

Social & Affective Neuroscience Society

Annual Meeting 2013

April 12-13, Hilton Financial District
San Francisco, CA

Local Organizers

Elliot Berkman, University of Oregon

Jennifer Pfeifer, University of Oregon

Talk/Poster Selection Committee

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Thalia Wheatley, Dartmouth College

Schedule-at-a-glance

Thursday April 11

Start	End	Session
6:00 PM	9:00 PM	Registration
7:00 PM	9:00 PM	Welcome Reception & Cash Bar, 750 Lounge

Friday April 12

Start	End	Session
8:00 AM	9:00 AM	Continental Breakfast and registration
9:00 AM	10:15 AM	Symposium Session A: Mentalizing & Joint Attention
10:15 AM	10:35 AM	Coffee Break
10:35 AM	11:50 AM	Symposium Session B: Social Networks & Reward
11:50 AM	12:00 PM	ICNC SANS Travel Award Presentation (Ballroom Foyer)
11:50 AM	1:30 PM	Lunch Break
1:30 PM	2:45 PM	Symposium Session C: Motivated Perception
2:45 PM	4:15 PM	Poster Session D (4 th floor)
4:15 PM	4:35 PM	Coffee Break
4:35 PM	5:50 PM	Symposium Session E: Intergroup Processes
5:50 PM	7:10 PM	Presidential Introduction & Distinguished Scholar Address
7:10 PM	9:00 PM	Reception & Cash Bar, 750 Lounge

Saturday April 13

Start	End	Session
8:00 AM	9:00 AM	Continental Breakfast and registration
9:00 AM	10:15 AM	Symposium Session F: Emotion & Regulation
10:15 AM	10:35 AM	Coffee Break
10:35 AM	12:05 PM	Keynote Symposium: Communicating About Neuroscience
12:05 PM	1:30 PM	Lunch Break
1:30 PM	2:45 PM	Symposium Session G: Health & Risk Behaviors
2:45 PM	4:15 PM	Poster Session H (4 th floor)
4:15 PM	4:35 PM	Coffee Break
4:35 PM	5:50 PM	Symposium Session I: Clinical Applications & Connectivity
5:50 PM	7:20 PM	Poster Session J (4 th floor)

2013 Awards

Distinguished Scholar Award

Ralph Adolphs, California Institute of Technology

Innovation Award

Tal Yarkoni, University of Colorado, "Large-scale automated synthesis of human functional neuroimaging data"

SANS Poster Awards

Eric S. Allard, Boston College
Shir Atzil, Northeastern University
Bonnie Auyeung, University of Cambridge
Matthew Brook O'Donnell, University of Michigan
Christopher N. Cascio, University of Michigan
Claudia Civai, University of Minnesota
Rebecca J. Lepping, University of Kansas
Jordan Livingston, University of Oregon
Flavia Mengarelli, University of Bologna
Laura Michaelson, University of Colorado
Jordan Miller-Ziegler, University of Oregon
Vanessa Puetz, University Hospital Aachen
Ajay Satpute, Northeastern University
Kamila E. Sip, Rutgers University
Steven Tompson, University of Michigan
Hongbo Yu, Peking University

SANS Graduate Student Travel Awards

Louis Chim, Stanford University
Alexander Genevsky, Stanford University
Erica Hornstein, UCLA
Tristen K. Inagaki, UCLA
Carolyn Parkinson, Dartmouth University

Developmental Cognitive Neuroscience Student Travel Award (Made possible by Oxford University Press)

Rachel Ellis, University of Melbourne

International Cultural Neuroscience Consortium Travel Awards

Jessica Busler, Auburn University
Non Pornpattananankul, Northwestern University
Vanessa Puetz, University Hospital Aachen
Lucia Sacheli, Sapienza University of Rome
Steven Tompson, University of Michigan
Fei Yang, University of Southern California

Symposia Presentations

Session A **Mentalizing & Joint Attention**

Friday, April 12, 2013

9:00 - 10:15 AM

Ulrich Pfeiffer, University Hospital Cologne

B. Locke Welborn, University of California, Los Angeles

Frank Van Overwalle, Vrije Universiteit Brussel

Robert Spunt, California Institute of Technology

A B S T R A C T S

ARE YOU HUMAN? COMBINING INTERACTIVE EYE-TRACKING AND FMRI TO INVESTIGATE THE REWARDING NATURE OF SOCIAL ENCOUNTERS *Ulrich Pfeiffer, University Hospital Cologne; Leonhard Schilbach, University Hospital Cologne, Max-Planck-Institute for Neurological Research; Bert Timmermans, University Hospital Cologne; Bojana Kuzmanovic, Research Center Juelich; Gary Bente, University of Cologne; Kai Vogeley, University Hospital Cologne, Research Center Juelich* – We are involved in various forms of social encounters on a daily basis and gain much of our knowledge about others by interacting with them. Moreover, we enjoy and strive for being in interaction with others. It has thus been argued that there is an intrinsic motivational drive for engaging in social interaction. However, there is a scarcity of studies examining the neural mechanisms supporting more basic social interactions face-to-face and in real-time due to the lack of appropriate methods. Here we present a combined eye-tracking and fMRI paradigm in which participants interact with a virtual agent in a series of gaze-based interaction blocks. These blocks consisted of five trials in each of which the agent would either engage in joint or non-joint attention after participants fixated an object on the screen. Participants believed that the agent's gaze behavior was either controlled by another participant or a computer program. For each block, they had to judge whether they experienced the interaction as social or non-social based on the agent's reactions. Unbeknownst to them, the agent was always controlled by a computer to allow for a systematic manipulation of gaze reactions ranging from zero to five out of five possible instances of joint attention. In addition, the experiment consisted of two phases in which the interaction partner was introduced as naïve to their task or as explicitly cooperative. This allowed us to create a tool to distinguish neural activity underlying the subjective experience of being engaged in social and non-social interaction in a naïve (i.e. baseline) and cooperative context. This has the advantage that participants are not informed a priori about the nature of their interaction partner as it is the case in many neuroeconomic approaches to social interaction. Instead, their experience of being in interaction with another human depends exclusively on the dynamics of the interaction. Results demonstrate that the subjective experience of human interaction is correlated with increased activation of the ventral striatum, while the experience of non-social interaction is associated with increased activity across a fronto-parietal attention network. In the naïve condition, the differential ventral striatal activation for social interaction is present early during the interaction. In contrast, it increases parametrically over the time course of the interaction block in the cooperative condition and hence seems to support two different types of cognitive processes during naïve and cooperative interaction: In the first case, it signals an automatic preference which is likely to be based on early mechanisms of impression formation. In the latter, the striatum encodes the accumulation of value, that is, the buildup

of evidence that the interaction partner is human. These results provide first evidence that the subjective experience of being in interaction recruits the reward system even without the presence of an explicitly cooperative interactor and hence give strong support to the idea of an intrinsic neural motivation to interact with others.

PERSON-SPECIFIC THEORY OF MIND: THE ROLE OF VMPFC IN MENTALIZING B.

Locke Welborn and Matthew D. Lieberman; University of California, Los Angeles – Numerous studies have demonstrated the involvement of medial prefrontal cortex in human Theory of Mind, but distinct perspectives have been offered to explain the apparent divergence in function between dorsal (DMPFC) and ventral (VMPFC) subregions. While DMPFC activity is observed when reasoning about the mental states of unknown or abstract individuals, VMPFC function during mentalizing has been associated variously with self-reflection, projection of self-characteristics onto similar others, and mentalizing about close others. We propose a novel theoretical framework that accounts for and extends prior findings: VMPFC is involved in representing and using person-specific Theories of Mind (ToMp) that represent the unique, idiosyncratic traits of well-known individuals regardless of their similarity or closeness to oneself. In order to test this hypothesis, we used fMRI to assess the VMPFC response in participants who strongly identified as either Democrats or Republicans as they evaluated the personality traits of political figures of both parties about whom they possessed varying degrees of knowledge. Consistent with the ToMp account, VMPFC showed greater activity to targets about whom participants were especially knowledgeable, irrespective of participants' reported perceptions of similarity or feelings of closeness. In the clearest test of the ToMp hypothesis, VMPFC responded more strongly to well-known than not well-known targets of the opposing party, but VMPFC responded similarly to well-known targets from both the opposing and one's own political party. Other analyses rule out similarity and closeness as mechanisms that could explain these effects. Only the ToMp account would predict strong VMPFC responses to disliked and dissimilar, but well-known political targets. These results suggest that VMPFC may complement the generic mentalizing processes (ToMg) of DMPFC with more individuated psychological representations of specific well-known others.

THE FUNCTION OF THE MEDIAL PREFRONTAL CORTEX: TRAIT CODE AND NON-SOCIAL REASONING

Frank Van Overwalle, Ning Ma, Kris Baetens, and Marie Vandekerckhove; Vrije Universiteit Brussel – The medial Prefrontal Cortex (mPFC) is critically involved in inference about the traits of the self and others. In a first fMRI study, we investigated whether the mPFC also represents the neural code for traits, or trait code. To localize the trait code, we used fMRI-adaptation, which is a rapid suppression of neuronal responses upon repeated presentation of the same underlying stimulus, in this case, the implied trait. Participants had to infer an agent's (social) trait from brief trait-implicating behavioral descriptions. In each trial, the critical (target) sentence was preceded by a sentence (prime) that implied the same trait, the opposite trait, or no trait at all. The results revealed robust suppression of activation in the ventral mPFC only. Crucially, this adaptation effect was graded: strongest after being primed with a similar trait, moderate after an opposite trait and negligible after a trait-irrelevant prime. These findings indicate that a trait code is represented in the ventral mPFC. However, the mPFC is not only involved in the processing of mental states, but is often also involved in tasks that don't involve mental state inferences. We hypothesized that the mPFC might be involved in high construal of stimuli, defined as the formation of abstract concepts or ideas by omitting non-essential features of stimuli. In a second fMRI study, we presented pictures of a person engaged in everyday activities (social stimuli) or of objects (non-social stimuli), and induced a higher level of abstraction by instructing participants to generate personality traits of the person or categories to which the objects belonged. This was contrasted against a lower level task where participants had to describe these same pictures visually. As predicted, we found strong involvement of the dorsal mPFC in high construal, with substantial overlap across social and non-social stimuli. In a third fMRI study, we pitted the construal level explanation for these results against an explanation in terms of high versus low constrained processing, but found only evidence for the construal level manipulation.

EVIDENCE THAT THE EVOKED RESPONSE OF DORSOMEDIAL PREFRONTAL CORTEX TO FIXATION BASELINE FACILITATES SOCIAL (BUT NOT NONSOCIAL) INFERENCE (BUT NOT NON-INFERENCE) *Robert Spunt, California Institute of Technology; Meghan Meyer, and Matthew Lieberman; University of California, Los Angeles* – People draw inferences about each other with great efficiency. Such inferences are typically executed in order to refer transient observed behaviors (e.g., “smiling”) to relatively more permanent unobservable states (“friendly”). A large body of evidence has delineated a set of brain regions that are reliably correlated with the performance of such mental state inferences: the mentalizing system. Intriguingly, this system shows considerable anatomical overlap with the default mode network, so-called because it exhibits strong, integrated activity when people are at rest, for instance, during fixation baseline periods. Here, we used fMRI to test the hypothesis that activity of the mentalizing system during these fixation periods prior to social inferential judgments would increase the efficiency of such judgments. 21 healthy adults underwent event-related fMRI while executing three types of judgments: social inferential (evaluating a mental description of a photographed behavior); social non-inferential (evaluating a motor description of a photographed behavior); or non-social (evaluating an arithmetical expression). Social inferential judgments robustly activated the mentalizing system, and many of the same areas were robustly de-activated by the non-social task when compared to the fixation baseline periods in between each trial. A parametric analysis of response time revealed that increased activity during these pre-trial periods in one of these regions, dorsomedial prefrontal cortex, was associated with faster response times for social (but not non-social) inferential (but not non-inferential) judgments. This provides the best support yet for a functional link between default activity of the mentalizing system and the execution of social inferences.

Session B Social Networks & Reward

Friday, April 12, 2013

10:35 - 11:50 AM

Noam Zerubavel, Columbia University

Carolyn Parkinson, Dartmouth College

** SANS Graduate Student Travel Award Winner*

Katja N. Spreckelmeyer, Stanford University & RWTH Aachen University

Sylvia Morelli, Stanford University & University of California, Los Angeles

A B S T R A C T S

THE BRAIN BASIS OF PERSON PERCEPTION AND SOCIAL COGNITION IN REAL-WORLD SOCIAL NETWORKS *Noam Zerubavel, Peter Bearman, and Kevin Ochsner; Columbia University* – Humans are a fundamentally social species, and the social networks in which we are each embedded constitute significant determinants of our physical and psychological well-being. Navigating interactions within these social networks requires efficient computational mechanisms for processing social information about network members as well as our own idiosyncratic relations to them. The present study investigates the neural substrates underlying these social-cognitive processes critical for person perception in real-world social networks. We developed a novel neuroimaging paradigm for person perception research that incorporates a round-robin design: the participants are all members of the same face-to-face social network (i.e., the Executive Board members of an MBA student group); in the scanner, they each passively view photographs of their social network’s members. Since each network member is represented in the study as both a

participant (Perceiver) and a stimulus (Target of social perception), this round-robin design enables analyses at the level of the Perceiver, the Target, and Perceiver X Target interactions unique to each interpersonal relationship. In addition to implicit neural responses collected during the fMRI passive face-viewing task, outside of the scanner we collected each network member's explicit ratings of self and others along fundamental dimensions emphasized across studies of person perception in both social psychology and neuroscience research (i.e., warmth, competence, trustworthiness, dominance, and attractiveness). We also utilize social network analysis (SNA) to measure participants' relative positions and interpersonal ties within the network structure. SNA is an analytic technique that enables precise measurements of sociometric variables by leveraging the interdependence of participants' data (e.g., rather than assessing social status using only self-report measures, we compute each individual's network centrality by integrating relevant social metrics collected from every member of the network). In the present study (n=26), we tested this novel paradigm in two separate social networks, with each of the two networks (n=13) constituting a distinct MBA student group's Executive Board. We modeled participants' neural activation patterns during the fMRI passive-face viewing task with regressors incorporated from both the self- and peer-reported measures typical of person perception research as well as the sociometric variables typical of SNA. Our findings suggest that the social-cognitive processes critical for person perception in real-world social networks rely on brain systems implicated in reward, emotion, and face perception. To our knowledge, the present research is the first neuroimaging study to incorporate social network analysis, thereby integrating theoretical and methodological frameworks across sociology, social psychology, and neuroscience.

A COMMON CORTICAL METRIC FOR SPATIAL, TEMPORAL AND SOCIAL DISTANCE *Carolyn Parkinson, Shari Liu and Thalia Wheatley, Dartmouth College* – Converging theories from cognitive linguistics, social psychology and evolutionary biology suggest that different dimensions of psychological distance are encoded similarly. More specifically, the prevalence of spatial language in descriptions of social and temporal distances (e.g., “close friend,” “distant future”) may reflect the recycling of neural circuitry originally devoted to spatial processing in order to “plot” increasingly abstract contents as the inferior parietal lobule (IPL) expanded over the course of primate evolution. The IPL is recruited in spatial, temporal and social distance processing. Do these overlapping activations reflect a shared neural code or nearby but distinct codes for different dimensions of psychological distance? The current study sought to resolve this question using multivoxel pattern analysis (MVPA) of fMRI data. Fifteen right-handed participants viewed photographs of acquaintances and familiar others, phrases referring to the immediate or remote future, and pictures of objects at different egocentric distances while being scanned in a 3T Philips scanner. Each trial consisted of one stimulus for 0.5 s followed by a second stimulus from the same category (physical, social or temporal) for 1.5 s. Two types of information-based searchlight mapping were performed. The first set of analyses entailed training linear support vector machine learning algorithms to discriminate one dimension of psychological distance (“closer” vs. “farther” physical distance trials) and testing their accuracy in classifying trials from another distance dimension (e.g., “sooner” vs. “later” temporal distance trials). All combinations of distance dimensions were used for training and testing the classifier, resulting in 6 accuracy maps for each participant. Each set of accuracy maps was spatially normalized and arcsine-transformed before submission to a group analysis (one sample t-test vs. chance accuracy). The conjunction of significant results from all 6 tests revealed that distances could be decoded across all dimensions in a large cluster in the right IPL, suggesting that this region may represent social, spatial and temporal distances according to a common metric. The second set of analyses probed for regions where the local information content reflected subjective distance ratings. Behavioral representational dissimilarity matrices (RDMs) were constructed based on each subject's post-scan distance ratings of stimuli. At each searchlight center, a neural RDM was generated based on pairwise correlations between local neural response patterns to each condition, and the significance of correlations between behavioral and neural RDMs was evaluated. The representational similarity structure within the right IPL reflected that evinced in subjective distance ratings, suggesting that population codes in this brain area may contribute to explicit distance judgments. The current findings provide a potential neural basis for the domain-general encoding of egocentric psychological distance. More generally, these results are consistent with recent speculation that IPL circuitry originally devoted to spatial

processing may have been redeployed to operate on increasingly abstract contents as this region expanded in size and function over the course of human evolution.

