of language processing: Can linear regression get the job done?

Poster F112, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Sean McWhinney[1], Kaitlyn Tagarelli[1], Antoine Tremblay[1], Aaron Newman[1]; [1]Dalhousie University

Strategies in language processing, and their associated neural substrates, are commonly assumed to be homogenous among a language's native speakers. However, mounting evidence suggests that individual differences in vocabulary, grammatical ability and cognition impact on the onset and latency of the event-related potential (ERP) components elicited during sentence processing. With increasingly complex research questions and the potential for high-level, nonlinear interactions, conventional statistical approaches to examining ERP data face limitations and new techniques must be explored. The present study investigated advances in analytical approaches in the context of language processing. Participants completed a test battery to assess a range of cognitive skills (including language, working memory, attention), habits (e.g., reading), and demographics. Sentences were presented that were well-formed or contained one of three types of violations: semantic, phrase structure, or morphosyntactic. Data were analyzed using two different variants of the general linear model (GLM): linear mixed effects (LME) and generalized additive mixed modelling (GAMM). Both offer advantages over more traditionally-used variants of the GLM (e.g., ANOVA, linear regression), including support for random effects to account for variable residuals and improved tolerance to heteroscedasticity. However, GAMM fits observations to a series of restricted cubic splines, allowing for nonlinear interactions between variables, and is capable of detecting ceiling/floor effects and nuanced fluctuations in effect sizes. Our results demonstrated important nonlinearities that GAMM was able to depict, reducing model residuals and improving sensitivity to effects.

Topic Area: METHODS: Other

Domain-specific accuracy of the Montreal Cognitive Assessment and the Mattis Dementia Rating Scale-2 in Parkinson's disease

Poster F113, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Taylor Hendershott[1], Delphine Zhu[1], Seoni Llanes[1], Kathleen Poston[1,2]; [1]Department of Neurology and Neurological Science, Stanford University School of Medicine, [2]Department of Neurosurgery, Stanford University School of Medicine

Individuals with Parkinson's disease (PD) have an increased risk of developing cognitive impairment (CI). Due to limited time and resources in research and clinical settings, global cognitive assessments, such as the Montreal Cognitive Assessment (MoCA) and Mattis Dementia Rating Scale-2 (DRS), are sometimes used to diagnose CI in lieu of a full neuropsychological battery. These tests contain subtests aimed to measure specific cognitive functions, but there are no published data assessing the domain specific accuracy of the MoCA and DRS. To examine this, we administered a MoCA and DRS to 85 PD participants, along with a neuropsychological battery that assessed five cognitive domains: attention/working memory, executive function, episodic memory, language, and visuospatial. Using published criteria, we defined CI as more than 1.5 standard deviations below the mean on at least two tests. Participants were categorized as PD without CI (n=45) or PD with CI (n=40). Using the receiver operating characteristic curve, the MoCA displayed a high sensitivity and specificity in identifying executive function impairment (89.3% and 82.5%), but was neither sensitive nor specific in identifying language (68.8% and 71.0%) and attention/working memory (59.1% and 79.4%) impairments. The DRS showed sensitivity, but not specificity in detecting domain-specific impairments for the attention (95.5% and 46.0%) and memory (79.5% and 50.0%) sections. The DRS construction section was sensitive but not specific (94.3% and 13.3%) in detecting visuospatial impairments. These results demonstrate that the MoCA and DRS are useful screening tools, but have limited domain specificity and therefore should be interpreted with caution.

Topic Area: METHODS: Other

Neural coding of odor "liking" and "wanting" in the olfactory sensory hierarchy

Poster F114, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Sarah Baisley[1], Thomas Campbell Arnold[1], Jaryd Hiser[2], Lucas Novak[1], Takuya Sato[3], Wen Li[1]; [1]Florida State University, [2]University of Wisconsin-Madison, [3]Kikkoman Singapore R&D Laboratory PTE LTD

The "liking" and "wanting" reward components are an increasingly popular research area, yet it is unclear how the human olfactory system contributes to the encoding of odor valence (liking) and reward incentive (wanting). This study examines neural representations of odor incentive and valence in the olfactory cortical hierarchy, including the anterior/posterior piriform cortex (APC/PPC), orbitofrontal cortex (OFC), and amygdala. Participants (N=27) categorized odors (isointense, merely detectable) from three categories (food/floral/wood) while viewing a picture congruent or incongruent to the odor. Food odors were high in reward incentive and positive valence; floral odors were high in positive valence only; and wood odors were low in both properties. Support vector machine (SVM) analysis and representational similarity analysis (RSA) were performed on functional magnetic resonance imaging (fMRI) data. SVM analysis misclassified floral odor more often as food than wood in the APC, PPC, and amygdala (P's<0.05) but not OFC, regardless of visual-olfactory congruency, suggesting that low- to intermediate-level olfactory regions are more likely to encode valence than incentive value. RSA results showed greater representational similarity between floral and wood odors in PPC than between floral

and food odors during congruent trials only (P<0.05), suggesting that visual input facilitates PPC incentive encoding. The amygdala showed greater representational similarity between floral and food odors, but only during incongruent trials (P<0.05), suggesting sensitivity to olfactory valence input. These results suggest that the olfactory sensory system contributes to odor valence "liking" encoding, while the PPC may also be involved in incentive "wanting" encoding of congruent visual-olfactory input.