PROBING THE NEURAL BASIS OF SOCIAL APPROACH MOTIVATION *Katja N Spreckelmeyer, Stanford University & RWTH Aachen University; Lena Rademacher, Sarah Groppe, Anna Gossen, RWTH Aachen University; Gregor Kohls, Robert T Schultz, Center for Autism Research, The Children's Hospital of Philadelphia; and Gerhard Gründer, RWTH Aachen University*

- Motivation for goal-directed behavior largely depends on the expected value of the anticipated reward. Mutual social interactions are experienced as innately rewarding, and the desire to be with others and to relate with others on a personal level is a main driving force of human behavior. However, despite a plethora of functional imaging studies trying to unravel the neural base of motivated behavior, relatively little is still known about the neural mechanisms guiding social approach behavior. Here, we present results from four different studies that used functional magnetic resonance imaging (fMRI) and a 'social incentive delay task' to identify neural representations of social approach motivation in the human brain. In our task, graphical cues were presented at the beginning of each trial to inform participants whether or not social reward (a smiling face) could be gained upon correct performance in the trial. This type of task has previously been successfully used to link brain activation patterns to feelings of positive arousal at the prospect of gaining reward. Specifically, Knutson et al. demonstrated that cued anticipation of monetary gains leads to increasing levels of neural activation in the nucleus accumbens (NAcc) of the mesolimbic reward system, and that NAcc-activation mirrors self-reports of positive arousal (reviewed in Knutson & Greer, 2008, *Philosophical Transactions of the Royal Society B*, 363, 3771-3786). In study 1 and 2 of our study series, we found evidence that the NAcc is also recruited during anticipation of positive social stimuli. Moreover, we were able to show that NAcc activation was modulated by anticipated subjective reward value of the presented faces. These findings confirm the NAcc's role in coding motivational salience and extend it to social stimuli. In study 3, we used the 'social incentive delay task' to test the theory-driven hypothesis that differences in social proficiency can be linked to fundamental differences in social interest/ social motivation. Developmental psychologists have argued that children who show a greater interest in social information (e.g. care giver's face) are better able to recognize social signals (eye gaze, emotional expressions) as cues of future events, and that this mechanism helps them to develop social competence. Our study of typically developing men scoring at extreme ends of the social proficiency spectrum yielded evidence that individual differences in social proficiency are indeed associated with differences in neural sensitivity towards the motivational salience of social incentives. Finally, in study 4, we provide evidence that the neuro-hormone oxytocin plays a role in attributing incentive salience to socially relevant cues. Oxytocin nasal spray application significantly enhanced activation in the mesolimbic reward system during processing of social reward predicting cues. Remarkably, behavioral effects of oxytocin (increased hit rates) were more pronounced in individuals reporting low social interest. This finding suggests that oxytocin may boost the incentive salience of social cues, hereby enhancing social motivation. Together our findings give important insights into how the brain codes incentive salience of social cues. They provide an important step in understanding the neural underpinnings of social approach motivation in health and disease.

THE NEURAL AND BEHAVIORAL CONSEQUENCES OF FEELING UNDERSTOOD

Sylvia A. Morelli, Stanford University & University of California, Los Angeles; Jared Torre, and Naomi I. Eisenberger, University of California, Los Angeles - Behavioral research has demonstrated that feeling understood by others enhances social closeness and intimacy, as well as subjective well-being. In contrast, feeling misunderstood can be harmful to social relationships, leading to loneliness and isolation. However, it is still unclear why and how felt understanding exerts such a powerful impact on both interpersonal and intrapersonal well-being. Therefore, we will examine (1) what neural systems track felt understanding and (2) if these neural systems can predict increased social closeness. In an initial behavioral session, 31 UCLA undergraduates were videotaped as they described their four most positive and four most negative autobiographical events. In addition, participants were asked for their consent to show other UCLA students their videos. A subset of 19 participants returned for an fMRI scanning session approximately one week later. Participants were told that they would see how other UCLA students had responded to four

of their previously recorded events (i.e. two positive and two negative). For each block in the scanner, participants saw a 20-second video clip of their event, followed by three sentences that another student had chosen in response to their video. Unbeknownst to the participants, responses were actually pre-set to make the participant feel either understood or not understood. Thus, each participant saw two responses (understanding and not understanding) to each of their four events. After each block, participants rated how understood they felt by the other student. After exiting the scanner, they also retrospectively rated how they felt after seeing each student's response (i.e. from very negative to very positive), as well as how much they liked each student. A series of parametric analyses demonstrated that activity in a reward-related region (i.e. ventral striatum, VS) parametrically increased as individuals felt more positive and more understood by another student's response. In contrast, a region associated with negative affect (i.e. anterior insula, AI) parametrically increased as individuals felt more negative and less understood by another student's response. Taken together, these results suggest that feeling understood may be dually tracked by regions associated with positive and negative affect. Interestingly, when individuals saw "not understanding" responses compared to neutral responses, individuals with higher sensitivity to rejection showed increased neural activity in the anterior insula. Lastly, parametric increases in VS also corresponded with increased liking for the student, while parametric increases in AI corresponded with decreased liking. Taken together, these data suggest that regions associated with positive and negative affect may track how understood individuals feel by others, as well as predicting how much they like the person providing feedback.

Session C Motivated Perception

Friday, April 12, 2013

1:30 - 2:45 PM

David Amodio, New York University

Brent Hughes, Stanford University

Jay Van Bavel, New York University

Peter Mende-Siedlecki, Princeton University

A B S T R A C T S

SOCIAL NEUROSCIENCE OF MOTIVATED PERCEPTION: INTERGROUP GOALS AFFECT THE VISUAL ENCODING OF FACES *David M. Amodio, New York University* - Social goals, such as to favor members of one's own group, are known to bias the ways people think about and act toward others. However, emerging evidence suggests that social goals can also change the way we "see" faces of ingroup and outgroup members. I will present three studies from my laboratory that examined the effect of intergroup goals on a neural marker of early face encoding – the N170 component of the event-related potential, which reflects activity in a network of neural regions that includes the fusiform gyrus. Results indicated that in a minimal group situation, in which bias is driven by ingroup favoritism, initial face encoding was enhanced for ingroup members compared with outgroup members (Study 1). However, a different pattern emerged in a situation where group membership was marked by conflict and outgroup threat: when White participants viewed faces of Black and White males, encoding of Black outgroup faces was enhanced among participants with strong implicit racial bias (Study 2) and in the context of intergroup anxiety (Study 3), compared with the encoding of White faces. These early biases in visual perception may contribute to downstream effects in cognition and behavior, suggesting a

new mechanism through which intergroup goals may lead to discrimination in social behavior.

NEURAL SYSTEMS OF MOTIVATED SOCIAL COGNITION *Brent Hughes, Stanford University* - Decades of research demonstrate that motivation influences social cognition. For example, people tend to evaluate themselves and certain other people in overly positive ways across different contexts. However, neural models have been relatively silent about how motivation influences the neural level of analysis. The experiments presented here attempt to deepen our understanding of how positively-biased evaluations occur as a function of different motivational contexts. I will present results from studies that explore the neural mechanisms of positively biased social cognition by first identifying a core set of neural regions associated with positivity bias, examining whether a heightened self-protection motivation elicited by threatening social-evaluative feedback changes the engagement of those neural systems, and specifying some of the precise computations and mechanisms supported by those regions. First, we found that the motivation to see the self and other people in a positive light modulates the extent to which ventral anterior cingulate (vACC) differentiates positive from negative information. Second, we found that medial orbitofrontal cortex (MOFC) may be a convergence zone for positivity bias in the brain. Across studies, we found that MOFC was modulated by the degree of positively biased responses. In the first set of studies (Studies 1-3), MOFC was negatively modulated by better-than-average judgments. The more people viewed themselves and other people as better-than-average, the less they recruited OFC activation. In addition, we applied a data-driven, multi-dimensional scaling (MDS) approach and found that MOFC may compute a trial-by-trial trait importance signal that predicts degree of positivity bias. The next study (Study 4), examined whether self-esteem threat changes the engagement of the neural systems associated with positively-biased self-evaluation. I used the same approach as previous studies to measure positivity ("better-than-average" ratings) to maximize comparability between results, but elicited positivity bias with an explicit threat manipulation. I found that threat changed the engagement of neural systems associated with positivity bias as well as engaged additional neural modulation. In particular, positivity bias in response to threat was associated with increased MOFC activation, as well as additional recruitment of amygdala and insula. Furthermore, MOFC activation predicted individual differences in increased positivity bias in response to threat. Finally, Study 5 examined the psychological processes that are supported by OFC in positively biased evaluation. Elucidating the mechanisms supported by MOFC in positively biased evaluation may lead to a deeper understanding of whether positivity biases represent a single phenomenon or multiple phenomena as a function of the motivational context. This study takes a step towards addressing this question by combining a signal detection (SDT) approach and a contextual manipulation that permits the measurement of a process that influences the expression of positively-biased evaluation in different contexts. I found that MOFC activation predicted shifts in decision thresholds that influence the expression of positively-biased responses as a function of the motivational context. The findings provide some preliminary evidence that positivity biases may represent distinct processes in different motivational contexts.

SOCIAL IDENTITY SHAPES SOCIAL PERCEPTION AND EVALUATION: EVIDENCE FROM BEHAVIORAL, ELECTROENCEPHALOGRAPHY AND NEUROIMAGING EXPERIMENTS *Jay Van Bavel, New York University* - Correctly identifying group members is critical for successfully navigating complex social environments. I will review a series of behavioral, electroencephalography, and neuroimaging experiments that demonstrate the dynamic influence of social identity on perception and evaluation. Across experiments, we assigned people to one of two mixed-race minimal groups and had them respond to faces of Black and White in-group and out-group members. This allowed us to compare the effects of a minimal social identity with a visually salient social category – race. Across methodologies, we found that assigning people to mixed-race minimal groups eliminated ostensibly automatic racial biases by leading people to categorize others on the basis of their minimal group membership rather than their race. Specifically, we found that minimal group membership influenced BOLD activity in core (Fusiform Face Area) and extended (amygdala) components of the face processing network, emerged as early as 100 milliseconds (P100) after face onset, and shaped consequential downstream behavior

(automatic evaluations and recognition memory). This pattern was evident despite the fact that the intergroup distinction was arbitrary, there were no visual cues to distinguish groups, and exposure to the faces was equivalent and brief. Follow-up experiments confirmed that this pattern of in-group bias was mediated by visual attention during learning and moderated by social roles and motives (e.g., the need to belong). However, multi-voxel pattern analyses of BOLD data revealed that membership in a mixed-race group does not make the visual system “color-blind” to race. Taken together, this program of research suggests that ostensibly automatic forms of racial bias are not inevitable, but are sensitive to seemingly trivial social identity motives that shape the value of in-group and out-group members.

THE NEURAL DYNAMICS OF UPDATING IMPRESSIONS *Peter Mende-Siedlecki, Sean Baron, Yang Cai, and Alexander Todorov, Princeton University* - As humans, we are faced with a constant challenge: figuring out the other humans around us. In service of this challenge, we form stable impressions of other people based on their behavior. In recent years, the neural bases of initial, behavior-based impression formation have been well documented. However, impression formation is a dynamic process that continuously evolves over time. Other people often surprise us with their unpredictability, and in some cases, it becomes necessary to update our initial impressions when new, inconsistent information comes to light. We devised two fMRI studies focused on the neural dynamics underlying impression updating, with two primary goals: 1) identifying the network of regions involved in the updating process, and 2) assessing the degree to which activity in this network is impacted by valence, behavioral content, and behavioral diagnosticity. In both studies, participants saw faces paired with valenced behavioral information and were asked to form impressions of these individuals. Each face was seen five times in a row, each time with a different piece of behavioral information. Critically, some of the individuals were inconsistent, in that the valence of the information changed on the fourth trial – making the fourth and fifth trials inconsistent with information previously learned about that individual and necessitating that participants update their impressions. Across both studies, we observed a consistent set of regions associated with updating impressions, including dorsomedial prefrontal cortex (dmPFC), lateral prefrontal cortex (lPFC), superior temporal sulcus (STS), and inferior parietal lobule (IPL). Previous research suggests that negative information is more diagnostic in the morality domain, while positive information is more diagnostic in the ability domain. One possibility is that highly immoral and highly competent behaviors are simply less statistically frequent in the environment, and as such, they are therefore more informative towards the ultimate goal of impression formation. Our second study was designed specifically to compare the updating of impressions based on morality- and ability-related attributions. While we hypothesized that activity in the updating network would reflect similar behavioral asymmetries based on diagnosticity, we also tested for the possibility that the network might show preferential activity when updating based on content (ability vs. morality) or valence. While content and valence did not impact update-related activity across the network, bilateral vlPFC and inferior frontal gyrus (IFG) were more strongly associated with updating impressions based upon diagnostic information. These results suggest that one parsimonious principle – behavioral diagnosticity – guides impression updating on a neural level.

Session D Poster Presentations: Session 1

Friday, April 12, 2013

2:45 - 4:15 PM

Session E Intergroup Processes

Friday, April 12, 2013

4:35 - 5:50 PM

Eva Telzer, University of Illinois

Michael Norton, Harvard Business School

Lasana Harris, Duke University

Leor Hackel, New York University

ABSTRACTS

THE IMPACT OF EARLY EXPOSURE ON RACE-RELATED AMYGDALA ACTIVITY: AN INTERNATIONAL ADOPTION DESIGN *Eva H. Telzer, Yang Qu, University of Illinois; Kathryn Humphreys, Jessica Flannery, and Nim Tottenham, University of California, Los Angeles* – Adults' behavioral and neural response to race has received much attention in the past decade (Lieberman et al., 2005). Recent research suggests that race-specific amygdala response emerges over development, suggesting that experience plays a role in race-related processing (Telzer et al., in press). Yet, we know little about how the amount of experience with own- and other-race faces impacts children's understanding of race. The amount of experience – or lack of experience – with race is difficult to quantify in the United States, an increasingly diverse society. Thus, we implemented an international adoption design and examined children who were adopted by American families from either Asian or European countries. The adoption design quantifies children's early exposure (i.e., to purely Asian faces or European faces). Because the date of adoption is documented, it provides a natural index of the amount of early exposure to a specific racial group and when that exposure ends. Participants included 34 internationally adopted children from Asian (N=15, Mage=10.99 years, age range=6.5-14.8yrs) and European countries (N=19, Mage=9.94 years, age range=6.33-15.66 years). The two groups were adopted at similar ages (Mage: Asian children=22.53 months, SD=20.39; European children=36.45 months, SD=33.02). Children were scanned while performing an Emotional Matching Task adapted from Telzer et al. (in press) in which children had to select a face expressing the same emotion as a target face. Participants completed one run in which all the faces were European-American and one run in which all the faces were Asian. All analyses control for children's age. We first examined group difference in behavioral performance on the emotional matching task. Asian children had significantly higher accuracy (99% accurate) than European children (87.5% accurate) when matching Asian faces whereas no group difference was found to European-American faces (95% and 96% accuracy, respectively). Moreover, when all children were examined together, children with less early exposure to Asian faces (i.e., adopted later for European children; adopted earlier for Asian children) had significantly worse performance when matching the Asian faces ($\beta \leq -.44$, $p < .05$). Next, we examined group differences in race-related amygdala activity to race. There was a double-dissociation between Asian and European children in amygdala responsivity to Asian and European faces; amygdala response to European faces was high in children adopted from Asia, and amygdala response to Asian faces was high in children adopted from Europe. Moreover, when all children were examined together, regression analyses showed that less postnatal time exposed to Asian faces (i.e., adopted later for European children; adopted earlier for Asian children) predicted significantly higher amygdala response to Asian faces ($\beta \leq .57$, $p < .001$). Thus, early absence of race exposure may result in those faces being more salient at the level of the amygdala and behavior, suggesting that early exposure to race is essential for children's understanding of race. These findings underscore the importance of exposing children to diverse groups at an early age.

AN FMRI INVESTIGATION OF RACIAL PARALYSIS *Michael I. Norton, Harvard Business School; Malia F. Mason, Columbia Business School; Joseph A. Vandello, University of South Florida; Andrew Biga, University of South Florida; Rebecca Dyer, Yale University* – We explore the existence and underlying neural mechanism of a new norm endorsed by both black and white Americans for managing interracial interactions: “racial paralysis,” the tendency to opt out of decisions involving members of different races. We show that people are more willing to make choices – such as who is more intelligent, or who is more polite – between two white individuals (same-race decisions) than between a white and a black individual (cross-race decisions), a tendency which was evident more when judgments involved traits related to black stereotypes. We use functional magnetic resonance imaging to examine the mechanisms underlying racial paralysis, to examine the mechanisms underlying racial paralysis, revealing greater recruitment of brain regions implicated in socially appropriate behavior (ventromedial prefrontal cortex), conflict detection (anterior cingulate cortex), deliberative processing (dorsolateral prefrontal cortex), and inhibition (ventrolateral prefrontal cortex). We also discuss the impact of racial paralysis on the quality of interracial relations.

SOCIAL NEUROSCIENCE EVIDENCE FOR EVERYDAY DEHUMANIZATION *Lasana T. Harris, Duke University* - Previous social neuroscience research documents reduced social cognition brain network activity to extreme social outgroups (see Harris & Fiske, 2009, for review), males viewing scantily clad females (Cikara, Eberhardt, & Fiske, 2010), psychopaths when viewing everyday people (Aharoni, et al., in prep), and violent video game players before they pull a trigger to eliminate an enemy (Mathiak & Weber, 2006). This reliable modulation of the social cognition brain network demonstrates a boundary condition to this cognitive ability across a variety of social targets and among varied human populations. Moreover, it suggests that this type of social cognition brain network modulation may serve functions preserved in evolution for social interaction. Specifically, having the ability to not see human beings as such may facilitate behavior otherwise reserved for non-human agents. This suggests that any social target could suffer dehumanized perception, and any group of people could engage this social perception if the social context structures rewards during the social interaction to behavior otherwise reserved for non-human agents. I present recent social neuroscience research documenting this phenomenon across three studies using economic game, legal decision-making, and facial mimicry paradigms. In study one, an initial sample of participants played a time estimation game. Each of these participants was assigned a price based on their accuracy. A second sample of participants then came to the lab, were endowed with \$20, and purchased five team members from the league. They were then scanned one week later, where they viewed the previous performance of both players they purchased and players they did not while assigning value to each player. We find that participants changed the value players they purchased more after incorrect than correct responses, and players they did not purchase more after correct than incorrect responses. More interestingly, brain imaging results show reduced social cognition network brain activity when participants first observe the faces of their own players’ relative to non-purchased players; a decrease that facilitated brain regions active during later subjective valuation. In study two, participants read vignettes describing crimes accompanied by statements referring to the perpetrators personality before making responsibility and punishment decisions. Personality descriptions are either presented with biological or personality language. We find that personality described using biological language mitigates responsibility and punishment decisions, as well as activity in brain regions underlying logic. In study three, participants categorize facial expressions along a social or physical dimension tied to eye color while we record facial electromyography (EMG). We find that participants do not spontaneously mimic facial expressions when categorizing along the physical dimension despite the fact that the same facial feature (eye color) is used in both conditions. Together, these studies present social neuroscience evidence that reduced social cognition may facilitate behavior not reserved for human beings.

SOCIAL IDENTITY ALTERS MIND PERCEPTION: BEHAVIORAL AND NEUROIMAGING EVIDENCE *Leor M. Hackel, New York University; Christine E. Looser, Harvard Business School; John T. Jost, New York University; Jay Van Bavel, New York University* – The tendency to infer goals, thoughts, and feelings behind the faces of others – termed mind perception – is a reflexive and ubiquitous feature of human social cognition, and influences

the extent to which people see others as worthy of moral consideration. However, the natural human propensity for mind perception may be bound by social group membership. In a combination of behavioral and neuroimaging experiments, we examined how identification with different social groups – termed social identity – influences mind perception. In each experiment, participants assessed a continuum of morphs along 11 points between human and doll faces described as in-group or out-group members. Participants were told that half the faces were based on in-group members and half were based on out-group members. Initial behavioral experiments confirmed that participants had lower (i.e., more lenient) thresholds for perceiving minds behind in-group faces, both in minimal groups in Experiment 1 and real-world groups (New York University/Boston University) in Experiment 2. In other words, in-group members required less humanness than out-group members to be perceived as having minds. To determine whether social identity was modulating the underlying perception of faces or merely their categorization, we regressed the objective amount of humanness in each face (i.e., the 11 stimulus points) and the subjective percept of mind (i.e., each subject's binary responses) on BOLD signal during neuroimaging, as participants viewed face morphs described as in-group (Americans) or out-group (Russians) (Experiment 3). Degree of objective humanness was positively associated with activity in bilateral fusiform gyri, while subjective percept of humanness was associated with activity in right temporoparietal junction (rTPJ). Social identity moderated BOLD signal in both regions: the association between objective humanness and fusiform was stronger for in-group members than out-group members and in-group members were associated with a greater neural response to subjective percept of mind in rTPJ. These results suggest dissociable neural bases of objective and subjective humanness, and suggest that group membership impacts both types of processing in the extended face network of the visual system and in regions associated with mentalizing. In a final behavioral experiment, Democrats and Republicans who perceived the other party as threatening had lenient thresholds for perceiving minds behind out-group faces (Experiment 4). As such, the influence of social identity on mind perception may be due to motivational concerns rather than mere categorization. In all, these experiments suggest that mind perception is a dynamic process, dependent not only on reflexive responses to the physical features of faces but also on the motivational influence of social identity and identity threat.

Keynote Distinguished Scholar Address

Friday, April 12, 2013

5:50 - 7:10 PM

**Jennifer Beer, University of Texas, Austin
Presidential Address**

**Ralph Adolphs, California Institute of Technology
2013 Distinguished Scholar Award Winner**

Session F

Emotion & Regulation

Saturday, April 13, 2013

9:00 - 10:15 AM

Kateri McRae, University of Denver

Louise Chim, Stanford University
* SANS Graduate Student Travel Award Winner

Hedy Kober, Yale University

Bryan Denny, Columbia University

ABSTRACTS

INDIVIDUAL AND GROUP DIFFERENCES IN EMOTION *Kateri McRae, University of Denver; James J. Gross, Stanford University; Iris B. Mauss, University of California, Berkeley; Leanne Williams, University of Sydney, Stanford University, Brain Resource; Kevin Ochsner, Columbia University; Tchikima Davis, University of California, Berkeley; Danny Lumian, University of California, Los Angeles; Pareezad Zarolia, University of Denver; Brett Ford, University of California, Berkeley; William Reksan, Brain Resource; Nicholas Cooper, Brain Resource* - Multiple studies have shown that individuals can use emotion regulation strategies to change an emotional response. This has raised the important question of whether individual and group differences in emotionality are due to differences in emotional reactivity, emotion regulation, or both. In a series of studies, we have demonstrated that several types of group differences can be better explained by differences in emotion regulation than by differences in emotional reactivity. Differences in emotional reactivity are measured by greater self-reported negative affect and greater activation in the amygdala during a non-regulation condition. Differences in emotion regulation ability are characterized by group differences in a) the down-regulation of self-reported negative affect b) activation in the amygdala during cognitive reappraisal and c) the engagement of prefrontal and parietal regions during reappraisal. Group differences in regulation, but not reactivity, are present when considering gender differences, age differences as older children develop into young adults, and individual differences in cognitive control. In addition, emotion regulation may better discriminate between individuals who belong to different clinical groups than emotional reactivity. Specifically, there is evidence that emotion regulation predicts response to antidepressant medication in those with major depressive disorder. In addition, individual differences in emotion regulation may better predict non suicidal self-injurious behavior than emotional reactivity.

CULTURAL DIFFERENCES IN BEHAVIORAL AND NEURAL RESPONSES TO CALM AND EXCITED SMILES *Louise Chim, Jeanne L. Tsai, Bo Kyung Park, Brian Knutson, Stanford University* - Although most people want to feel good, people from different cultures want to feel good in different ways. Whereas European Americans want to feel excited and other high arousal positive (HAP) states more than Chinese, Chinese want to feel calm and other low arousal positive (LAP) states more than European Americans. What implications do these cultural differences in "ideal affect" have for how people judge high and low arousal smiles? We predicted that European Americans would rate high arousal smiles as more friendly and better leaders than would Chinese, and that Chinese would rate low arousal smiles as more friendly and better leaders than would European Americans. We tested these hypotheses in Study 1. 43 European Americans and 45 Hong Kong Chinese rated 48 computer generated low, moderate, and high arousal smiles (varying in gender and race [Asian, White]) along a number of traits. As predicted, European Americans rated the high arousal smiles as more friendly and better leaders than did Hong Kong Chinese, while Hong Kong Chinese rated the low arousal smiles as more friendly and better leaders than did

European Americans ($p < .05$). These associations did not depend on gender or race of target. Why might different cultures respond more favorably to different smiles? Three levels of potential differences include: (1) visual/perceptual processing of expressions (e.g., valuing excitement makes people attend more to excited versus calm expressions), (2) emotional processing of expressions (e.g., valuing excitement makes excited faces more rewarding than calm faces), and/or (3) cognitive processing of expressions (e.g., valuing excitement makes excited faces seem more self- or goal-relevant). To distinguish among these possibilities, 13 European Americans and 10 Chinese international students studying in the U.S. viewed faces from Study 1 during fMRI scanning, and rated the familiarity and leadership potential of each. High arousal smiles elicited less nucleus accumbens activity than low arousal smiles in Chinese but not European American participants, consistent with a different affective response to low versus high arousal smiles. Groups did not differ in neural responses to expressions, however, in the fusiform face area (associated with perception), or the medial prefrontal cortex (associated with identity and reflection). These findings suggest that Chinese found the high arousal versus low arousal smiles to be less rewarding than did European American participants. These findings suggest that cultural differences in ideal affect can influence peoples' social inferences from emotional cues. Chinese students rated faces showing excited (vs. calm) smiles as less friendly and worse leaders than European Americans in Study 1, and showed less NAcc activation in response to faces with excited (vs. calm) smiles in Study 2. Thus, cultural differences in ideal affect may influence perception of emotional expressions at the level of affective experience, rather than perception or identification. Associations of these responses with individual differences in ideal affect will be discussed further.

MINDFUL-ACCEPTANCE MODULATES NEGATIVE EMOTION AND PHYSICAL

PAIN *Hedy Kober, Yale University, Columbia University; Jason Buhle, Columbia University; Peter Mende-Siedlecki, Princeton University; Jochen Weber, Columbia University; Brent Hughes, Stanford University; Kevin Ochsner, Columbia University; Tor D. Wager, University of Colorado, Boulder* - Mindfulness has been an integral part of psychological and medical approaches to stress and suffering for several decades. It is typically defined as a two-component construct that includes (1) attention to present-moment experience and (2) a non-judgmental, accepting attitude. Mindfulness has been demonstrated to ameliorate clinical and self-report measures of depression and chronic pain, but whether it influences fundamental affective brain processes or mainly judgment, decision-making, or reporting processes, remains unclear. In this study, we trained 16 participants in mindfulness-based acceptance of negative emotion and physical pain. We then exposed them to two kinds of stimuli: Negative and Neutral visual images and Painful and Non-painful heat. On alternating blocks, we asked participants to either react naturally (REACT instruction) or exercise mindful-acceptance (ACCEPT instruction) in the presence of these stimuli. Mindful acceptance was associated with a significant reduction in reported negative affect for both negative images and painful heat. In addition, mindful-acceptance significantly reduced amygdala responses to negative images. Mindful-acceptance was also associated with a significant reduction in reported pain as well as heat-evoked responses in both medial and lateral pain systems, including dorsal anterior cingulate cortex, anterior and posterior insula, thalamus, and S2. Furthermore, classification analysis on pain trials showed that acceptance significantly reduced activity in a distributed, a priori pattern established in previous studies as a biomarker for experimental pain. Taken together, these findings suggest that mindful-acceptance can reduce reactivity to aversive events in a modality-specific manner. Its effects appear to extend beyond judgment, decision-making, and self report to influence affective brain processes in neurobiologically-meaningful ways.

WHAT DETERMINES WHETHER THE EFFECTS OF EMOTION REGULATION WILL

LAST? *Bryan T. Denny, Columbia University; Marika Inhoff, New York University; Noam Zerubavel, Columbia University; Lila Davachi, New York University; Kevin N. Ochsner, Columbia University* - Cognitive reappraisal has been shown to effectively regulate negative emotion via recruitment of prefrontal control systems to down-regulate activity in the amygdala. Little is known, however, about how long these regulatory effects last or what factors - like regulation practice - determine their durability. In the present study, healthy adult participants viewed aversive stimuli during fMRI scanning. On baseline Look trials participants simply viewed images and responded naturally. On Reappraise trials

participants viewed pictured scenes from a psychologically distant and objective perspective. To examine the effects of prior exposure and practice on reappraisal ability, the day before scanning participants viewed half of the images and either Looked at or Reappraised each one three times. For the other half of the images, they either Looked at or Reappraised them in the scanner for the first time. To address the durability of regulation, participants passively viewed brief re-presentations of these stimuli in the scanner one week after completion of the reappraisal task. Behaviorally, we found that reappraisal was effective at diminishing negative emotion, particularly for repeatedly reappraised stimuli. Neurally, during the reappraisal task, both amygdala and left VLPFC showed effects that mirrored affect reports: activity decreased as a function of both Reappraisal and prior exposure/practice with stimuli for amygdala, and increased for VLPFC. One week later, only for Reappraisal practice trials was sustained attenuation of right amygdala activity observed, without a corresponding interaction in PFC activity. Overall, these results suggest that neural reactivity drives the sustained effects of reappraisal practice.

Keynote Communicating Social Neuroscience

Saturday, April 13, 2013

10:35 – 12:05 PM

Tal Yarkoni, *University of Colorado Boulder*
*** 2013 SANS Innovation Award Winner**

Rebecca Ferrer, *National Cancer Institute*

Philip Fisher, *University of Oregon and the Oregon Social Learning Center*

Jamil Zaki, *Stanford University*

A B S T R A C T S

SCIENCE COMMUNICATION SIGNS UP FOR INTERNET SERVICE: WHAT TWITTER, ARXIV, AND REDDIT CAN DO FOR SOCIAL AND AFFECTIVE NEUROSCIENCE

Tal Yarkoni, Ph.D., University of Colorado Boulder

Many subfields of psychology and neuroscience are currently experience something of a crisis of confidence, but it is not immediately clear what researchers can or should do to improve the situation. In this talk, I argue that rather than developing standardized checklists, creating null result journals, or encouraging replication efforts, our best collective hope for improving the quality of our science lies in dramatically increasing utilization of new online platforms and social media services. I discuss a number of limitations of current publishing practices that could be ameliorated by adopting a more rapid, open, and less formal approach to the communication and evaluation of scientific products. Suggested solutions range from the relatively trivial (tweeting and blogging more) to the somewhat grand (abandoning pre-publication review). I argue that such developments stand to have large benefits for social and affective neuroscientists in the long run, and urge researchers to invest the minimal effort required to speed the transition along.

COMMUNICATING SOCIAL AND AFFECTIVE NEUROSCIENCE PROJECTS TO THE NATIONAL INSTITUTES OF HEALTH (NIH)

Rebecca Ferrer, Basic Biobehavioral and Psychological Sciences Branch, National Cancer Institute

Using the National Cancer Institute (NCI) as an example, this talk will present an “insider” perspective on framing social and affective neuroscience research proposals in the context of NIH funding priorities. I will discuss social and affective science research priorities in the Basic Biobehavioral and Psychological Sciences Branch (at the NCI), which seeks to stimulate research that facilitates a better understanding of psychological processes and biobehavioral mechanisms that underlie cancer decisions, behaviors, and biological processes in order to inform future applied cancer research. In addition, I will discuss ways in which more basic and affective neuroscience questions can be examined in a cancer context or framed in the context of NCI priorities. The presentation will also feature tips about the NIH funding process that can facilitate an application’s successful navigation through peer review and programmatic prioritization. Finally, other Institutes at NIH with interest in social and affective neuroscience will be highlighted.

COMMUNICATING EFFECTIVELY TO GENERAL AUDIENCES ABOUT TRANSLATIONAL NEUROSCIENCE: LESSONS FROM THE LAND OF TOXIC STRESS

Philip Fisher, University of Oregon and the Oregon Social Learning Center

The increase in public interest in neuroscience has created a “seller’s market” for brain research, in which scientific information is likely to be embraced enthusiastically and uncritically by general audiences. This has made it much easier to disseminate important findings outside of academic settings, but it has also introduced a number of challenges. In particular, there can be a tendency for misinformation to be promulgated (especially when it is consistent with preconceived or cultural beliefs), and even valid scientific findings can be overgeneralized or miscommunicated. This talk will focus on the issues in scientific communication in one area: Research on how early adverse experiences shape the developing brain, and what to do to mitigate neurobiological vulnerabilities arising from early life stress. Examples of both opportunities and challenges will be provided, based on the author’s using materials developed at the Harvard Center on the Developing Child, that include the conceptual framework of “toxic stress.”

PUT YOUR MOUTH WHERE YOUR MONEY IS: THE IMPORTANCE OF COMMUNICATING SOCIAL NEUROSCIENCE

Jamil Zaki, Stanford University

In recent years, social neuroscience—and psychology more generally—has developed a bipolar relationship with the public. On the one hand, the findings of our research are communicated through the popular press more quickly and broadly than ever, often being simplified and sensationalized beyond recognition in the process. On the other hand, our field has come under unprecedented scrutiny following new focus on problematic methodological choices, and this criticism joins an alarming dismissal of social sciences within large and important sectors of the public. In both cases, scientists rightfully take offense: either to uncritical characterizations of their work or careless denials of its importance. In this talk, I will argue that the onus is on us, as our field’s practitioners, to address these problems by directly communicating about our work to the public. Such communication can be implemented in simple ways that will benefit both our field and consumers of popular science in a number of ways. From the scientist’s point of view, direct communication allows us to curate the ways in which our work is described, maximizing accuracy and transparency. From the public’s point of view, it affords a peek into the scientific process (and not just its end products), and makes the relevance of our work abundantly clear. I will propose two simple ideas—“pop abstracts” and science writing workshops—that could provide first steps towards a broadly communicative social neuroscience, and close with the recognition that communication is a vital form of teaching we should think of as at least somewhat of a responsibility.