Topic Area: PERCEPTION & ACTION: Multisensory

Multi-sensory Connections: Matching Stimuli across Auditory and Visual Domains

Poster F115, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Lauren Hendrickson[1], Ferrinne Spector[1]; [1]Edgewood College

Although adults do not usually see colors and shapes while hearing music, there are consistencies between individuals when asked to match stimuli across these sensory dimensions. Examining such consistencies may reveal clues into underlying perceptual processes, particularly when combined with the experiences of individuals with synesthesia who do experience extraneous concrete percepts in response to sensory stimuli. In a previous study (Callahan, Bertz & Spector, 2016), non-synesthetic and synesthetic adults created drawings in response to music clips. The purpose of the current study was to examine whether non-synesthetic adults match visualizations to the music for which each visualization was created. Across three experiments, non-synesthetic adults (n=40) listened to music clips and made a forced-choice between a congruent or incongruent visualization. The congruent visualizations were created by either a non-synesthete (Experiments 1 & 2) or an audio-visual synesthete (Experiment 3) in response to the target music clip. The incongruent visualizations were created in response to a different clip of music by either the same non-synesthete (Experiment 1), a different non-synesthete (Experiment 2), or a different audio-visual synesthete (Experiment 3). We randomized trial presentation within each experiment and counterbalanced experiment order across participants. Preliminary results suggest that non-synesthetic adults consistently match congruent visualizations to the target music clips, and that congruent matching is more likely when visualizations are created by different people. These results support the hypothesis that sensory information can be reliably matched across sensory domains, which may reflect inherent neural organization and provide insight into the processes underlying multisensory perception.

Topic Area: PERCEPTION & ACTION: Multisensory

Integration and segregation of task-specific areas during task preparation

Poster F116, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Laura Quante[1,2], Daniel S. Kluger[1,2], Ricarda I. Schubotz[1,2,3]; [1]Westfälische Wilhelms-Universität, Münster, Germany, [2]Otto Creutzfeldt Center for Cognitive and Behavioral Neuroscience, Germany, [3]University Hospital Cologne, Germany

Integration and segregation in global brain communication are necessary prerequisites for complex behavior. While segregation means that distributed areas work independently from one another and perform specialized functions, integration denotes a global coordinative coupling of functionally distinct brain regions. Using fMRI and measures of functional connectivity, the present study aimed to investigate the extent to which integration is modulated by the predictiveness of audiovisual input. Based on an initial cue, participants were asked to exploit only auditory, only visual, both auditory and visual, or neither of the information sources presented during a 12-second period to predict the target location in a subsequent visual search task. Crucially, predictability of the target location varied as a function of prior sensory information: exploiting both modalities allowed the most precise prediction of the target location, whereas target prediction was less precise if using visual or auditory information only. In case neither modality was cued to be useful, no target prediction was possible. Functional connectivity measures of integration were assessed at the global as well as at the individual node level. With respect to global connectivity patterns, the non-predictive condition showed least integration, as indicated by higher clustering and greater characteristic path length. At the nodal level, we found modality-specific areas to be more integrated whenever the respective information was predictive. In sum, our findings show that predictiveness of sensory information leads to an increase in integration at both the global and the nodal level, thus aiding preparation of behavior.

Topic Area: PERCEPTION & ACTION: Multisensory

AudioVisual Integration and Training in Hemianopia: A Neurocomputational Study

Poster F117, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Elisa Magosso[1], Caterina Bertini[1], Cristiano Cuppini[1], Mauro Ursino[1]; [1]University of Bologna, Italy

Hemianopic patients manifest a loss of conscious vision in one hemifield, generally resulting from unilateral lesion to striate cortex (V1). Behavioral data suggest that these patients may enormously benefit from multisensory audiovisual integration, both 'online' and 'offline'. As to online effects, visual detection in the blind hemifield improves when the visual stimuli are concurrently presented with spatially coincident auditory stimuli. As to offline effects, visual performances ameliorate after a training with systematic congruent audiovisual stimulation in the blind hemifield. To enhance comprehension of the underlying neural mechanisms, we propose a neurocomputational model embracing the retino-striate-extrastriate (primary) visual pathway, the retino-colliculo-extrastriate (secondary) visual pathway and the auditory cortex. The Superior Colliculus integrates visual and auditory information and projects back to the cortices. Hemianopia is simulated by unilaterally lesioning V1; conscious vision is assumed to depend on extrastriate activation. The model reproduces: a) Loss of conscious vision in the blind hemifield, due to damage of

primary visual pathway and weakness of the secondary one. b) The online effect of multisensory stimulation on visual detection, ascribing it to multisensory enhancement of SC activation, which triggers extrastriate activation. c) The offline effects of the multisensory training, by applying Hebbian synaptic rules. Post-training visual improvements are ascribed to synaptic reinforcement along the secondary retino-colliculo-extrastriate pathway. The model provides a coherent framework for interpretation of behavioral multisensory effects in hemianopia; moreover, by simulating different paradigms of training (audiovisual/visual, with/without top-down attention towards the blind hemifield) can predict different forms and levels of rehabilitation.