Session G **Health & Risk Behaviors**

Saturday, April 13, 2013

1:30 – 2:45 PM

Amanda S. Bruce, University of Missouri-Kansas City

Emily B. Falk, University of Michigan

Gideon Nave, Caltech

Keely A. Muscatell, University of California, Los Angeles

A B S T R A C T S

FOOD FOR THOUGHT: SELF-CONTROL, WEIGHT LOSS, AND THE BRAIN *Amanda Bruce, University of Missouri-Kansas City; Jared Bruce, University of Missouri-Kansas City; Rebecca Lepping, University of Kansas; Steven Malley, Malley Surgical Weight Loss Center; Joseph E. Donnelly, University of Kansas Medical Center; Cary Savage, University of Kansas Medical Center* - The great prevalence and grim consequences of obesity make it one of the most serious health concerns facing industrialized nations. Many studies document the improved health outcomes associated with even small amounts of weight loss. Bariatric surgery and behavioral interventions can both result in successful weight-loss. Few studies have examined functional brain changes in response to effective, purposeful weight loss and yet none have compared different methods of intervention. Here we compare functional brain changes associated with a behavioral weight loss intervention with those associated with bariatric surgery. Fifteen obese participants were recruited prior to adjustable gastric banding surgery and fifteen obese participants were recruited prior to a behavioral diet weight loss intervention. The groups were matched for demographics (age, sex, educational attainment) and amount of weight lost in the intervention (surgical M = 10%; diet M = 11%). Functional magnetic resonance imaging (fMRI) scans were conducted before and 12 weeks after intervention. At each time, participants were scanned while hungry and immediately following a standardized meal. During the fMRI scans, participants viewed blocks of food, nonfood (animals) and blurred baseline control images. Behavioral weight loss participants demonstrated increased activity in right medial prefrontal cortex and bariatric weight loss participants demonstrated decreased activity in this region [max voxel 6, 50, 19; $t = 3.72$; 8 contiguous voxels; $p < .01$, corrected]. This could be due to the requirement for greater self-control in a strict behavioral diet program. In a sense, it may be that the bariatric participants have the "self-control" surgically placed as a laparoscopic band, thus not needing the extra cognitive control in the form of cortical inhibition. When hungry, diet participants also showed significantly greater increases from pre to post intervention in left precuneus when compared to bariatric patients. Medial PFC and precuneus may be working together to facilitate both increased cognitive control and improved self-monitoring for the behavioral diet participants. It is possible that continual monitoring of the self helps facilitate self-control, though further research is needed. When participants in this study were scanned after eating, findings indicated increases in bilateral temporal cortex activity in bariatric participants compared to behavioral diet participants. Activations in middle temporal cortex are commonly reported in studies of food motivation and are associated with higher level perception including visual and semantic processing. It is possible that food cues are more salient and stimulating for those who have undergone a more restrictive weight loss procedure (such as a surgery). Overall, we demonstrated that functional brain changes observed following behavioral diets are not due to decreased body mass alone, but appear to be associated with the process by which weight loss is achieved.

WHY IS SOCIAL INFLUENCE SUCH A POWERFUL DETERMINANT OF HUMAN BEHAVIOR? NEURAL PREDICTORS OF SUSCEPTIBILITY TO PEER INFLUENCE IN ADOLESCENCE

Emily B. Falk, University of Michigan; Christopher N. Cascio, University of Michigan; Matthew O'Donnell, University of Michigan; Frank Tinney, University of Michigan; Joe Bayer, University of Michigan; Kristin Shumaker, University of Michigan; Josh Carp, University of Michigan; Anuj Pradhan, NICHD; Marie-Claude Ouimet, University of Sherbrooke; Jean Shope, University of Michigan; Ray Bingham, University of Michigan; Bruce Simons-Morton, NICHD

The opinions and behaviors of others powerfully shape our own. These effects are particularly strong in adolescence. This has important everyday consequences; for example, auto crashes are the leading cause of death in teens, and occur significantly more often in the presence of teen passengers. Yet the neural mechanisms of peer influence in adolescence are not well understood. This presentation will review convergent evidence suggesting that among adolescents, neural sensitivity to social rewards and punishments is associated with susceptibility to social influence. I will focus on data from two recent large-scale neuroimaging studies of peer influence in adolescents. These studies demonstrate that neural activity in systems associated with the distress of exclusion (anterior insula [AI], subgenual cingulate cortex [subgenACC], dorsal anterior cingulate cortex [dACC]), as well as with mentalizing (dorsomedial prefrontal cortex [DMPFC], temporoparietal junction [TPJ], temporal pole [TP]), and reward (ventral striatum, orbitofrontal cortex) predict susceptibility to diverse forms of social influence. In the first study, male teens (n=46, ages 16-17) rated mobile game applications prior to an fMRI scan. In the subsequent scan, they received feedback about how their peers rated the game apps, and were given an opportunity to re-rate the games. Separately, we identified neural activity associated with being excluded by peers using the game Cyberball. Neural activity during the app-rating task increased when receiving feedback that the group's opinion differed from the participant's initial opinion in anatomically defined regions of interest (ROIs) encompassing social pain and mentalizing systems, as well as in functionally defined ROIs identified based on exclusion > inclusion in Cyberball. Activity within these systems, and the reward system, also predicted changing one's behavior to conform with peers. These effects were most pronounced when peers ostensibly rated the games lower than the participants' initial ratings, but were modulated by the size and density of participants' online social networks. In a second study, we examined the hypothesis that individual differences in neural sensitivity to exclusion predispose adolescents to be susceptible to risky peer influence. Increased sensitivity to social and emotional cues may prompt teens to try to preemptively attempt to fit in by taking risks in the presence of peers. In this study, male teens (n=43, ages 16-17) experienced inclusion and exclusion in the game Cyberball in an fMRI session. One week later, they drove alone and with a peer-confederate in a fixed-based driving simulator. Individual differences in activity in anatomically-defined ROIs within social pain (AI, dACC, subgenACC) and mentalizing (DMPFC, rTPJ) systems during exclusion predicted susceptibility to risky social influence during the subsequent driving session, and did so above and beyond self-reports of susceptibility to peer influence and distress during exclusion. These results: 1) highlight the role of socio-emotional brain systems in social influence; 2) contribute to our understanding of key processes relevant to social and emotional function in the adolescent brain; and 3) illustrate an approach to linking neural activity in specific, hypothesized ROIs to outcomes beyond the neuroimaging lab.

VASOPRESSIN FACILITATES RISKY COLLABORATION IN HUMANS

Claudia Brunnlieb, University Magdeburg, University Lübeck; Gideon Nave, Caltech; Colin Camerer, Caltech; Bodo Vogt, University Magdeburg; Claus Tempelmann, University Magdeburg; Thomas F. Münte, University Lübeck; Marcus Heldmann, University Lübeck, University Magdeburg

- Animal studies have shown that neuropeptide Arginine Vasopressin (AVP) facilitates social behaviors such as pair bonding and paternal behavior. In humans, AVP was linked to marital satisfaction, attachment security, social words detection and charitable giving. However, there is little evidence about the role of AVP in human strategic interactions. Based on the above-mentioned findings, we hypothesized that AVP would enhance partner-specific cooperative behavior. In our double blind study, 34 healthy male participants received either intranasal AVP (20 IU) or Placebo, and their brain activity was recorded in the fMRI scanner. Participants played variations of a 2x2 Stag-hunt game with a fixed partner (no feedback). In the game, players choose between a cooperative strategy (A) and a non-cooperative strategy (B). The game has two pure equilibriums: payoff-dominant, in

which both players choose A, and risk-dominant, in which both players choose B. The optimal strategy in the game depends on one's belief about his partner's action: when believing that the partner would choose A with a probability that is greater than a certain threshold, one should choose A as well; otherwise, B is a safer option that secures a higher worst-case payoff (according to the max-min criteria). The rate in which players select the collaborative strategy A is, therefore, a measure for one's willingness to take a social risk, and implies a greater belief that his partner would also choose to collaborate. Our behavioral results show that AVP subjects selected the cooperative strategy significantly more times than the placebo group, for every given belief threshold. Furthermore, the AVP subjects responded significantly faster when choosing A than when choosing B. The opposite effect was observed in the placebo group, where responses were significantly faster when choosing the risk dominant strategy B. Our fMRI results showed a significant drug (AVP, Placebo) x strategic choice (cooperative strategy, non-cooperative strategy) interaction in the left dorsolateral prefrontal cortex (DLPFC), a brain area known to be involved in the encoding of anticipated risk during decision-making. Under AVP treatment the BOLD signal in the DLPFC was significantly diminished during the choice of the cooperative strategy. The opposite effect occurred during the choice of the non-cooperative strategy, where AVP treatment resulted in an increased BOLD-signal in the left DLPFC BOLD-signal relative to the Placebo group. These findings imply a relation between AVP treatment and the perceived risk of each strategy; AVP subjects perceived the cooperative strategy as less risky (implying a stronger belief that their partner would collaborate), whereas Placebo subjects perceived the non-cooperative strategy as less risky (implying a belief that their partner would not cooperate). Our findings provide behavioral (choice, response times) as well as neural evidence for the role of AVP in human cooperative behavior. AVP strengthens one's belief that his partner would collaborate, and as a result increases one's willingness to take a social risk for the benefits of mutual collaboration.

SOCIAL STRESS AND THE DORSOMEDIAL PREFRONTAL CORTEX: THE DARK SIDE OF MENTALIZING? *Keely A. Muscatell & Naomi I. Eisenberger, UCLA* - Social stressors, such as experiencing social evaluation or being low in social status, are associated with a variety of negative outcomes, including poorer physical health and well-being. Behavioral research suggests that perceptions of threat, feelings of evaluation, and self-conscious emotions may all play a role in linking social stressors with negative outcomes. However, the mechanisms by which social stressors are represented in the brain and translated into physiological processes important for health are largely unknown. In this presentation, converging lines of research suggesting a key role for the dorsomedial prefrontal cortex (DMPFC) in responding to social stressors will be discussed. Specifically, I will present data from three studies showing that: 1) DMPFC activity during social evaluation is associated with decreased self-esteem, 2) DMPFC activity during a perspective-taking task and a social threat task is associated with lower social status, and 3) DMPFC activity during social evaluation is associated with increases in immune system activation. Together, these data suggest that, in certain contexts and for certain individuals, attending to the thoughts and feelings of others may be associated with negative emotions, lower feelings of self-worth, and heightened physiological activation. In other words, while the bulk of research in social cognitive neuroscience has focused on the positive side of mentalizing and perspective-taking, the research presented demonstrates that mentalizing may have dark side as well.

Session H Poster Presentations: Session 2

Saturday, April 13, 2013
2:45 – 4:15 PM

Session I Clinical Applications & Connectivity

Saturday, April 13, 2013
4:35 – 5:50 PM

Rachel Ellis, University of Melbourne & Murdoch Children's Research Institute
* OUP Developmental Cognitive Neuroscience Student Travel Award Winner

Jeffrey M. Spielberg, University of California, Berkeley

Josh Carlson, Stony Brook University

Wesley Moons, University of California, Davis

A B S T R A C T S

BRAIN CONNECTIVITY NETWORKS AND AFFECTIVE DISORDERS IN

ADOLESCENCE Rachel Ellis, University of Melbourne & Murdoch Children's Research Institute; Nicholas Allen, University of Melbourne; Marc Seal, Murdoch Children's Research Institute -

Research Question: What is the relationship between the development of structural connectivity in the adolescent brain and the emergence of psychopathology? Background: Emotional regulation, which has been linked to risk for affective disorders such as depression, depends on connectivity between frontal and limbic regions of the brain. White matter tracts support structural connectivity in the brain, and alterations in their integrity are implicated in a range of psychological disorders. This study uses diffusion-weighted imaging of white matter development in a cohort of adolescents to investigate the relationship between brain connectivity patterns and the emergence of psychopathology. Methods: 145 neurologically healthy adolescents were recruited from a random selection of Melbourne schools. Diffusion weighted MRI images were acquired, and used to perform white matter tractography and brain network analysis. Key topological properties of the resulting connectivity networks were identified and compared across individuals. Participants completed a self-report measure of depressive symptomatology. Preliminary results: Brain network topology continues to develop between the ages of 16 and 18, and higher global efficiency may be linked to higher levels of depressive symptoms. Analysis of local connections implicates connectivity between the rostral anterior cingulate and thalamus in the development of depressive symptoms.

PUBERTAL INCREASES IN TESTOSTERONE INFLUENCE AMYGDALA-ORBITOFRONTAL COUPLING

Jeffrey M. Spielberg, University of California, Berkeley; Thomas M. Olin, University of Pittsburgh; Erika E. Forbes, University of Pittsburgh; Cecile D. Ladouceur, University of Pittsburgh; Neal D. Ryan, University of Pittsburgh; Ronald E. Dahl, University of California, Berkeley - Adolescence is characterized by complex changes in social and affective processing including puberty-associated increases in reward processing, threat processing, and emotional reactivity (Crone & Dahl 2012). These changes appear to contribute to difficulties regulating emotions (and affective disorders) in adolescence. Take together these pubertal changes in affective processing can appear somewhat paradoxical: pubertal maturation is associated with both 1) increases in "boldness" (including greater sensation-seeking and risk-taking) and 2) increases in anxiety (Cohen et al., 1993; Grunbaum et al., 2002) and reactivity to threat (e.g., increased fear-potentiated startle, Quevedo et al., 2009). Given the long term health impact of both sides of this paradox (i.e., increased anxiety/depression as well as the negative trajectories from adolescent risky and reckless behavior; Dahl, 2004), it is crucial to achieve a deeper understanding of the mechanisms by which increased reactivity to threat emerges during puberty. Emerging evidence suggests that puberty-linked increases in amygdala activation to threat form an important link in this mechanism (Moore et al., 2012; Spielberg et al., in prep). However, the neural mechanisms by which puberty increases amygdala reactivity to threat remain unresolved. Given that orbitofrontal cortex (OFC) is heavily interconnected with amygdala (Cohen et al., 2008) and is thought to exert top-down modulation of amygdala value representations (Dolan, 2007), decoupling of amygdala and OFC may lead to increased amygdala reactivity. Emerging research in adults indicates that testosterone decreases amygdala-OFC coupling, providing one mechanism by which puberty may lead to greater amygdala reactivity (Bos et al., 2012; van Wingen et al., 2010; Volman et al., 2011). However, no study to date has examined the

impact of testosterone on amygdala-OFC coupling during adolescence, the period in which testosterone undergoes dramatic increases. Thus, it remains unclear whether this decoupling contributes to the increased amygdala reactivity observed in adolescence. The present study tested the hypothesis that puberty-linked increases in amygdala reactivity to threat are related to decreased top-down modulation of amygdala by OFC. To test this hypothesis, functional magnetic resonance imaging data were collected at two time points (2 years apart) in a sample of 41 typically developing adolescents who viewed stimuli associated with potential threat (i.e., faces with anger or fear expressions). In order to assess the impact of testosterone on amygdala-OFC coupling, longitudinal changes in endogenous testosterone were correlated with variation over time in condition-dependent amygdala-OFC connectivity (i.e., psychophysiological interaction [PPI]). In line with hypotheses, increased testosterone over time was associated with decreased PPI connectivity between amygdala and right OFC over time. Specifically, individuals with a large increase in testosterone exhibited positive connectivity during the threat condition between amygdala and right OFC at Time 1, and these regions became decoupled at Time 2. Thus, present findings support the hypothesis that drastic changes in testosterone during adolescence are associated with decoupling of amygdala and OFC, which, in turn, may lead to reduced top-down regulation of amygdala by right OFC. These changes may contribute to the somewhat paradoxical changes, which include increased emotional reactivity, threat reactivity, and risk-taking associated with pubertal maturation.

FEELING LOST: DISRUPTED BRAIN-BASED TRACKING OF DYNAMIC AFFECTIVE STATES IN ANXIETY AND DEPRESSION *Josh Carlson, Stony Brook University; Denis Rubin, Stony Brook University; Lilianne Mujica-Parodi, Stony Brook University* - Emotional states are complex multi-dimensional phenomena that continuously evolve as we interact with the environment. Studying the brain basis of dynamic emotional states may be particularly important for understanding disorders such as anxiety and depression, which are characterized by abnormal affective states including prolonged and unexplainable worry and despair. Yet, the neural system that supports dynamic fluctuations in emotional state is unknown and it is further unknown how this system might be compromised in disorders of anxiety and depression. We hypothesized that areas of the brain, which support dynamic shifts in affective state, should display activity that correlates with experienced affect. We further hypothesized that, compared to healthy controls, individuals with anxiety and depression would display weaker correlations between activity in this network and their experienced affect. To test this hypothesis, patients with generalized anxiety disorder (N=17), major depressive disorder (N=15), those comorbid for anxiety and depression (N=15), and a sample of healthy controls (N=13) viewed the pilot episode of ABC's TV-series "Lost" (42min) while fMRI data were acquired. This episode follows a group of plane crash survivors who are stranded on an unknown island and are forced to deal with a number of emotional challenges ranging from crash-related deaths and injuries to other mysterious threats encountered on the island. Immediately after viewing the episode, participants rated their experienced emotional arousal and valence levels on a nine-point scale for each of the 200 scenes in the episode. Across all individuals fluctuations in reported arousal were correlated with widespread activity in the occipital lobe, posterior parietal cortex, precuneus, supplementary motor area, dorsomedial and dorsolateral prefrontal cortex, caudate, amygdala, anterior insula, and anterior cingulate. Similarly, fluctuations in valence were associated with activity in the precuneus, dorsomedial prefrontal cortex, caudate, amygdala, anterior insula, and anterior cingulate. Valence also correlated with areas not linked to arousal such as the posterior cingulate, superior temporal gyrus, fusiform gyrus, and anterior temporal pole. Anxious and depressed individuals displayed weaker brain-based tracking of valence within this network, including the amygdala, anterior cingulate, posterior cingulate, and dorsomedial prefrontal cortex. Thus, our results provide evidence for a large-scale brain-based network in which activation correlates with variation in the valence and arousal components of emotional state. Of particular interest, we find specific abnormalities in patients with anxiety and depression within this network. This abnormality in brain-based tracking of affective states may result in a lost representation of one's feelings, which provides a putative basis for disorder-related symptoms such as unexplainable worry and despair.

ANXIETY CAUSES GREATER INFLAMMATORY ACTIVITY THAN ANGER Wesley G. Moons, *University of California, Davis* - Acute stressors elicit systemic inflammatory activity. There are at least two adaptive reasons for psychological stressors to elicit an inflammatory response. First, preemptive activation of the immune response can facilitate healing of subsequently sustained injury or infection. Thus, when stressors signal that future injury is likely, an inflammatory response would be beneficial. Second, an inflammatory response in anticipation of future challenges or threats presumably produce behaviors that enhance dealing with those challenges or threats. For example, sickness behaviors produce withdrawal and social avoidance behavior that may encourage distancing from a perceived danger. Thus, when stressors signal that certain situations or individuals are best avoided, an inflammatory response could enhance appropriate avoidance of that danger. General models of stress posit a mostly undifferentiated physiological response to stressors, which includes a spike in inflammatory activity. However, not all stressful situations present equivalent likelihood of potential injury and a related need for avoidance. For example, feeling angry is a common response to some stressors, but anger is associated with appraisals of relatively great levels of control and a sense of certainty or confidence. Further, anger promotes approach behavior such as aggression toward the stressor perhaps because angry people perceive less risk of injury. In such situations, an inflammatory response may be irrelevant because the stressor is seemingly manageable, the perceived chance of injury is low, and there is little motivation to avoid the stressor. In contrast, avoidance emotions like anxiety and fear strongly indicate a threatening and potentially overwhelming stressor. Such reactions are commonly associated with a sense of little control over one's environment. Consequently, these emotions are accompanied by a powerful motivation to withdraw from potentially harmful stimuli. In such situations, an inflammatory response that further promotes avoidance and prepares the body to deal with potential injury could be particularly adaptive. An experiment was conducted to provide causal evidence that the avoidance emotion of anxiety produces an inflammatory response, whereas the approach emotion of anger produces less or no inflammatory reaction. Forty men and women were provided oral mucosal transudate (OMT) samples from which the proinflammatory cytokines interferon- γ (IFN- γ), interleukin-6 (IL-6), and interleukin-1 β (IL-1 β) were assayed as markers of inflammatory activity. Participants' heart rate (HR) was also assessed at baseline and continuously throughout the experiment. Participants completed a guided writing emotion induction in which they wrote about a situation that made them feel either very anxious or very angry. Twenty minutes after the essay completion, participants provided a second OMT sample from which post-induction cytokine levels were assessed. Participants in both conditions showed an equivalent and significant increase in HR from baseline while they were writing their emotion induction essays. This indicated that a similar level of physiological arousal was obtained in both emotion conditions. Despite this similarity, only participants in the anxiety condition showed an increase in the mean levels of the inflammatory markers IFN- γ and IL-1 β , but not IL-6. Participants in the anger condition showed no sign of inflammatory reactivity. Participants' self-reported post-induction anxiety levels, controlling for baseline levels, were also significantly correlated with IFN- γ , IL-1 β , and IL-6, but self-reported anger was not. The results support a model in which avoidance emotions cause notable inflammatory reactivity, whereas approach emotions do not. Limiting inflammatory responses to situations in which immune activity may be most beneficial is likely both adaptive and helpful in conserving resources for generating immune reactivity when only most necessary. These results indicate that not all stress responses are created equal and that distinct patterns of emotional responding to stressors mediate inflammatory reactivity.

Session J Poster Presentations: Session 3

Saturday, April 13, 2013

5:50 - 7:20 PM

Poster Session D

Friday, April 12, 2:45-4:15pm

D-01

DOES JOINT ATTENTION FACILITATE SPONTANEOUS FACIAL MIMICRY? *Janina Neufeld, University of Reading; Sebastian Korb, University of Wisconsin; Christina Ioannou, University of Reading; Garret O'Connell, University of Reading; Etienne Roesch, University of Reading; Leo Schilbach, Max-Planck-Institute for Neurological Research; Bhismadev Chakrabarti, University of Reading* - Spontaneous facial mimicry may reflect a key component of empathy, i.e. emotional contagion (Niedenthal, 2007). Another key component of empathy is cognitive empathy or theory of mind, that is involved in understanding mental states of others. Joint attention is a reliable predictor of theory of mind from early childhood (Charman et al., 2000). However, it is not known if and how these two components of empathy (i.e. joint attention and spontaneous facial mimicry) interact with each other. While eye contact per se is known to increase facial mimicry (Schrammel et al 2009), it does not constitute joint attention, which involves the social coordination of visual attention towards an aspect of the environment. To create the subjective experience of joint attention in an experimentally controlled way, we used an interactive paradigm involving eye-tracking. The paradigm uses face stimuli of virtual characters, whose gaze behaviour is determined in real time by the gaze behaviour of the participant (Wilms et al., 2010). The task had a 2 x 2 design, with the virtual character either engaging in joint attention or not, and displaying a happy as compared to a disgusted facial expression. The virtual character and participant engaged (or not) in joint attention to one of two simultaneously presented neutral objects matched for luminance and colour. This was instantiated by establishing mutual gaze between the participant and the virtual character prior to the virtual character shifting gaze to one of the two objects. This was followed by the virtual character producing a facial expression and looking back at the participant. Facial EMG was recorded simultaneously from the participants throughout the experiment. Spontaneous facial mimicry was measured by indexing the facial EMG response for the duration of the facial expression made by the virtual character. Preliminary results from 10 adults (4 males) from the general population show a greater response in the zygomaticus major for happy compared to disgust expressions of the virtual character, indicating emotion-congruent spontaneous facial mimicry. There is a trend for greater spontaneous facial mimicry in trials with joint attention compared to those without. Future analysis will include more participants as they continue to be recruited, and test the nature and magnitude of the relationship between joint attention and spontaneous facial mimicry. In addition, it will test the impact of individual differences in autistic traits on the link between these two components of empathy.

D-02

THE ROLE OF GENETIC VARIATIONS OF IMMUNE SYSTEM REGULATORY MOLECULES CD28 AND CTLA-4 IN COGNITIVE FUNCTIONING IN SCHIZOPHRENIA *Dorota Frydecka, Wroclaw Medical University; Lidia Karabon, Polish Academy of Sciences; Edyta Pawlak-Adamska, Polish Academy of Sciences; Anna Jele, Wroclaw Medical University; Andrzej Kiejna, Wroclaw Medical University* - Background: Genetic factors that modulate the immune response have been implicated as risk factors both for schizophrenia as well as for cognitive impairments, which are considered to be endophenotypes of schizophrenia, i.e. subclinical, heritable and independent of clinical state traits associated with genetic susceptibility. Regulation of immune response is mediated by two related receptors: CTLA-4 and CD28, which mediate differentially T-cell activity. CD28 is a major co-stimulator, whereas CTLA-4 performs negative regulatory functions. The level of activation of immune response depends on the balance between co-stimulatory and inhibitory signals. One of the key mechanisms leading to immune dysregulation is the expression of the regulatory molecules due to their genes polymorphisms. Aim: The study was carried out to investigate the association between polymorphisms of the CTLA-4 gene (49A/G, -319C/T, CT60 A/G) and CD28 gene (+17C/T) and frontal lobe functions in patients with schizophrenia. Methods: 118 patients diagnosed with schizophrenia according to ICD-10 criteria and 352 controls were included in the study. The participants were evaluated for lifetime symptomatology using the Operational Criteria for Psychotic Illness Checklist (OPCRIT). Cognitive functions were assessed by performance on the most commonly administered measures of frontal lobe functioning: Trail Making Test (TMT) and Stroop Color Word Interference Test (SCWT). TMT-A involves connecting numbers in succession, while TMT-B requires subjects to connect numbers and letters alternately in successive order. TMT-A requires mainly visuo-perceptual abilities, TMT-B reflects primarily working memory and secondarily task-switching ability, while the difference between TMT-B and TMT-A score provides an indicator of executive control function. Stroop Test involves reading printed color names when the name of the color is printed in a color not denoted by the name, thus allowing to measure the ability to inhibit a prepotent response tendency. Results: There was no significant difference in distribution of genotypes in the polymorphisms of CTLA-4 gene between patients and controls. However, there were significant differences ($p=0,0007$) in distribution of genotypes of CD28 gene between group of patients and controls (CC: 2% vs. 1%, CT:41 vs 23%, TT: 58% vs. 76% respectively). Patients performed significantly below the norms for general population on both TMT A and TMT-B tests. There were no significant differences between patients with respect to CTLA-4 and CD28 gene polymorphisms in TMT-A and TMT-B scores. However, with respect to +17C/T CD28 gene polymorphism there was a trend level difference: C allele carriers (CC and/or CT genotype) performed worse than T allele carriers (TT genotype) ($p=0,054$), suggesting weaker executive control function. Additionally, there were no significant

differences among patients with respect to CTLA-4 and CD28 gene polymorphisms and performance on Stroop Test. Conclusions: Our data support a role of CD28 +17 C/T gene polymorphisms for the predisposition to schizophrenia according to ICD-10 criteria. Moreover, in the group of patients the distribution of genotypes of CD28 gene polymorphism is similar that found in patients with autoimmune disorders such as: early onset type 1 diabetes and Behçet's disease. Additionally, +17C/T CD28 gene polymorphism might be considered as a risk factor for cognitive impairment in schizophrenia.

D-03

REAPPRAISAL CHOICE ENHANCES ABILITY TO UPREGULATE POSITIVE AFFECT *Bruce Dore, Columbia University; Kevin Ochsner, Columbia University* - Although an extensive literature shows the benefits of choice and control for psychological well-being, no prior studies have assessed the impact of active choice on emotion regulation effectiveness. We conducted a behavioral study to investigate whether actively choosing to reappraise a stimulus will lead participants to reappraise more effectively than those given no opportunity for choice. Participants (n=80) were trained to use a positivity-enhancing ('Make Positive') or a negativity-dampening ('Make Neutral') reappraisal strategy before viewing a series of image trials for which they either chose to reappraise or look naturally (Choice condition), or were yoked to the choices of a previous participant (NoChoice condition). All participants made affect ratings for each trial on unipolar positive and negative affect scales. Results reveal a reappraisal strategy by choice interaction such that choice conferred a benefit for the Make Positive strategy but not for the Make Neutral strategy. Additionally, Make Positive choice preference correlated negatively with individual differences in rumination tendency, as assessed by the Ruminative Responses Scale. These findings shed light on the importance of motivational factors for reappraisal efficacy and suggest a connection between chronic preferences for rumination and positive reappraisal.

D-04

NEURAL CORRELATES OF SOCIAL DISCOUNTING *Tina Strombach, University of Dusseldorf; Bernd Weber, University Hospital Bonn; Peter Kenning, Zeppelin University; Philippe Tobler, University of Zurich; Tobias Kalenscher, University of Dusseldorf* - Objective: Sharing is rewarding. And sharing with close friends or family is more rewarding than sharing with strangers. Previous studies have shown that generosity levels decline hyperbolically across social distance, a process dubbed social discounting (Jones and Rachlin, *Psych Science*, 2006), and that sharing money with close others recruits dopaminergic reward brain regions more robustly than sharing the same amount with distant others (Fareri et al., *J Neurosci*, 2012). We therefore hypothesized that the social-distance-dependent other-regarding utility, i.e., how much subjects value increasing the wealth of another person at social distance X, is associated with activity in reward-related value areas. Methods: We studied the

neural correlates of social discounting by adapting a social decision making task by Jones and Rachlin (2006). While lying in the MR scanner, subjects made 160 decisions. In the experiment social distance was transformed into a scale consisting of 100 icons, representing the social distance between the participant and the other person. In each trial, participants had to choose between a selfish and a generous option, yielding a large reward for the participant alone, or smaller rewards for the participant and another individual at the specified social distance. For each social distance level, we determined the point at which the subjects were indifferent between being generous and selfish by titrating the selfish reward magnitude, revealing how much money they are willing to forego to give a reward to the other person. These points were then used to econometrically reconstruct the other-regarding utility of giving a specified sum of money to a person at social distance X. Results: We present preliminary data of 16 subjects. Half of the subjects (n=8) were used to identify brain regions responsive to making generous decisions. This localizer task identified the anterior PFC, dlPFC, vmPFC and Caudate/vStr, being significantly more active when deciding in favor of the generous option. In the other half of the subjects (n=8), we found that the activity in these ROIs was parametrically modulated by the econometrically reconstructed other-regarding utility. Conclusions: Neural activity in regions usually associated with decision value and reward processing correlate with the econometrically reconstructed other-regarding utility. Our preliminary results suggest that social distance is systematically integrated into the decision making process and social distance is represented as part of the value function in reward-related brain regions.

D-05

DEVELOPMENT OF NEURAL MECHANISMS UNDERLYING SOCIAL COMPARISONS *William E. Moore III, University of Oregon; Jennifer H. Pfeifer, University of Oregon* - Social comparisons are an important means by which we gain information about the self, but little is known about the neural mechanisms underlying comparative social judgment, as most prior neuroimaging research on this topic has investigated judgments of self or others in isolation in adult populations. No work to date has explored the developmental trajectories associated with comparative social judgment, but as adolescence is associated with dramatic changes in both the importance of social contexts and in self-related processing, it presents an ideal epoch from which to investigate the self as it emerges from a rich social milieu of interpersonal interactions and evaluations. To address this gap in the literature, we used fMRI to investigate the neural correlates of social comparisons in early adolescents and adults across judgment contexts that varied in degree of personal involvement in the comparison and self-similarity of judgment targets. In adult populations, ventromedial prefrontal cortex (vmPFC) has routinely been implicated in social cognitive tasks that rely on such absolute judgments about the self or others. Recent work from our laboratory has demonstrated that the interaction between personal involvement and self-similarity of

judgment targets determines neural activity during social comparisons in vmPFC (specifically, perigenual anterior cingulate cortex; pACC) as well as in the bilateral anterior insula. In adults, comparisons between the self and similar others exhibit a unique response in this region when contrasted against other judgment contexts, suggesting that the special psychological status afforded to these social comparisons is indexed by activity in the pACC region of vmPFC. Here, developmental analyses assess differences in pACC response to comparisons between the self and similar others for adolescents and adults. Results from repeated measures analyses at the group level additionally consider development, personal involvement, and self-similarity of comparison targets as they interact to modulate the brain's response to social judgments.

D-06

CULTURAL BACKGROUND AND RESTING CARDIAC VAGAL CONTROL INDEPENDENTLY INFLUENCE EMOTION RESPONSES

*Xiao-Fei Yang, University of Southern California, *ICNC Travel Award Winner; Mary Helen Immordino-Yang, University of Southern California* - Our emotion behavior is shaped both by biological factors and social norms and expectations. For example, members of the Chinese culture have been described to value emotion moderation (Russell & Yik, 1996), and to experience emotions with "lower frequency, intensity and duration" (Bond, 1993), comparing to members of the Western culture. Higher resting cardiac vagal control (rCVC), an index of the parasympathetic nervous system functioning, has been considered a positive biological factor for emotion regulation (Porges, 2007), and been linked with less negative emotional expression (Pu, et al., 2010). However, most studies on rCVC and emotion regulation were done with western participants; and most studies of cultural differences in emotion behavior did not take into consideration variations in participants' rCVC. Here we investigated how cultural background and rCVC together influence emotion responses, including expressive behavior and heart rate response, as well as possible interactions between cultural background and rCVC. 15 Chinese participant (C) in Beijing, 16 second-generation East-Asian American (EA) and 16 non-Asian American (NA) participants in Los Angeles were recruited. Three participant groups were matched for age and gender. Participants first viewed video-clips depicting another person's painful physical injury, designed to elicit compassion for physical pain, and discussed their feelings during a one-on-one, private interview session. Independent coders watched recorded interview and rated participants' behavioral expressivity. During a later ECG recording session, participants viewed 5-second reminders of the video-clips followed by periods of 13-second black-screen for reflection/deliberation (see Immordino-Yang et al., 2009). Peak heart rate increases were identified during the stimulus presentation phase and the reflection/deliberation phase respectively. Baseline ECG recordings were also taken to establish measures for rCVC. We found that controlling for cultural group, those with higher rCVC were less expressive during the interview ($F[1,39] = 6.01, p = 0.02$).

And controlling for rCVC, three groups' behavioral expressivity differed ($F[2,42] = 5.38, p = 0.01$), with C being least expressive and NA most expressive (linear contrast, $p = 0.004$). No interaction between these two factors was found. Cultural background modulated participants' peak heart rate increases during the reflection/deliberation phase ($F[2,39] = 2.65, p = 0.08$), but not the stimulus presentation phase. Further, in bicultural EA participants, those who have higher rCVC also showed stronger bias towards East-Asian culture (self report measures; $\rho = 0.74, p = 0.003$). Our results extended previous understanding of how cultural background and rCVC influence emotion responding by demonstrating that contributions from these two factors are statistically independent (additive). We also demonstrate an intriguing interplay between biological propensity towards emotion regulation and adopted cultural value in bi-cultural participants. Future developmental studies are needed to investigate the causal relationship of this effect.

D-07

NEURAL BASES OF MESSAGE PROPAGATION

Stephanie Vezich, UCLA; Ben Gunter, UCLA; Locke Welborn, UCLA; Matthew Lieberman, UCLA - Mentalizing regions in the brain (e.g., medial prefrontal cortex, precuneus) reliably activate when individuals encode social information, such as inferring another person's mental state. However, we hypothesize that people may recruit these same regions while encoding non-social information (e.g., the premise of an upcoming action film) because of an underlying motivation to share this information with individuals for whom it may be relevant (e.g., tell a friend who likes action movies that she might like this film). In the current study, 22 participants viewed trailers for 12 not-yet released films while in the MRI scanner. Unbeknownst to them until after the scanner portion of the study, they were later given the opportunity to share information about each film. Sharing information was associated with activity in mentalizing and reward regions, suggesting support for our theory that participants were spontaneously encoding information about certain films as socially valuable.