Topic Area: PERCEPTION & ACTION: Multisensory

Mechanisms for Bayesian inference maturation in a biologically inspired neurocomputational model

Poster F118, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Mauro Ursino[1], Cristiano Cuppini[1], Elisa Magosso[1]; [1]University of Bologna, Italy

Several experimental studies suggest that, in multisensory conditions, the brain performs a near-optimal Bayesian estimate of the external events, laying more weight to the more reliable stimuli. However, the neural mechanisms responsible for this behavior, and its progressive maturation in a multisensory environment, are still insufficiently understood. Aim of this work is to investigate this problem with a neurocomputational model of audio-visual integration. Model assumes the presence of two unimodal areas (auditory and visual, respectively) with a topological organisation. Each area receives an input of its own modality through synapses from the external environment (implementing neuron receptive field, RF), and is connected with neurons in the other area with cross-modal recurrent synapses (responsible for multisensory integration). On the basis of past experience, synapses were trained via Hebbian potentiation and a decay term. A third chain of multisensory neurons performs a simple sum of auditory and visual excitations to provide a single causal inference. Simulations show that, after training, the network realizes a maximum likelihood estimate of auditory (or visual) positions in unimodal conditions, and a near-optimal Bayesian estimate in cross-modal conditions. In particular, prior information on the co-occurrence of stimuli is encoded in the cross-modal synapses. Furthermore, the model explains the ventriloquism illusion and, from the activity in the multimodal layer, accomplishes causal inference according to the reliability of the individual cues. The network can represent an important tool to analyze how Bayesian inference can be learned from experience, and to point out some of the underlying neural mechanisms.

Topic Area: PERCEPTION & ACTION: Multisensory

Alpha Matters: Alpha Oscillatory Activity Correlates With Sensory Profile Measures

Poster F119, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Nika Kartvelishvili[1], Kevin Clancy[1], Sarah Baisley[1], Wen Li[1]; [1]Florida State University

It has long been suspected that alpha oscillations (8-12 Hz) play an important role in the inhibition of irrelevant sensory input, and are thus involved in sensory gating and processing. The relationship between various alpha measures and the way an individual processes and reacts to sensory input, however, has never been explicitly tested. We recruited healthy undergraduate volunteers (n=20) and assessed sensory processing styles using the Adolescent/Adult Sensory Profile (ASP) questionnaire. We obtained individual peak alpha frequencies (PAF's), alpha power, and causal connectivity measures in the alpha range [as indexed by granger causality (GC)] using resting-state eyes-open electroencephalography (EEG). Pearson correlational analysis revealed a significant positive correlation between left hemispheric alpha power and sensation seeking behavior (r=0.459, p=0.042) and a marginally significant positive correlation between these measures in the right hemisphere(r=0.376, p=0.102). Additionally, we found a marginally significant negative correlation between low visual registration and left alpha GC (r=-0.435, p=0.055). Finally, we discovered marginally significant negative correlations between left alpha GC and sensory sensitivity (r=-0.433, p=0.051) and between left alpha GC and sensory avoidance (r=-0.430, p=0.058). No significant correlations were found between PAF and any sensory measures on the ASP. Overall, the results suggest that alpha power and GC (especially in the left hemisphere) play important roles in the processing of sensory information. These findings have implications for the treatment of sensory processing disorder (SPD) as well as other conditions that may involve sensory processing abnormalities, such as autism spectrum disorder (ASD), attention deficit hyperactivity disorder (ADHD), and schizophrenia.

Topic Area: PERCEPTION & ACTION: Multisensory

Startling Sounds Presented under Dark Adaptation Evoke Synesthetic Experiences

Poster F120, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Anupama Nair[1,2], David Brang[1]; [1]University of Michigan, [2]University of Amsterdam

Synesthesia is a perceptual phenomenon in which stimulation of one sensory modality evokes additional experiences in an unrelated modality (e.g., sounds evoking colors), thought to arise from increased connectivity between associated sensory areas. However, non-synesthetes can experience these sensations via hallucinogenics or as the result of brain damage, raising the possibility that synesthesia exists as a latent feature in all individuals, manifesting only when the balance of activity across the senses has been altered. Indeed, multisensory connections exist in all individuals that support the processing of dynamic auditory, visual, and tactile information present in the environment, but it is thought that inhibition of these pathways and the presence of dominant bottom-up information prevents normal

multisensory interactions from evoking the subjective experience of synesthesia. In this study, we sought to counter these two features of normal sensory perception in order to evoke auditory-visual synesthetic experiences in non-synesthetes. First, participants were placed in a visually deprived environment while sounds were presented from two spatial locations at random and infrequent intervals. Visual percepts evoked by startling sounds were observed in 5 out of 20 subjects. Next, we added a visual-imagery task to increase top-down feedback to early visual areas, resulting in 14 out of 24 subjects experiencing auditory-visual synesthetic percepts. Across both experiments subjects reported seeing visual images (vivid colors and Klüver's form-constants) localized to the speaker position. These results indicate a higher prevalence of synesthetic experiences in the general population and a link to normal multisensory processes.