D-08

DISSOCIATIONS IN REWARD NETWORK ACTIVATION WHILE LEARNING FROM COGNITIVE VERSUS AFFECTIVE FEEDBACK

Jenna M. Reinen, Columbia University; Catherine Insel, Columbia University; Sergio Zenisek, Columbia University; Tor D. Wager, University of Colorado, Boulder; Nathaniel D. Daw, New York University; Daphna Shohamy, Columbia University - Converging evidence indicates that the human reward network supports incremental, trial-by-trial learning from feedback. Specifically, functional imaging has demonstrated that prediction errors are represented in the striatum and ventromedial prefrontal cortex (vmPFC), as well as in the hippocampus, insula, and amygdala in response to positive and negative outcomes. These learning signals are thought to drive future choices that maximize gain and minimize loss. Importantly, the ability

to learn to make the best choices over time involves both associating cognitive feedback with a stimulus, as well as experiencing an appropriate affective reaction to a reward or loss. To date, most studies present feedback information and reward outcome temporally collapsed together, which does not allow one to identify the separate contributions of different neural systems to cognitive versus affective reactions to feedback. To address this, we tested 24 subjects on a two-stage, probabilistic, feedback-based learning task while undergoing fMRI. Participants made choices during two phases of non-intermixed conditions (gain, loss). On each trial, subjects chose between two shapes and received feedback (correct, incorrect) followed by reward outcome (monetary gain or loss). To assess learning at each stage, we calculated prediction error independently for feedback and reward outcome. Results indicated that there was a dissociation in activation in several structures associated with the reward network. In particular, prediction error was represented in the striatum during cognitive feedback, and in the amygdala during reward presentation. Further, vmPFC showed more activation when subjects received rewards as opposed to reward-related feedback. These findings suggest that structures within the reward network contribute differentially to cognitive and affective aspects of feedback-based reward learning.

D-09

KINEMATIC FINGERPRINTS OF SOCIAL INTERACTION: A TMS STUDY *Lucia Maria Sacheli, Sapienza University of Rome, IRCCS, *ICNC Travel Award Winner; Matteo Candidi, Sapienza University of Rome, IRCCS; Enea Francesco Pavone, Sapienza University of Rome, IRCCS; Emmanuele Tidoni, Sapienza University of Rome, IRCCS; Salvatore Maria Aglioti, Sapienza University of Rome, IRCCS* - The ability to jointly perform an action with another individual necessarily requires a discrete and yet integrated computation of both agents' motor plans possibly through simulational-like mechanisms. Here we explored the role of simulation in joint-contexts by analysing the kinematics of a face-to-face joint-grasping task. In particular, we investigated whether the recruitment of anticipatory motor simulation during the interaction was modulated by participants' individual interactional role (Experiment 1). Moreover, we investigated by means of Transcranial Magnetic Stimulation (TMS, Experiment 2) the causal contribution of fronto-parietal regions - crucial for the individual reach-to-grasp planning - to the interpersonal coordination process; in particular, we explored the role of these regions in supporting participants' ability to predict the partner's movements and to adapt their individual action on the base of these predictions. In the first experiment, we asked pairs of participants to perform synchronous joint-grasps. The task was to synchronously grasp a bottle-shaped object placed in front of them via either a gross or a precise grasping and to perform either imitative or complementary actions as a couple. Participants could perform the task acting as: i) Leader, i.e., knowing in advance the movement to be performed; or ii) Follower, i.e., receiving the instruction to

adapt to the partner. Our results show that predictive simulation differs from plain motor resonance and is differently recruited according to the individual interactional role. Indeed, i) when acting as Leader, participants are impervious to the influence of the other's movements and try instead to make their kinematics more "communicative" in order to enhance their own movement predictability; in contrast ii) when acting in the role of Follower, participants tend to imitate the Leader in the complementary action condition, although this involuntary mimicry is detrimental to the joint-performance. Thus, we hypothesize that the ability to achieve good coordination is supported by the ability to inhibit automatic imitation and to on-line integrate the prediction of the partner's goal with information about his/her on-going movements. Within this framework, we studied the possibility to interfere with these processes by virtual inhibition of the anterior Intra Parietal Sulcus, (aIPS); this was achieved by an off-line 20 s continuous Theta Burst Stimulation applied before the kinematics recording of individuals engaged in a motor interaction with a virtual partner.

D-10

EMOTION, MOVEMENT, AND THE CENTRAL NERVOUS SYSTEM: THINKING OUTSIDE THE BRAIN

Jennifer Kornelsen, University of Winnipeg; Theresa A. McIver, University of Winnipeg; Stephen D. Smith, University of Winnipeg - **BACKGROUND:** Emotional stimuli receive prioritized attentional and motoric processing in the brain, thus allowing for rapid behavioural responses to salient, and potentially threatening, elements of the environment. Indeed, recent studies have identified a neural link between emotional and motoric responses; numerous transcranial magnetic stimulation studies have detected greater excitability of the motor cortex and corticospinal tract during the presence of emotional, as opposed to neutral, images and sounds (e.g., Schutter et al., 2008). However, missing from existing models of emotion-movement interactions is the activity of neurons within the spinal cord. This omission is surprising given that the spinal cord is the neuroanatomical link between the brain regions involved in planning the movements and the peripheral nervous system that executes them. Recent advances in functional MRI scanning sequences have enabled researchers to consistently detect neural responses in spinal cord neurons. Using these techniques, our research group reported negative-emotion-dependent neural responses in the cervical spinal cord (Smith & Kornelsen, 2011). Subsequent studies have found that these responses are limb-specific (McIver et al., 2012). Specifically, images of emotional scenes involving the hands (e.g., defending oneself) produced greater cervical spinal cord responses than did neutral images or emotional images involving the feet (which are innervated by the lumbar region of the spinal cord). The current research attempts to complete this model of the "emo-motoric system" by examining whether foot-related emotional responses elicit greater activity in lumbar spinal cord neurons than do neutral or hand-related emotional responses. **METHODS:** Twelve healthy undergraduate participants completed four 320-

second fMRI runs involving passive viewing of images. Separate fMRI runs were conducted for each valence type (negative or neutral) and targeted limb (hand or foot), which resulted in four different conditions: Hand-Negative, Hand-Neutral, Foot-Negative, and Foot-Neutral. Runs were presented in a pseudo-counterbalanced order across participants and images within a given run were randomized. Stimulus blocks of 53s duration were composed of 15 individual photographs shown for 3533ms each; these blocks were alternated with 40s presentations of a fixation cross. fMRI images were acquired spanning the lumbar spinal cord segments using a 3-Tesla Siemens scanner. RESULTS: Consistent with our predictions, images depicting negative emotional scenes involving foot movements elicited the greatest amount of activity. The Foot-Negative condition (346 active voxels) produced significantly more activity than the Foot-Neutral (221 voxels, $p < 0.0025$), Hand-Neutral (266 voxels, $p < 0.033$), and Hand-Negative (258 voxels, $p < 0.05$) conditions. CONCLUSIONS: These data indicate (1) that emotional perception in the brain leads to specific motoric inputs to the rest of the nervous system and (2) that these inputs can be detected and quantified at the level of the spinal cord using fMRI. Emotional images involving the hands elicit greater activity than other stimulus types in the cervical spinal cord (McIver et al., 2012) and emotional images involving the feet elicit greater activity than other stimulus types in the lumbar/sacral spinal cord (current study). Future studies will attempt simultaneous fMRI of the brain and spinal cord to further specify the neural substrates of this emo-motoric system.

D-11

NEUROBEHAVIORAL EVIDENCE FOR "COMPASSION CARRYOVER" Alexander Genevsky, Stanford University, *SANS Graduate Student Travel Award Winner; Thupten Jinpa, McGill University; Brian Knutson, Stanford University - Introduction: From a Buddhist perspective, extending compassion involves efforts to identify with the suffering of others, to wish them be free of suffering, and (optionally) to feel a compulsion to rid them of suffering. From a psychological perspective, while extending compassion undoubtedly invokes negative affect, it also might elicit positive affect towards the target. In this study we sought to behaviorally examine whether extending compassion can have a lasting positive affective impact on reactions to the target, and to neurally explore whether evidence for such a positive shift might be reflected by changes in brain activity. Methods: While undergoing functional magnetic resonance imaging (fMRI) in a 3.0 Tesla GE scanner, subjects ($n=25$) participated in two compassion related tasks. First in an "extend compassion" task, they viewed faces with sad or neutral expressions and were instructed to either extend compassion or remain neutral toward the target (6 sec), after which they rated how effectively they followed each instruction. In a second "compassion carry-over" task, subjects rated the affective impact of pieces of abstract art which were subliminally paired with the faces previously presented in the "extend compassion" task. Results: Behaviorally, subjects rated

art that was subliminally paired with compassion instruction faces as eliciting more positive affect than art that was subliminally paired with neutral instruction faces. Target facial expression, however, had no significant effect on ratings. Neurally, in the first "extend compassion" task, extending compassion versus neutrality was associated with significantly ($p < .001$, uncorrected) increased activity in regions implicated in value integration (medial prefrontal cortex, mPFC), positive arousal (nucleus accumbens, NAcc), and theory of mind (temporal parietal junction, TPJ). In the second "compassion carryover" task, abstract art which was subliminally paired with faces to which compassion versus neutrality had previously been extended elicited significantly increased activity in the NAcc. Discussion: The current findings suggest that beyond invoking negative affect, extending compassion elicits positive feelings towards the target, which may "carry over" into other encounters, even below the level of awareness. Thus, the findings suggest that even a simple exercise in cultivating compassion can have significant and lasting benefits towards interactions with others, even when they are strangers. Acknowledgements: Stanford Center for Cognitive and Neurobiological Imaging, Stanford Center for Compassion and Altruism Research and Education.

D-12 *SANS Poster Award Winner

BRAIN ACTIVATION DURING JUNK FOOD REAPPRAISAL MODERATES THE REAL WORLD CRAVING-EATING LINK Jordan Miller-Ziegler, University of Oregon; Nicole R. Giuliani, University of Oregon; Traci Mann, University of Minnesota; Janet Tomiyama, UCLA; Elliot T. Berkman, University of Oregon - Successful emotion regulation is integral to pursuing long-term goals. However, while previous research has examined the neural mechanisms of emotion regulation extensively, and has linked emotion regulation to everyday well-being broadly, little research thus far has directly examined how the neural systems involved in emotion regulation relate to goal-relevant outcomes in a specific real-world context. The present research combines neuroimaging and experience sampling methods to explore the relation between neural indices of emotion regulation and successful avoidance of idiosyncratically craved energy-dense foods among college students. In the study, 41 subjects completed a craving reappraisal task during functional magnetic resonance imaging. For two weeks following the scan, they reported their craving for and consumption of a personally-salient, craved food item four times each day using experience sampling measured with SMS text messaging. Hierarchical linear modeling analyses revealed that, during the experience sampling phase, craving for the target food at one time point predicted how much of that food was eaten by the next time point, and this relationship was attenuated by reappraisal-related activation (vs. rest) in left inferior frontal gyrus during the craving reappraisal task performed prior to experience sampling. This finding supports the role of inferior frontal gyrus in real-world, goal-relevant affect regulation.

D-13

BOTH EXPECTATION AND PSYCHOPATHY MODERATE THE NEURAL RESPONSE TO FEARFUL FACES: AN ERP STUDY OF SUCCESSFUL FEMALE PSYCHOPATHS

Katherine Pappas, Hampshire College; Colin Quirk, Hampshire College; Jane Couperus, Hampshire College - Viewing fearful, as opposed to neutral, faces has been associated with many different event related potential (ERP) responses, such as enhanced amplitude for the: P1, N1, P2, N3, and P3 components. Fearful faces orient attention and can be processed unconsciously, but when a person expects to see a fearful face then the neural response is smaller. Psychopathy research has intersected with emotion-processing research, yielding widespread results showing that people with high levels of psychopathic traits have a deficit in processing the fear of others. However, most of this research has been conducted on an all-male inmate population, which does not address issues such as potential gender differences or whether there are neural abnormalities seen in a population of successful (non-incarcerated) psychopaths. This study is one of the first to investigate the effect of cueing on the neural response to fear, as well as one of the first to investigate the neural underpinnings of female psychopathy. We used a group of twelve female college students, with six showing high levels of psychopathic traits (constituting the high traits group), and six who showed low levels of psychopathic traits (the low traits group). Psychopathy was measured using the Psychopathic Personality Inventory. We used a gender discrimination task, with the latent purpose of looking at the neural correlates of viewing fearful and neutral faces under validly cued and uncued conditions. In the cued condition, the participant was shown a fearful picture (the cue), followed by a fearful face (the target), and was asked to discriminate the gender of the face; in the uncued fearful condition there was no fearful picture preceding the face, only a fixation cross. In the neutral condition the cue picture was of neutral valence, and the target picture was of a person making a neutral expression. The four conditions occurring in the task were: uncued fearful, cued fearful, uncued neutral, and cued neutral. ERP data for the P2 and P3 components were analyzed using repeated measures analysis of variance, and significant effects were followed up with paired sample T-tests. There was overall a significant group effect seen in both P2 ($F=7.263$, $p=.023$) and P3 ($F=5.365$, $p=.043$) amplitude, where the high traits group showed significantly attenuated P2 and P3 amplitudes when compared to the low traits group across the same trial conditions. There was also a significant effect of cueing in both the P2 ($F(1,10)=9.069$, $p=.013$) and P3 ($F(1,10)=6.983$, $p=.025$) component, where uncued fearful expressions elicited augmented neural responses when compared to the cued fearful expressions ($t(11)=-4.809$, $p=.001$ for the P2 component). These findings support theories of psychopathy that involve aberrant neural processing of fearful stimuli, and demonstrate that this is present even in sample of female college students.

D-14

WHAT WAS I THINKING? CONTENT DIMENSIONS AND TRAIT PREDICTORS OF SELF-GENERATED THOUGHT

Jessica Andrews-Hanna, University of Colorado Boulder; Amy Turner, University of Colorado Boulder; Andrew Reineberg, University of Colorado Boulder; Roselinde Henderson, Yale University; Marie Banich, University of Colorado Boulder - Though it is well established that our minds often stray from the external environment, the dimensions of content characterizing such "self-generated thoughts" (SGTs) and the factors driving their individual differences remain poorly understood. To seek insight into these questions, we developed a novel thought sampling paradigm in which 77 healthy young adults generated numerous SGTs and rated each thought on several content-specific variables. Exploratory principle components and cluster analyses across these variables revealed four distinct dimensions of content: 1) personal significance, 2) episodic specificity, 3) social orientation, and 4) valence. On average, participants reported SGTs that were highly personally significant, moderately specific, somewhat socially-oriented, and positive in valence. Importantly, individual differences in content dimensions were predicted by dimensional traits relevant to mental health. In particular, individuals who scored higher on depression/negative affect questionnaires rated their thoughts as more negatively valenced (dimension 4) and personally significant, or central to their sense of self-identity (dimension 1). In contrast, individuals who scored higher on mindfulness traits rated their thoughts as more positive in valence (dimension 4). Additionally, depression/negative affect and mindfulness were strongly inversely correlated, suggesting that mindfulness may be a protective factor against depression/negative affect. Interestingly, the relationship between trait measures and valence was mediated by state affect, suggesting that current mood may modify the accessibility of negative vs. positive SGTs. In contrast to valence, state affect did not affect the perceived personal significance of such thoughts, suggesting that alterations in one's self-concept may represent a stable characteristic of affective traits. Overall, these results highlight the content of SGTs as an important factor underlying dimensional traits relevant to mental health.

D-15

VASOPRESSIN MODULATES NEURAL ACTIVITY IN THE RIGHT SUPERIOR TEMPORAL CORTEX DURING HUMAN REACTIVE AGGRESSION

Claudia Brunnlieb, University Magdeburg, University Lübeck; Thomas F. Münte, University Lübeck; Ulrike M. Krämer, University Lübeck; Bodo Vogt, University Magdeburg; Claus Tempelmann, University Magdeburg; Marcus Heldmann, University Lübeck, University Magdeburg - Research on animal models and investigations in humans point to a key role of the neuropeptide arginine vasopressin (AVP) in social forms of aggressive behavior, primarily in male-to-male aggression. For example, cerebrospinal fluid AVP levels were positively correlated with life histories of general aggression - an effect more pronounced for men than for women. Nonetheless, to what extent AVP

modulates the neural underpinnings of human aggressive behavior are not clear yet. By using fMRI and a modified version of the Taylor aggression paradigm (TAP), the current study delineated the impact of AVP on the neural basis of the distinct stages of human reactive aggression. We administered 20 IU AVP intranasally in a placebo controlled double-blind manner to 31 healthy males (16 AVP/15 Placebo). Participants were told that they would play a reaction time task (rtt) against another person who in fact was a confederate of the experimenter. The TAP comprised 'passive' and 'active' blocks. In 'passive' blocks participants were punished by a loud aversive tone, when they lost the rtt, but could not administer a punishment to the opponent player when winning the rtt. In 'active' blocks the participant could punish the opponent player on win trials, but did not get punished on loss trials. Each trial comprised a decision phase (selection of punishment level) and an outcome phase (feedback about the opponents' punishment level and whether won or lost the trial). At the end of each trial the punishment was administered depending on the actual block. On the neural level, AVP enhanced the BOLD signal in the right STS during the decision phase of 'passive' trials to a level comparable to that observed for 'active' trials in both groups. This finding might be interpreted in terms of an AVP effect on neural processes supporting mentalizing/appraisal processes. During the decision phase of 'passive' blocks the AVP group might have reflected more on their punishment level selection and its possible consequences on the opponents' choice. In a similar fashion like in Thompson et al. (2004), this finding might also indicate that AVP increases the salience of less meaningful social interactions (the decision phase of 'passive' trials in the present study). Unexpectedly, we did not find any substantial impact of AVP on behavior. According to the General Aggression Model of Anderson and Bushman (Anderson and Bushman, 2002) numerous variables impact aggressive behavior in humans with each of these factors contributing only a small fraction of the variance in order to prevent erratic aggressive responses and to stabilize behavior. Thus, it might not be surprising after all that AVP changed neural responses, but did not lead (yet?) to changes in overt aggressive behavior in humans.

D-16

THE FACE VALUE OF FEEDBACK: COMPARING THE EFFECTS OF SOCIAL AND NONSOCIAL FEEDBACK ON NEURAL ACTIVITY AND ERROR CORRECTION *Christopher M. Crew, Columbia University; Olta Hoxha, Baruch College; Geraldine Downey, Columbia University; Jennifer Mangels, Baruch College* - Evaluative feedback is an effective means of influencing learning and behavior. Yet, despite the fact that feedback is often provided in interpersonal contexts, little research has investigated the effects of social vs. nonsocial feedback cues on learning and error correction. In addition, although considerable research suggests that females are better at interpreting facial expressions than males, it is unknown whether this advantage influences the effects of social compared to nonsocial performance feedback on learning and memory. The current study was designed to

address these issues. First, we ask whether social and nonsocial performance feedback elicit different neural responses and/or behavioral consequences. Then, we explore whether gender moderates these effects, and if so, to what extent gender differences are related to individual differences in sensitivity to interpersonal rejection. To address these questions, we used an incidental-learning paradigm where participants answered general knowledge questions (What is the capital of Delaware?) followed by immediate performance feedback (correct vs. incorrect) and the correct answer (Dover). Initially incorrect items were retested 24 to 48 hours later to determine if the correct answer had been successfully encoded. We used a counterbalanced blocked design where accuracy feedback during the initial test phase was either social (disapproving face saying "incorrect"; approving face saying "correct") or nonsocial (incorrect: red asterisk paired with low tone; correct: green asterisk paired with high tone). Although correction rate was unaffected by feedback condition (e.g., social vs. nonsocial) or rejection sensitivity (RS) overall, this result was moderated by gender. Specifically, females corrected more items than males in the social condition, but an equal amount in the nonsocial condition. For females, however, higher RS scores were associated with poorer error correction in the social condition. RS did not influence error correction in males. To better understand the mechanisms underlying these behavioral effects we measured the following ERP components during initial accuracy feedback (correct or incorrect): the frontally-maximal feedback related negativity (FRN) and a centrally-maximal late positive potential (LPP). These components have been shown to reflect more automatic processing of feedback valence, and more controlled, sustained attention and arousal to the feedback, respectively. Overall, social feedback was associated with an earlier and larger FRN, as well as an enhanced LPP. With respect to gender, females showed a larger FRN to corrective feedback in the social condition, but there were no gender effects for the LPP. RS did not appear to predict the amplitude of the FRN or the LPP for either gender. We also measured the relationship between these ERPs and successful error correction. Although the FRN was not associated with learning, the LPP negatively predicted learning success for social feedback and positively predicted learning success for non-social feedback. Neither gender nor RS moderated these effects. Taken together, these results suggest that heightened attention and arousal to social feedback is not always adaptive for learning. Furthermore, although RS may not moderate neural responses to negative social feedback it appears that, for females, high sensitivity to interpersonal rejection impairs retrieval success during negative social feedback.

D-17

RESPONSES OF DORSAL MEDIOFRONTAL AND RIGHT VENTROLATERAL PREFRONTAL CORTEX TO INTERPERSONAL CONFLICT FOR RESOURCES *Leonie Koban, University of Colorado Boulder, University of Geneva; Swann Pichon, University of Geneva; Patrik Vuilleumier, University of Geneva* - Little is known about

brain mechanisms recruited during the monitoring and appraisal of interpersonal conflicts - for instance when individuals compete with each other for the same resources. Recent research points to an important role of the dorsal mediodorsal cortex (dmFC) not only in cognitive, but also in affective and social conflict and error monitoring. We designed a novel experimental task inducing resource conflicts between two individuals. In an event-related fMRI design, participants (n=22) played with another human participant or against a computer, who across trials chose either different (no conflict) or the same tokens (conflict trials) in order to obtain monetary gains. In conflict trials, the participants could decide whether they would share the token, and the resulting gain, with the other person or instead keep all points for themselves. Our behavioral results showed that participants shared much more often when playing with a human partner than with a computer. fMRI results demonstrated that the dmFC was selectively activated during human conflicts, but not in the computer control condition. This region might play a key role in detecting situations in which self- and social interest are incompatible and require behavioral adjustment, in line with a more general "social conflict monitoring" mechanism. In addition, we found a conflict-related response in the right ventrolateral prefrontal cortex (vlPFC) that correlated with measures of social relationship and individual sharing behavior, indicating that the vlPFC may be important for the regulation of emotions and behavior in social interactions. Taken together, these findings reveal a key role of these prefrontal areas for the appraisal and resolution of interpersonal resource conflicts.

D-18

INDEPENDENT VERSUS INTERDEPENDENT SELF-CONSTRUAL PRIMING ELICITS DIFFERENCES IN THE SPONTANEOUS REGULATION OF POSITIVE EMOTIONS IN CHINESE PARTICIPANTS *Kate Anne Woodcock, University of Birmingham; Yi Liu, Peking University; Shihui Han, Peking University* - When compared to those from independent cultures (like the US), people from more interdependent cultures (like China) tend to report less experience and expression of positive emotions and greater emotion differentiation across social contexts. We used self-construal priming in Chinese participants to investigate the effect of activating more independent versus interdependent thinking on spontaneous emotion regulation in specific contexts. 32 Chinese students (16 males) observed positive photographs in two sessions following independent or interdependent priming. Imagined ingroup versus outgroup social context was manipulated in separate blocks. Participants reported more suppression of positive emotion (questionnaire) and less self-reported arousal (post picture ratings) following interdependent priming. However, the decrease in arousal was greater in the ingroup context. Gender differences emerged in a performance based measure of cognitively effortful regulation. 20 Chinese male students observed positive photographs during fMRI acquisition. In order to localize brain areas involved in emotion regulation, participants were instructed not to regulate, or

to up- or down-regulate their emotions on separate trials. To investigate the effect of self-construal priming on spontaneous emotion regulation, experimental trials were administered in two blocks following independent or interdependent priming. Participants either observed photographs with no specific instructions or regulated their positive emotion as they would in an ingroup context. Using areas of neural activation associated with up- or down-regulation in the localization scans as regions of interest, we compared spontaneous and ingroup-context linked regulation following independent versus interdependent priming. Results revealed effects of self-construal priming on spontaneous regulation of positive emotions.

D-19

POWER ENHANCES THE NEURAL PROCESSING OF OUTGROUP FACES: EVIDENCE FROM THE N170 COMPONENT OF THE ERP *Petra Schmid, David Amodio; New York University* - Previous research has shown that powerful people stereotype minority group members more than powerless people. Our aim was to better understand how power influences the perception of racial minority members by investigating its effect on the initial neural processing of White and Black American faces. Additionally, we want to test whether power affects intergroup face processing differently depending on the context; that is, whether faces are viewed in the context of evaluations or trait associations. In an evaluative context, threat associated with Blacks faces would be emphasized, leading high-power people to be more vigilant to the potential threat and thus show stronger effects of early face processing. By contrast, when making trait judgments that are not evaluative in nature, the potential threat of the outgroup to the high-power status is less salient. Therefore, we expect high-power people to show increased neural activity in regions specialized for face processing in the context of making evaluative judgments but not when making non-evaluative trait judgments. Forty White participants were induced to feel either high or low in power and then completed two sequential priming tasks. In the tasks, prime stimuli included White and Black males faces, followed by words categorized according to either their valence (pleasant vs. unpleasant) or traits that did not differ in valence (intelligence vs. athleticism). EEG was recorded during task performance, and face encoding processes were indexed by the N170 ERP component. Consistent with our hypothesis, a three-way interaction pattern emerged: Power priming affected N170 responses to Black faces, but not White faces, and only during the evaluative context. No such difference was found in the trait judgment context. These results suggest that power can alter the way faces of minority outgroup members are perceived, but only in contexts that emphasize threat and potential intergroup conflict.

D-20

CONDITIONED INHIBITION AND THE LEARNING OF NEGATIVE VALUES *Randy O'Reilly, Tor Wager, Guido Frank; University of Colorado Boulder* - To look at what happens in the brain when rewards are worse than

expected, we ran a condition inhibition study which involved pairing a CS with two different stimuli, orange juice and a neutral solution. After the conditioning procedure, we began conditioned inhibition, which involves pairing the previously rewarded CS with an inhibitor that “cancels” the expected reward. We also included several other neutral controls for comparison purposes, including a single stimulus and a pair of two neutral stimuli. With 17 subjects, we ran several contrasts looking at the effect of reward omission on learning. Overall, the results show that there are significant effects of this procedure in several parts of the prefrontal cortex and brainstem. In particular, we observed effects for the pairing of the conditioned stimulus with the conditioned inhibitor after the training period in the dorsomedial thalamus. Additional results show an activation for the CS-Inhibitor in the lateral PFC, as well as a slightly anterior deactivation. There was also an activation in the VTA and amygdala for the AX-stimulus. The activation for the CS-Inhibitor was strongest in the vmPFC after learning. Perhaps this vmPFC activation reflects high-order abstraction of the pairing of negative and positive valence. For the BY stimulus there was a deactivation in medial PFC and OFC, indicating that this stimulus is less rewarding than the other stimuli. Looking at the non-rewarded stimulus, we see deactivations in the basal ganglia and thalamus. For the control stimulus (artificial saliva), there is a deactivation in the VTA and amygdala. For the control rewards, we see deactivation in the VTA, amygdala and hippocampus. For the conditioned inhibitor rewarded in the last block, we see a deactivation in the pgACC, which fits with the ideas that this region is involved in negative valence. Similarly, when the control stimulus was rewarded, we also see deactivations in vmPFC, and OFC. A contrast between the CS in conditioning and after learning shows an activation in the hippocampus. There was also interesting activity in the sgACC for the inhibitor during learning, which is consistent with previous studies showing its role in negative valence learning. In addition, looking at the inhibitor contrasted with control showed an activation in the medial dorsal thalamus. In addition, learning about the negative valence CS caused activations in the OFC and hippocampus. In a parametric model looking at rewards that were better and worse than expected, while controlling for all CS types, there was activity in the vmPFC for the positive valence CS. For the positive US that was expected to be rewarded but ended up not getting rewarded, there was an activation in the sgACC. For the rewarded negative valence CS, there was an activation in the lateral PFC. For a contrast of the CS-Inhibitor during the learning period with after the learning period, there is activity in the sgACC.

D-21

PSYCHOPATHIC TRAITS AND THE REPRESENTATION OF OTHERS' EMOTIONAL STATES *Gustav Nilsson, Sandra Tamm, Karolina Sörman, Armita Golkar, Katarina Gospic, Marianne Kristiansson, Andreas Olsson, Martin Ingvar, Predrag Petrovic; Karolinska Institutet* - Evolutionary game theory predicts that prosocial traits will be non-uniformly distributed in the

human population. Individuals with very low prosocial traits may receive a medical diagnosis of psychopathy or antisocial personality disorder. One neurophysiological mechanism generating prosocial motivation is the empathic representation of others' emotional states in brain networks overlapping those brain networks that represent own emotional states. We validated the Psychopathy Personality Inventory-Revised (PPI-R) in Swedish, thus enabling us to measure psychopathic personality traits. We found that PPI-R total scores were approximately normally distributed in our sample, indicating that psychopathic traits are dimensional and not taxonic. The translated instrument showed good convergent validity and retest reliability. We then investigated the effects of psychopathic personality on emotional contagion and empathy. Emotional contagion was measured by electromyography of facial muscles as participants viewed film clips showing different facial expressions. Psychopathic coldheartedness predicted lower muscle responses to happy faces but did not predict muscle responses to angry faces. Empathy was measured by self-rated unpleasantness and skin conductance responses as the subject observed another person in pain. Psychopathic coldheartedness predicted lower self-rated and skin conductance responses to the other's pain. These results suggest that observed lower levels of prosocial behaviour in psychopaths may be due to a weaker representation of the other's emotional state.

D-22

DISC1 GENE POLYMORPHISMS WITH RESPECT TO COGNITIVE FUNCTIONING IN SCHIZOPHRENIA

Dorota Frydecka, Wrocław Medical University; Lidia Karabon, Polish Academy of Sciences, Wrocław Medical University; Edyta Pawlak-Adamska, Polish Academy of Sciences; Anna Jele, Wrocław Medical University; Błażej Misiak, Wrocław Medical University; Andrzej Kiejna, Wrocław Medical University - Background: DISC1 has been shown to participate in the regulation of cell proliferation, differentiation, migration, neuronal axon and dendrite outgrowth and cell-to-cell adhesion. Several studies have shown that unregulated expression or altered protein structure of DISC1 may predispose individuals to the development of schizophrenia and other psychiatric conditions. DISC1 has been also implied to play role in cognitive impairments, which are considered to be endophenotypes of schizophrenia, i.e. subclinical, heritable and independent of clinical state traits associated with genetic susceptibility. Surprisingly, a recent meta-analysis (Dickinson, 2007) demonstrated that reliable and easy to administer Digit Symbol Coding Task (DSCT) discriminate people with schizophrenia from comparison individuals better than the more widely studied neuropsychological instruments. Purpose: The study was carried out to investigate the association of SNP polymorphisms of DISC1 gene (rs1538979, rs1122330) and schizophrenia with respect to performance on DSCT. Material and methods: We included 103 patients diagnosed with schizophrenia according to ICD-10 criteria and 578 controls in our study. The patients were evaluated for lifetime psychotic symptomatology using the Operational Criteria for Psychotic Illness

(OPCRIT) checklist. DSCT was administered to 80 patients. Results: The polymorphisms were in HWE both in the cases' and controls' groups. In single marker analysis, we did not find any associations for the SNPs tested. However; we have found that with respect to rs1538979 polymorphism patients with TC genotype performed worse than with CC genotype ($p < 0.05$) and with respect to rs1122330 polymorphism patients with AG genotype performed worse than with GG genotype ($p < 0.05$) suggesting weaker cognitive processing efficiency. Conclusion: Our data do not support the role of DISC1 gene polymorphisms in the predisposition to schizophrenia; however, DISC1 gene polymorphisms might be considered as a risk factor for cognitive impairment in schizophrenia.

D-23

SEPARABLE FMRI CORRELATES OF EXPERIENCE AND BELIEF IN PLACEBO ANALGESIA *Scott Schafer, Tor Wager; University of Colorado Boulder* - Previous experience with a treatment and belief that the treatment works are two behaviorally separable mechanisms that underlie conditioned pain relief to a placebo. In this study, healthy subjects received painful stimulation in the context of two pharmacologically inert creams: a 'control' cream and a 'treatment' (placebo) cream. Subjects were instructed that the treatment cream possessed strong analgesic properties and would reduce their experienced pain. During the conditioning process, subjects received higher temperature stimulations with the control cream compared to the placebo cream. After conditioning subjects received identical thermal stimulations with both control and placebo creams. Placebo analgesia is measured as the reduction in pain rating with the placebo cream compared to the control cream. To separate the effects of experience and belief on placebo analgesia, we manipulate experience between subjects and belief within subjects. We randomly assign subjects to high (4 conditioning sessions) and low (1 conditioning session) experience groups. Following initial testing of placebo analgesia using identical temperatures, we reduced belief in the treatment by revealing that it was a placebo. Prior to the reveal, all subjects reported experiencing less pain on average with the treatment cream ($p < .001$). Following the reveal we find that analgesia persists only in the extensive experience group ($p = .04$), despite the reported belief in the effectiveness of the treatment being identical across groups. This implies that extensive experience with a treatment can lead to placebo analgesia that is not extinguished by instruction alone. We suspect that this effect may be caused by an involuntary opioid response conditioned from the repeated exposures to the treatment. Given these findings, we hypothesized that different brain regions would be related to different behavioral aspects of placebo analgesia. To test this hypothesis, half of the subjects were scanned using fMRI during the testing procedure. Placebo analgesia is generally marked by a reduction in activation in the bilateral anterior insula (aIns), dorsal anterior cingulate cortex (dACC), and the medial thalamus. Prior to the reveal, deactivation in bilateral aIns and dACC was correlated with the strength of placebo analgesia ($p <$

.001), consistent with previous findings. High experience subjects in particular show reduced activation in the periaqueductal gray (PAG) during thermal stimulation with the placebo compared to the control cream ($p < .001$). The PAG is a central region for the release of opioids and the experience of pain relief and reduction in activation here is consistent with our hypothesis that the experience manipulation increased opioid release in high experience subjects. Following the reveal, we find decreased activation in the medial thalamus associated with the strength of placebo analgesia for the high experience group only ($p < .001$). This suggests that the medial thalamus may be more important for placebo analgesia that results from experience, while the bilateral aIns and dACC may be more important for placebo analgesia resulting from belief. In total, these findings suggest separable roles for neural pain systems relating to experience and belief in placebo analgesia and related affective learning processes.

D-24

SOCIAL WORKING MEMORY: NEURAL MECHANISMS AND IMPLICATIONS FOR SOCIAL COGNITIVE NEUROSCIENCE RESEARCH *Meghan L Meyer, Matthew D Lieberman; UCLA* - Whether keeping track of friends' perspectives in a conversation, a roomful of colleagues' beliefs during a conference, or the political ideology of someone we just met, we constantly juggle social cognitive information. However, the neural mechanisms supporting our ability to maintain and manipulate social cognitive information, or social working memory (SWM), remain elusive. On the one hand, the neurocognitive network associated with social cognition ('mentalizing system') engages in simple social cognition tasks and may therefore support SWM. On the other hand, this network reliably reduces activation during traditional (i.e. non-social cognitive) working memory tasks, and tends to be functionally antagonistic with the lateral executive control network known to support working memory. To examine how these networks may support SWM, we conducted a series of studies employing a SWM paradigm in which during fMRI scanning participants encode 2, 3, or 4 of their friends' names, rank their friends along a trait dimension during a delay period, and finally, answer a true/false probe question about their rank order. Across studies, results from parametric analyses show regions of the mentalizing and executive control networks linearly increase in activation as a function of the number of friends considered during delay and retrieval. These findings suggest previous generalizations of the mentalizing and executive control networks as antagonistic oversimplify their relationship. Instead, the mentalizing and executive control network may work together, rather than in opposition, to support effortful thinking about the social world. Implications for social cognitive theory and disorders of social cognition will be discussed.