Topic Area: PERCEPTION & ACTION: Multisensory

Word-Shape, Taste-Shape, and Taste Word-Shape Associations in Persons With Aphasia

Poster F121, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Vijayachandra Ramachandra[1]; [1]Marywood University

There has been a resurgence of the motor theory (MT) of speech perception with the discovery of mirror neurons. There seems to be a striking resemblance between the MT and mirror neuron functions because both make connections between production and perception. The mirror neuron system (MNS) especially in the frontal and temporal regions may be crucial for speech perception. Given that persons with aphasia (PWA) generally have lesions in these regions containing the MNS, it is reasonable to hypothesize that they may have problems with multisensory integration required for speech perception. 29 subjects (9 people with non-fluent aphasia, 10 age-matched older controls and 10 younger controls) were given multisensory integration tasks which required making iconic associations. They included word-shape, taste-shape and taste word-shape association tasks. One-sample t-test revealed that the aphasia group was significantly below chance (at 50%) on both word-shape and taste-shape association tasks ($P>0.05$). Both the control groups performed significantly above chance on both these tasks ($P< 0.05$). Finally, the performance of the aphasia group was comparable to that of the control groups on the taste word-shape association tasks. Overall, the results indicate that PWA were not as good as healthy controls at multisensory processing, indicating a MNS deficit. This should be interpreted with caution because there were four individuals with aphasia who performed above chance on these tasks. Moreover, PWA were as good as control participants on taste word-shape association. The discussion of results considers how iconicity may facilitate language recovery at least in some PWA.

Topic Area: PERCEPTION & ACTION: Multisensory

Differences in Neural Correlates of Error Correction in Auditory and Visual Sensorimotor Synchronization

Poster F122, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Daniel Comstock[1], Ramesh Balasubramaniam[1]; [1]University of California - Merced

Tapping in synchrony to a metronome with occasional temporal perturbations produces quickly corrected synchronization errors. Previous research has shown that these error corrections fall into two types: period corrections or phase corrections. Period corrections are quick corrections occurring when a perturbation is large enough to be consciously noticed, while phase corrections are more gradual and correspond to perturbations small enough to be subconscious. This study used these temporal perturbations to investigate the differences in the auditory and visual timing mechanisms. Electroencephalography (EEG) was measured during synchronization tapping tasks with either an auditory, or flashing visual metronome, both with an interonset interval of 600 milliseconds. Occasional perturbations of +/- 66 milliseconds and +/- 16 milliseconds were inserted to produce period correction and phase correction responses, respectively. We hypothesized that the corrections in the visual modality would be more gradual than in the auditory modality, and that these differences would be represented by separate neural components as measured by EEG. Our findings show period corrections only in the auditory modality for the +/- 66 perturbations. All other conditions, auditory and visual, produced only phase corrections. EEG data showed an Error Related Negativity (ERN) in the +66 auditory condition as expected, but no ERN was found for any of the visual conditions. Interestingly, Visual P1 and P2 components suggest detection of the +/-66 perturbations, even though they did not translate into a period correction response. The findings suggest the auditory system may have privileged access to timing mechanisms in the brain.

Topic Area: PERCEPTION & ACTION: Multisensory

Automatic Counting and Involuntary Polymodal Imagery (Involving Olfaction, Audition, Touch, Taste, and Vision)

Poster F123, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Jamie Renna[1], Wei Dou[1], Sabrina Bhangal[1], Mark W. Geisler[1], Ezequiel Morsella[1,2]; [1]San Francisco State University, [2]University of California, San Francisco

The Reflexive Imagery Task (RIT) reveals that high-level conscious thoughts and mental imagery can be activated involuntarily through the mere activation of action sets (Allen et al., 2013). In the original version of the RIT, participants are presented with visual objects and instructed to not think of the names of the objects. Involuntary subvocalizations arise on the majority of the trials. We extended this paradigm to investigate involuntary counting (Study 1) and unintentional imagery (Study 2). In Study 1, participants (n = 30) were presented with an array of nonsense shapes after receiving the instruction to not count the shapes. Some arrays had object counts below the "subitizing" range (2-5 shapes, the range for automatic counting); other arrays had counts exceeding this range (6-10 shapes). Involuntary counting was more likely for the former condition than the latter condition, $t(29) = 29.42$, $p < .001$. Does the likelihood of an RIT effect vary as a function of the type of sensory modality? To address this question, in Study 2, participants (n = 33) were presented with food items as orthographic stimuli (e.g., BANANA) or as line drawings. For each stimulus, participants were instructed to not experience a certain type of imagery (e.g., visual, olfactory, haptic, or auditory). Across the 216 trials, the rate of the RIT effect (involuntary imagery) varied as a function of modality, $F(3, 96) = 47.10$, $p < .001$. Because these RIT variants involve imagery and minimal overt behavior, they are well suited for exploration with neuroimaging technologies.

Topic Area: PERCEPTION & ACTION: Multisensory

Magnifying the view of the hand changes its cortical representation. A Transcranial magnetic stimulation study.

Poster F124, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Elisabetta Ambron[1], Nicole White[1], Jared Medina[2], Branch Coslett[1]; [1]Laboratory for Cognition and Neural Stimulation, Dept. of Neurology, Perelman School of Medicine at the University of Pennsylvania, [2]Department of Psychology, University of Delaware.

Changes in the perceived size of a body part, like the hand, using magnifying glasses influence pain and tactile perception, and motor functions. If the beneficial effect of the magnification of the hand in task performance has been reported in different domains, the mechanisms by which this effect occurs are still little understood. One possible interpretation is that the visual magnification of hand increases the cortical excitability (Experiment 1) and the cortical area devoted to the body part in question (Experiment 2). We measured motor evoked potentials (MEP) from the first dorsal interosseus (FDI) when participants were looking at their hand in normal or magnified vision. In Experiment 1, TMS was applied over the FDI area (hotspot), while in Experiment 2, a 3x5 grid of stimulation sites was superimposed over the hotspot and TMS was applied over these 15 sites. MEP amplitude increased with the magnification of the hand at the hot spot (Experiment 1) and in the areas surrounding the hotspot (Experiment 2). These evidence suggest that the magnification effect might be due to a rapid remapping of the cortical representation of hand.

Topic Area: PERCEPTION & ACTION: Multisensory

Tactile and visual motion processing in congenitally deaf humans

Poster F125, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Agnes K. Villwock[1,2], Davide Bottari[1], Brigitte Roeder[1]; [1]University of Hamburg, [2]University of California San Diego

Sensory deprivation has been shown to partially impact the development of the remaining modalities. However, to date, the consequences of congenital deafness on the processing of the spared senses remain inconclusive. This is particularly the case with regard to the somatosensory modality. In the present study, we investigated the consequences of auditory deprivation from birth on the processing of tactile and visual motion. To this end, we recorded event-related potentials (ERPs) in congenitally deaf signers (N = 21) and matched hearing controls during a target detection task with unimodal, dynamic tactile and visual stimuli. The motion of standard stimuli was continuous, whereas deviants comprised a gap in motion. Participants were asked to respond to rare deviants moving in a target direction. We predicted to find an enhanced behavioral performance in the deaf group compared to hearing controls. Furthermore, we expected a more anterior distribution of the ERPs in the deaf group compared to the hearing group after tactile or visual stimulation, indicating crossmodal reorganization. No between-group differences were found in the behavioral measures. The ERPs at 150 ms poststimulus onset displayed a more anterior distribution of the potential in the deaf group compared to the hearing control group. Importantly, this difference was observed independently of the presented modality. This finding suggests crossmodal reorganization as a result of congenital deafness – that is, enhanced activation of areas, which are typically associated with auditory processing in hearing individuals. Acknowledgement: This study was supported by the European Research Council (ERC-2009-AdG 249425-CriticalBrainChanges).

Topic Area: PERCEPTION & ACTION: Multisensory

Decoding Across Senses the Representations of Everyday Objects from the Lateral Occipital Complex

Poster F126, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Raúl Hernández-Pérez[1], Laura V. Cuaya[1], Luis Concha[1], Victor De Lafuente[1]; [1]Instituto de Neurobiología, Universidad Nacional Autónoma de México

Visual paradigms highlight the role of lateral occipital complex (LOC) in the representation of everyday categories. Our goal was to determine if it is possible to decode everyday object categories in LOC independently of the sensory system used. In the first experiment (n=10) each participant explored by means of touch ten categories

of everyday objects in each run (12 runs in total). In the second experiment (n=10) we used a multisensory paradigm in which we presented blocks of carrots, breads, apples and marshmallows in independent runs of visual, olfactory, gustatory and tactile modalities (8 runs for each sense). Functional images were acquired on a 3-T Philips scanner (TR/TE = 2000/27 ms, 2x2x3.5 mm3 resolution). A multivoxel pattern analysis and full-brain searchlight were performed using a 5 voxel radius. The resuls show in the fist experiment that the cerebral patterns in LOC can predict with accuracy above chance ($p<0.01$) the category that the participants were exploring and that the organization of these cerebral patterns are shared between participants. To our knowledge this is the first evidence of a shared organization of tactille categories. In the second experiment we found that the only region with predictions above chance ($p<0.05$) for all senses was LOC. In conclusion, we found that LOC contains category-specific patterns of BOLD activity, suggesting that LOC encodes high-level characteristics of the stimulus independent of the sensory modality of presentation. We believe that our results are important for understanding the nature of the representations in LOC.

Topic Area: PERCEPTION & ACTION: Multisensory

Choosing to make an effort: the effect of reward on performance speed under risk

Poster F127, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Xingjie Chen[1], Youngbin Kwak[1]; [1]University of Massachusetts Amherst

Reward and risk are two main variables of everyday decision making including whether or not to exert motor efforts. We investigated how reward and risk influenced decision to make a speeded response during a Go/NoGo task. At the beginning of each trial, participants were presented with reward points at stake (high vs. low) and the probability that a Go signal would follow (Go-probability) (Trial Information), followed by a Go/NoGo signal. Faster responses to a Go signal resulted in larger proportion of the rewards at stake, whereas false alarm resulted in losing rewards. In a behavioral study of 110 participants, we found a significant effect of reward magnitude on response time, which was modulated by Go-probability. Reward magnitude influenced response time when the Go-probability was 50% or above (i.e. when the assessed risk level was low). In order to investigate the neural underpinnings of these effects, an EEG study was conducted in 20 participants. We focused our analysis on beta frequency oscillations in the sensorimotor cortex, which is known to be associated with motor processing. In particular, we analyzed the time period in between Trial Information and Go/NoGo signal during which motor planning takes place. Consistent with the behavioral data, there was a significant effect of reward magnitude on beta oscillations and this was modulated by Go-probability. Reward effect on beta oscillations was greater with high vs. low Go-probability. These findings provide a mechanistic understanding of the effect of reward and risk on decisions for exerting motor efforts.

Topic Area: THINKING: Decision making

Neural Subjective Value Representations across Age and Discount Factors: Time Delay, Physical Effort, and Probability Discounting

Poster F128, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Kendra Seaman[1], Nicholas Brooks[1], Teresa M. Karrer[1,2], Linh Dang[3], Ming Hsu[4], David H. Zald[3], Gregory R. Samanez-Larkin[1]; [1]Yale University, [2]TU Dresden, [3]Vanderbilt, [4]University of California Berkeley

Here we attempt to dissociate behavioral preferences for different discount factors to examine the convergence and divergence of neural representations of subjective value in an adult life span sample. We examined neural subjective value representations when monetary rewards must be integrated with one of three discount factors: time delays, physical effort, or probability. 77 healthy participants between the ages of 22 and 83 (N=33M/44F) completed fMRI studies at Vanderbilt University. Participants made choices between either (1) a smaller magnitude reward with a shorter time delay / higher probability / lower physical effort required and (2) a larger magnitude reward with a longer time delay / lower probability / higher physical effort required. For each task, participants were compensated with the payout from one trial. Subjective values were computed using individual subject discount rates estimated using a hyperbolic discount function. We found that discount rates – preferences for short time delays, lower physical effort, or high probability – were not correlated across tasks. In spite of the apparent behavioral dissociation between preferences, we found overlapping subjective value-related activity in the medial prefrontal cortex. These results suggest that while the tolerance of these decision features is behaviorally dissociable, they share a common neural representation. Interestingly, the regions that are critical for computing and/or representing subjective value have a high density of dopamine receptors. All participants also completed a PET scan; in the future we will examine whether individual differences in subjective value representation are related to individual differences in dopamine receptor availability.

Topic Area: THINKING: Decision making

Altered feedback responses to negative gambling outcomes in combat PTSD

Poster F129, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Matt Schalles[1,2], Nikki Honzel[3], Jary Larsen[1], Felix Bacigalupo[4], Carolyn Alderson[1], Diane Swick[1,4]; [1]VA Northern California Health Care System, [2]Mills College, [3]Carroll College, [4]UC Davis

Cognitive deficits in Post-traumatic Stress Disorder can be subtle, such as impaired response inhibition (Swick et al. 2012) but relatively unperturbed error monitoring (Swick et al. 2015). We used EEG recordings to ask whether veterans with PTSD would exhibit neurocognitive deficits when engaged in a blackjack gambling task that

combined aspects of response inhibition and error monitoring. Behaviorally we observed no differences between patients and matched military controls on task performance in terms of winnings or risk decision thresholds. Event-related potentials time-locked to win or loss feedback over frontal midline (Fz) showed within subject effects with the control group exhibiting a greater magnitude P3 for wins around 400ms, and both groups exhibiting a late (> 500 ms) positivity to wins (FCz). Patients exhibited greater frontal midline (FM) theta power (4-8 hz) around 250-300 ms for win conditions relative to loss, which is counter to predictions from previous work showing increased theta power for loss (Cohen et al, 2007) and negative outcomes (Cavanagh et. al., 2014). Patients also showed increases in low beta power (15-20 Hz) at later intervals (> 1000ms) in response to win conditions relative to loss. The relative lack of a feedback negativity ERP in patients, but presence of theta differences compared to controls, suggests that there may be a perturbed neural response to negative outcomes in this task. This perturbation may be specific to losses that are beyond the control of participants, as the effect was not observed for bust ("over 21") vs win.

Topic Area: THINKING: Decision making

Decoding the Representational Space of Decision Values using EEG

Poster F130, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Pablo Morales[1], Atsushi Kikumoto[1], Ulrich Mayr[1]; [1]University of Oregon

Losses loom larger than gains during decision making—likely leading to decision phenomena such as risk aversion or the status-quo bias. We do not have a full understanding about how gain and loss information is represented and how these representations contribute to decision making. In order to probe the representational space of value information we recorded EEG during a novel gambling task: Trials consisted of streams of eight stimuli, each indicating monetary values along a continuous dimension ranging from $0-$20. Subjects were asked to choose between a random pick from one of these eight stimuli or a sure gain of $10. Behavioral choices indicated typical risk aversion tendencies. Decoding of time-frequency decomposed EEG via a linear classifier revealed that oscillations in the delta range (~1-3Hz) carried information that reliably indexed each stimuli's gain/loss qualities (relative to the sure gain option). A median split of the sample into individuals with high versus lower risk aversion revealed a sharp, categorical gain-loss representation in risk-averse subjects. Less risk-averse subjects showed a graded pattern indicative of a more continuous gain-loss representation. These results indicate that risky choices are driven in part by the precision with which value information is represented, where course gain/loss distinctions lead to stronger risk aversion. In contrast, there was no evidence for a greater sensitivity to losses on the level of the observed value representations (i.e., a shift of the category boundary), suggesting that the actual risk aversion is created upstream from these representations.

Topic Area: THINKING: Decision making

Changes in information integration strategy in multi-cue probabilistic reasoning under anticipatory anxiety induced by threat-of-shock

Poster F131, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Hanna Oh[1], Hitomi Tanaka[1], Jeffrey Beck[1], Kevin LaBar[1], Tobias Egner[1]; [1]Duke University

Anticipating a negative event typically provokes anxiety, which has been shown to affect attention, memory and simple decisions. However, it is not known how anticipatory anxiety affects the more complex decision-making we face in everyday life, where we need to integrate multiple pieces of uncertain information. Here, we combined a threat-of-shock manipulation with a multi-cue probabilistic classification task. On each trial, participants saw two compound stimuli consisting of combinations of four binary cues and had to predict the stimulus that is likely to "win", as quantified by the combined weights of the cues, which had to be learned via probabilistic feedback. Following an initial learning period, participants performed two successive post-learning phases, a neutral and a threat-of-shock phase, during which participants experienced five randomly occurring unpleasant shocks. Skin conductance level (SCL) was recorded to objectively assess the efficacy of the anxiety induction procedure, and to group participants into low and high threat-responsive groups. We then employed variational Bayesian inference to characterize group-level changes in cue usage under threat. Specifically, we compared all possible combinations of cue usage to identify the most likely strategy that participants adopted. Results show that, during the neutral phase, both groups of participants integrated all available cues in a near-optimal manner. Under threat-of-shock, the low threat-response group showed no change in strategy, but the high threat-response participants dropped the weakest cue from their decision making process. These findings suggest that, to cope with heightened anxiety, people engage in selective information integration in line with satisficing heuristics.

Topic Area: THINKING: Decision making

Stengthening Goal-directed Decision Making through a Cognitive Intervention

Poster F132, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Maria Eckstein[1], Anne Collins[1]; [1]University of California at Berkeley

Much of everyday decision making is based on habits, which are fixed stimulus-response associations. Nevertheless, humans can also plan actions to achieve desired goals, mentally simulating potential sequences of choices and their outcomes. The distinction between habitual and goal-directed decision making can be quantitatively framed as two classes of machine learning algorithms: model-free and model-based reinforcement learning. Here we investigate whether we can manipulate the balance between habitual and goal-directed choice, selectively increasing either habitual or goal-directed control in two independent groups of human participants.

Although many experimental paradigms have successfully reduced goal-directed control, none have yet achieved to increase it. We used a task-based intervention, in which participants' model-based and model-free decision strategies were assessed pre- and post-intervention employing a widely used 2-step decision task (Daw et al., 2011). The intervention consisted of exposure to two unrelated cognitive tasks in each condition, which were tailored to engage either model-based or model-free processes. We predicted that each intervention would selectively boost its targeted process, increasing the weight of model-based to model-free control in learning, or decreasing it, respectively. Results supported our predictions: regression revealed an interaction between testing time (pre vs. post) and intervention (model-based vs. model-free) on the weight of model-based to model-free control, estimated by computational modeling. Our findings show that it might be possible to purposefully strengthen goal-directed decision making, a process potentially distorted in psychiatric conditions such as ADHD and depression, which is of great relevance to make successful long-term decisions in everyday life.

Topic Area: THINKING: Decision making

Medial Prefrontal Cortex Activation for Food Tracks Individual Differences in Food-reward Sensitivity

Poster F133, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Timothy Kelley[1], Jason Van Allen[1], Tyler Davis[1]; [1]Texas Tech University

FMRI-based food cue reactivity (FCR), the difference in activation elicited by food compared to non-food objects, has been found to track a number of clinically relevant variables in food consumption research such as obesity and efficacy of dietary interventions. Although useful for looking at such person-level variables, FCR alone cannot isolate specific neurocognitive processes that change with obesity and problematic eating behaviors such as changes in reward processing, attentional salience, and behavioral disinhibition. In the present study, we sought to isolate brain regions that track individual differences in reward sensitivity during FCR by pairing it with a relative reinforcing value (RRV) task that measures how much effort participants are willing to expend to obtain food rewards. Participants first completed an FCR task in the MRI by rating how much they wanted different foods and objects. This was followed by an RRV task in which participants could play a computerized slot machine for points toward food rewards. Consistent with its broader role in reward processing, we found that activation in medial prefrontal cortex was positively associated with how many times the participants were willing to play the slot machine. These results suggest that it may be possible to isolate specific neurocognitive processes impacted by food consumption within FCR tasks by pairing FCR with measures that selectively target such functions.

Topic Area: THINKING: Decision making

On the Way to the Top: PINNACLE - A Theoretical Process-Model of Human Visual Category Learning

Poster F134, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Ben Reuveni[1], Paul J. Reber[1]; [1]Northwestern University

We previously described a unique computational model of visual category learning that incorporates the roles of multiple memory systems to focus on how these systems interact during learning (Nomura, Maddox & Reber, 2007; Nomura & Reber, 2012). PINNACLE (Parallel Interactive Neural Networks Active in Category Learning) is a theoretically inspired model of category learning based on separate information processing streams for explicit rule discovery and implicit learning. PINNACLE produces behavior that matches human learning for both rule-based (RB) and information-integration (II) category learning. Trial-by-trial hypotheses about internal mental representations derived from these fits were used to guide fMRI analysis and identify regions of DLPFC active during mediation of competition between the two memory systems. To further explore the neural basis of cross-system strategy switching, we developed a new paradigm using stimuli order sequences designed to lure participants into initial use of an RB strategy followed by gradually revealing the structure to require an II strategy. Fitting PINNACLE to learning behavior with this paradigm revealed limitations in the original, simplified model. For example, over an extended set of trials performance showed periods of stable non-ceiling plateau performance that the simple, incremental learning mechanism within PINNACLE cannot fit. Here we report an update to the structure of PINNACLE that incorporates feedback based on reward-prediction error and uses perceptual noise to provide an improved account of category learning. We anticipate that this model will enable better predictions about strategy switching and the mental representation of category knowledge for use in future fMRI analyses.

Topic Area: THINKING: Decision making

The role of thalamo-striatal interactions in human behavioural flexibility.

Poster F135, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Tiffany Bell[1], Michael Lindner[1], Angela Langdon[2], Ying Zheng[1], Anastasia Christakou[1]; [1]University of Reading, UK, [2]Princeton University, USA

Animal studies have shown that connections between the thalamic centromedian-parafascicular complex (CM-Pf) and dorsal medial striatum play a key role in behavioural flexibility. CM-Pf neurons fire in response to stimuli requiring an unpredicted reaction. This input elicits cholinergic modulation of striatal output, facilitating behavioural flexibility. However, evidence of this system in humans is difficult to obtain, given that the origin of the fMRI signal is difficult to disentangle. This study's

aim was to investigate the role of thalamo-striatal interactions in human reversal learning. Participants completed a multi-alternative probabilistic reversal learning task whilst undertaking a high resolution, multiband fMRI scan. Learning and reversal periods were modelled separately during analysis. Parametric modulation was used to assess the specificity of dorsal striatal involvement during reversal learning. Psychophysiological interaction (PPI) analysis was used to examine changes in functional connectivity between striatal and thalamic subdivisions. Dorsal striatal activation increased relative to the length of the perseverative period. Additionally, functional connectivity between the centro-medial thalamus and the dorsal striatum increased during the reversal period, and not initial learning. This effect was specific to this connection and was not seen between other thalamo-striatal pairs. These results are in line with prior evidence for the role of the dorsal striatum in behavioural flexibility. Moreover, we demonstrate for the first time that communication between the centro-medial thalamus and the dorsal striatum is important specifically for reversal learning. This is in line with evidence from the animal literature, providing further support for the role of thalamo-striatal input in behavioural flexibility.

Topic Area: THINKING: Decision making

Ventromedial Prefrontal Cortex (VMPFC) Tracks Subjective Expectancy in a Gambler's Fallacy Task

Poster F136, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Kimberly Morris[1], Sean O'Bryan[1], Evan Livesey[2], Darell Worthy[3], Tyler Davis[1]; [1]Texas Tech University, [2]University of Sydney, [3]Texas A&M University

The gambler's fallacy describes the tendency to expect an opposite outcome (e.g., tails) after a long run of another outcome (heads). Previous behavioral studies have been able to produce Gambler's fallacy behavior in the laboratory; such that when two outcomes, outcome A, and outcome B (OA, OB) occur equally frequently, participants rate OB as more likely to occur as the run of OA increases. One outstanding question is whether this fallacious conscious expectancy taps the same Ventromedial Prefrontal Cortex (VMPFC) systems associated with choice confidence in value-based decision making and category learning. Our hypothesis was that the VMPFC would track conscious expectancies, even when they are at odds with the actual stimulus probabilities. To test this question, participants were given a categorization task were they were first asked to predict the next stimuli (face or house), and then asked to rate the likelihood of their response on a 1-7 scale. Behaviorally we found evidence of a Gambler's fallacy where participants increased their expectations of face stimuli as the number of houses presented increased (and vice versa). This increase in expectancy was accompanied by an increase in VMPFC activation, consistent with the hypothesis that the VMPFC would track subjective confidence even when it is at odds with the objective probabilities in the task. These results bolster results from previous studies suggesting that VMPFC function may have a role in problem gambling.

Topic Area: THINKING: Decision making

Cautious decision criterion drives widespread fronto-parietal fMRI activity across multiple domains

Poster F137, Tuesday, March 28, 8:00 – 10:00 am, Pacific Concourse

Evan Layher[1], Benjamin O. Turner[1], Nicole Marinsek[1], Puneeth Chakravarthula[1], Anjali Dixit[1], Amir H. Meghdadi[1], Barry Giesbrecht[1], Miguel Eckstein[1], Michael Miller[1]; [1]UCSB

Previous recognition memory fMRI studies have revealed that the successful retrieval effect (SRE) contrast (hits > correct rejections) is associated with increased activity across prefrontal and dorsal parietal cortices when people establish a cautious versus lax decision criterion. To better understand the processes underlying the observed fronto-parietal activation, we orthogonally manipulated decision domains (memory and perception), decision criterion, and decision evidence during fMRI. Participants (N=30) viewed images of scenes for 200ms and either made memory judgments by responding 'old' (studied) or 'new' (unstudied), or perceptual judgments by determining if a human was 'present' or 'absent' in the scene. Participants were rewarded for correct responses and incentivized to switch between lax and cautious decision criteria by either penalizing a 'miss' or 'false alarm,' respectively. Memory strength was manipulated by how often a scene was repeated at study, while perceptual strength was determined by the difficulty of finding the human in a scene. In total, there were 8 different mini-blocks (memory vs. perception, cautious vs. lax, and low vs. moderate d') composed of 16 trials within each of the 8 fMRI scans. The fMRI SRE contrasts in the cautious versus lax conditions revealed widespread activation of fronto-parietal regions for both the memory and perceptual judgments, whereas moderate vs. low d' comparisons showed little to no differences in either domain. These results suggest that establishing a cautious decision criterion is strongly associated with increased fronto-parietal activity regardless of task domain or the strength of evidence.

Topic Area: THINKING: Decision making