D-25

NEURAL CORRELATES OF CONVENTIONAL AND CARE-BASED MORAL DECISION-MAKING

Kelly K. Leong, National Institutes of Health, National Institute of Mental Health, Tufts University School of Dental Medicine; Stuart F. White, National Institutes of Health, National Institute of Mental Health; James R. Blair, National Institutes of Health, National Institute of Mental Health - **OBJECTIVES:** Recent cognitive neuroscience models of moral decision-making have stressed the importance of emotion, in addition to traditional, purely cognitive accounts. Evidence suggested that care-based moral decision-making is underpinned by an association with the distress of others and negative emotional states and is observed in regions such as the amygdala, vmPFC and insula. Neural regions associated with conventional moral decision-making are lesser known. The current study sought to compare care-based and conventional moral decision-making. **METHODS:** Participants were 17 healthy adults (9 female) aged 21-40 years (Mean=26.46, SD=5.5) who rated the wrongness of vignettes depicting social-conventional moral transgressions (e.g. a student having a conversation during class) or care-based moral transgressions (e.g. kicking a boy) while undergoing functional MRI. **RESULTS:** A contrast between activation during ratings of care-based moral transgressions and ratings of conventional moral transgressions found significantly greater activation in several regions of insula during care-based moral decision-making. However, during ratings of conventional moral transgressions increased activation in bilateral temporal pole, temporal parietal junction, precuneus and dorsal medial prefrontal cortex was observed. **CONCLUSIONS:** Care-based moral decision-making was associated with increased activity in insula, a region associated with negative affect. Conventional moral decision-making was associated with greater activation in a network of regions implicated in the representation of other individual's intentions (Theory of Mind). This is consistent with the contextual nature of conventional moral decision-making. The data provide further support for the idea that care-based morality is underpinned by emotional processes and is context independent while conventional moral decision-making requires understanding the greater social context and is highly context dependent. This work was supported by the Intramural Research Program of the National Institute of Mental Health and the National Institutes of Health Medical Research Scholars Program.

D-26

LEADERSHIP IS ASSOCIATED WITH LOWER LEVELS OF STRESS

Jennifer Lerner, Harvard University; Gary D. Sherman, Harvard University; Joao J. Lee, Harvard University; Amy J. C. Cuddy, Harvard University; Jonathan Renshon, Harvard University; Christopher Oveis, University of California, San Diego; James J. Gross, Stanford University - As leaders ascend to more powerful positions in their groups, they face ever-increasing demands. As a result, there is a common perception that leaders have higher stress levels than nonleaders. However, if leaders also

experience a heightened sense of control, a psychological factor known to have powerful stress-buffering effects, leadership should be associated with reduced stress levels. Using unique samples of real leaders, including military officers and government officials, we found that, compared with nonleaders, leaders had lower levels of the stress hormone cortisol and lower reports of anxiety (study 1). In study 2, leaders holding more powerful positions exhibited lower cortisol levels and less anxiety than leaders holding less powerful positions, a relationship explained significantly by their greater sense of control. Altogether, these findings reveal a clear relationship between leadership and stress, with leadership level being inversely related to stress.

D-27

VENTRAL STRIATUM RESPONDS MORE TO ATTRACTIVE SAME-RACE MEMBERS THAN ATTRACTIVE OTHER-RACE MEMBERS

Robert S. Chavez, Todd F. Heatherton; Dartmouth College - It has long been established that people favor others who share characteristics similar to their own. This is reflected in certain mate preferences where there has traditionally been high degree of assortative mating among individuals of the same race. However, more recent evidence suggests that mixed-race individuals are a perceived as more attractive than non-mixed-race individuals (Rhodes et al., 2005) and that more having more diverse genetic information may confer certain health benefits (Roberts et al., 2004). This discrepancy leaves open the question as to whether or not people perceive attractive same-race members differently than attractive other-race members. To test this, we presented Caucasian male participants with a set of photographs of peer-aged females in an event-related functional magnetic resonance imaging (fMRI) paradigm. The females in the photographs were Black, East Asian, or Caucasian, and were categorized as either high or low on attractiveness based on within-race norms from an independent pilot study. Our results indicate that compared to other-race pictures high in attractiveness, same-race pictures high in attractiveness elicited significantly greater activity in the bilateral ventral striatum, including the nucleus accumbens and ventral putamen. Previous research has shown that the ventral striatum responds more to attractive faces than unattractive faces, perhaps reflecting greater reward related processing of those stimuli (Cloutier et al., 2008). Consistent with the literature on in-group bias, the current study provides preliminary evidence that individuals show preferential reward related neural activity to attractive same-race members than to attractive other-race members.

D-28

EFFECT OF SELF-CONTROL TRAINING ON NEURAL OVERLAP OF RESPONSE INHIBITION AND AFFECT REGULATION

Kathryn S. Gilliam, Rebecca D. Calcott, Junaid S. Merchant, Lauren E. Kahn, Elliot T. Berkman; University of Oregon - Both behavioral and neural evidence support a domain-general model of self-control in which various forms of self-control rely upon a shared neural

substrate. The aim of the current work is to investigate the extent to which two different self-control tasks - response inhibition and affect regulation - recruit similar neural regions and to determine the extent to which training in one self-control domain (response inhibition) leads to behavioral or neural improvements in the untrained self-control domain (affect regulation). To answer these questions, we conducted a functional neuroimaging study on eighty healthy college-aged participants. These participants were randomly assigned to one of three groups - a response inhibition training group, a sham training group, or a passive control group. All groups completed pre and post-training fMRI scans during which they performed the Stop Signal Task (SST) and an affect regulation task involving both cognitive reappraisal and affect labeling. The SST required the participants to establish a prepotent "go" response and then to selectively inhibit this response after hearing an auditory "stop" cue. The affect regulation task directed participants either to decrease their emotional response to distressing images using either cognitive reappraisal or affect labeling or to simply observe the images. During the three-week period between scans, the training group returned to the lab to complete ten 7-minute training sessions on the SST. The sham-training group also returned to the lab ten times and completed the SST but without the auditory stop cue, preventing training on the task. The passive control group only completed the pre and post scans. Results reveal that both self-control tasks recruit overlapping frontal regions, including the inferior frontal gyrus (IFG), at baseline. Preliminary analyses also suggest that the degree of this neural overlap varies across experimental groups following the training period. Results will be discussed in the context of domain-general self-control and the feasibility of improving it with training.

D-29

POLITICAL IDEOLOGY AND THE REPRESENTATION OF BLACKNESS: CONSERVATIVES (VS. LIBERALS) HAVE DISTINCT NEURAL RESPONSES TO OBJECTIVE VISUAL FEATURES OF RACE Amy R. Krosch, John. T. Jost, Jay J. Van Bavel; New York University - From the earliest days of American slavery through the Civil Rights Era, political discourse has focused on the definition of race. Despite having flexible boundaries and graded content, race has often been treated as categorical, leading to discriminatory policies like the "one-drop" rule. The current research investigates the motivational influence of political ideology on the representation of race in the brain. In earlier behavioral research, we found that conservative (vs. liberal) participants were more likely to categorize mixed Black and White faces as Black. The present neuroimaging study was designed to assess whether ideological differences in race categorization are merely driven by differences in the subjective categorization of mixed-race faces or more basic differences in the representation of objective visual features (i.e., "Blackness"). Forty-five White participants completed a race categorization task during neuroimaging as well as a self-report questionnaire

assessing political ideology (i.e., liberalism-conservatism). In the race categorization task, participants saw a series of faces, ranging from 100% White to 100% Black - at 10% increments of racial ambiguity, and indicated whether the face was Black or White. Group-level analyses (with political ideology scores entered as a covariate) revealed that as the objective racial content of faces increased monotonically from White to Black, BOLD responses in the insula and amygdala increased. These results extend previous findings that Black vs. White faces elicit greater insula and amygdala activation by suggesting that these regions track the objective visual features (i.e., "Blackness"), rather than discrete racial categories. Participants' subjective categorization of faces as Black or White was related to activity in areas of the visual cortex, such that faces categorized as Black elicited greater activity than faces categorized as White. Finally, we found that individual differences in participants' political ideology moderated the relationships between objective face "Blackness" and insula and amygdala activity. Specifically, greater conservatism (vs. liberalism) was related to a greater insula and amygdala activity as faces increased in "Blackness". However, political ideology did not moderate the relationship between subjective race categorization and visual cortex activity. These findings suggest that there are distinct neural bases of graded race perception vs. categorical race judgments and that ideological differences in the neural representation of objective visual features (i.e., "Blackness") may lead to biased racial categorization.

D-30

EMPATHIC DEFICITS IN AUTISM ARE ASSOCIATED WITH ALTERED INTRINSIC FUNCTIONAL CONNECTIVITY OF THE AMYGDALA Christine L. Cox, Phyllis Green and Randolph Cowen Institute for Pediatric Neuroscience, NYU Langone Medical Center; F. Xavier Castellanos, Phyllis Green and Randolph Cowen Institute for Pediatric Neuroscience, NYU Langone Medical Center, Nathan Klein Institute for Psychiatric Research; Michael P. Milham, Child Mind Institute, Nathan Klein Institute for Psychiatric Research; Clare Kelly, Phyllis Green and Randolph Cowen Institute for Pediatric Neuroscience, NYU Langone Medical Center; Adriana Di Martino, Phyllis Green and Randolph Cowen Institute for Pediatric Neuroscience at the New York University Child Study Center, NYU Langone Medical Center - Deficits in empathy have been observed across various psychiatric disorders. Previous work in our lab suggests that Relative Empathic Ability (REA; Cox et al., 2012, SCAN), or an individual's tendency to be more affectively or cognitively empathic, is a sensitive measure of the interplay between multiple dimensions of empathy, and is reflected in the intrinsic functional dynamics of social-emotional brain networks. Extending this work, we examined the relationship between REA and the intrinsic functional connectivity (iFC) of the amygdala in a sample of adults diagnosed with an Autism Spectrum Disorder (ASD) and an independent sample of neurotypical adults. We collected resting-state fMRI scans (3T, EPI, TR=2000ms, 180 volumes) from 31 ASD adults (mean age 32.1 [SD 11.6], 8 female; 1 PDD, 15 Asperger's, 15 Autism)

and 51 neurotypical adults (mean age 31.2 [SD 9.9], 8 female). Groups did not differ in age, gender, or in-scanner motion, but all were entered as covariates in group iFC analyses. All participants also completed the Interpersonal Reactivity Index (IRI), a standard self-report measure of empathy, which was used to calculate individual REA scores. After standard preprocessing and nuisance signal regression, the residual timeseries from the left amygdala seed (Cox et al., 2012) was extracted for each individual and correlated with every other voxel in the brain. REA scores were entered as covariates of interest, and the resultant iFC maps were compared between ASD and control groups ($Z > 2.3$, $p < 0.05$, corrected), identifying brain regions in which the relationship between amygdala iFC and REA varied as a function of diagnosis. ASD participants scored significantly lower than controls on cognitive ($t(81) = 4.38$, $p < 0.001$) and affective ($t(81) = 2.68$, $p < 0.01$) empathy scales, but there was only a marginal group difference for REA scores ($t(81) = 1.77$, $p = 0.08$). We observed group differences in the relationship between iFC of the amygdala and REA in two brain regions. 1) Controls exhibited stronger iFC between the amygdala and superior temporal gyrus (STG) with greater cognitive relative to affective empathic ability, while the ASD group exhibited the opposite relationship - stronger iFC with greater affective empathy. 2) ASD participants exhibited stronger iFC between the amygdala and medial prefrontal cortex (mPFC) with greater cognitive relative to affective empathic ability, while controls exhibited a less pronounced, but opposite relationship - stronger iFC with greater affective empathy, consistent with results from our previous study (Cox et al., 2012). These findings suggest that empathic deficits often observed in ASD are related to altered intrinsic functional dynamics of social-emotional brain networks. Specifically, functional connectivity between the amygdala, STG, and mPFC appears to be differentially sensitive to cognitive and affective empathic ability in ASD relative to neurotypical adults.

D-31

EXTERNALIZING AND ERROR MONITORING IN BOYS: THE EFFECTS OF EMOTIONAL STRESS *Mora A. Reinka, Rose E. Jeffries, Brandon A. Bray, Alexander J. Giovanetti, Cameron S. Laue, Kristina Hiatt Racer; University of Oregon* - The error-related negativity (ERN) is a response-locked event-related potential (ERP) that coincides with an incorrect response, and is indicative of error-awareness and monitoring (e.g. Legault & Inzlicht, 2012). The ERN appears at medio-frontal sites, and typically peaks between 80 and 150 milliseconds after the erroneous response (e.g. Luu, Flaisch, & Tucker, 2000). The relationship between the ERN and internalizing symptoms, specifically anxiety, has been well established, with more anxious individuals exhibiting larger ERNs (e.g. Aarts & Pourtois, 2010). However, the relationship between the ERN and externalizing symptoms hasn't been adequately explored. One previous study used a clinical sample of boys and found that boys with externalizing disorders had smaller ERN amplitudes than boys with internalizing disorders (Stieben et al. 2007).

Here, we extend this work to a community sample of boys with a range of externalizing symptoms. We were particularly interested in the relationship between externalizing and performance monitoring during stress. Participants ($n = 27$ boys ages 9-13 years) completed an emotional go/no-go task (Stieben et al 2007). The task consisted of three blocks, the first and third of which were identical and had a lower degree of difficulty than the second block. The second block was designed to be emotionally frustrating; the participant lost all the points he had accumulated in the first block regardless of performance. The third block was structured in such a way that the participant gained back a significant number of his points. We examined relationships between parent-reported externalizing symptoms and ERN amplitude for incorrect trials. At baseline (Block 1) there was no relationship between externalizing and ERN amplitude ($r = -.02$, n.s.). However, externalizing was associated with a larger ERN both during (Block 2; $r = -.51$, $p = .008$) and after (Block 3; $r = -.45$, $p = .02$) the emotion manipulation. These results held after controlling for internalizing behaviors. These findings indicate that externalizing behaviors are related to error responsiveness under emotional duress. Furthermore, the lack of recovery in the third block suggests a prolonged reactivity to emotional frustration. The inconsistencies between our results and those of the few other studies that have examined ERNs in externalizing populations call for greater scrutiny of the nature of the relationship between these two variables. In particular, they suggest that the ERN during and after emotional challenges can illuminate new aspects of the relationship between externalizing and self-regulation.

D-32

THE NEURAL BASIS OF CULTURAL DIFFERENCES IN THE PROCESSING OF EMOTION: A BRAINMAP META-ANALYSIS *Jessica Busler, *ICNC Travel Award Winner, Alejandro Lazarte, Jennifer L. Robinson; Auburn University* - Over the last decade, a surge of research has been aimed toward understanding differences in emotional processing that result because of cultural alignment. Evidence from studies relating to the cognitive model of emotions has shown that cultural differences can account for variation in emotional processing in each of the seven components of the model (antecedent events, event coding, appraisal, physiological reaction patterns, action readiness, emotional behavior, and regulation). This contradicts the idea that emotions are universal in nature. Furthermore, differences attributed to culture have emerged in the realm of attention to positive and negative emotional stimuli. From a neurophysiological perspective, differences in amygdala activation for recognition of emotional faces with contrasting contexts and fear processing have also demonstrated cultural specificity. Taken together, the data suggest that there may be unique neural contributions during emotional processing dependent on native culture. To elucidate these differences, we conducted three meta-analyses of the BrainMap database within the 'Emotion' behavioral domain. Search criteria were further refined to include only Native English speakers (Meta-analysis 1), only Native German speakers

(Meta-analysis 2), and finally, only Native Chinese speakers (Meta-analysis 3). A total of 53 papers were included in our study. For the meta-analysis on native English-speakers, 34 papers were identified (753 subjects, 205 experiments, 144 conditions, and 1395 locations), while the native German speaker search criteria yielded 14 papers (260 subjects, 43 experiments, 60 conditions, and 337 locations). Finally, the meta-analysis on native Chinese speakers had the smallest number of papers meeting search criteria with a total of 5 papers (74 subjects, 15 experiments, 14 conditions, and 138 locations). Activation likelihood estimation (ALE) was performed on the resultant sets of coordinates for each meta-analysis to determine regions of convergence within emotional processing networks. Resultant ALE maps (thresholded at FDR-corrected $p < 0.05$, cluster thresholded at 200mm^3) were then qualitatively compared to identify brain regions consistently involved across cultures during emotional processing, and those that were culture-specific. Our data support limited shared neural components involved across all cultures, mainly involving sub-lobar neural nodes such as the thalamus, caudate, and claustrum. English and German ALE maps showed the most convergence across a distributed network of regions including the amygdala, parahippocampus (BA28), anterior cingulate (BA24/32), inferior frontal gyrus (BA45/46), putamen, portions of the thalamus, and left insula (BA13), with the Chinese ALE map showing the most divergent (i.e., culture-specific) results (e.g., precuneus [BA7], inferior parietal lobule [BA39], right insula [BA13]). These results suggest that cultural differences may exist at the neurophysiological level in the processing of emotion, with support for more independent cultures utilizing similar networks (e.g., Germans and English) compared to interdependent cultures (e.g., Chinese). Data should be interpreted with caution given the disparity in the number of studies identified for each meta-analysis. Furthermore, future studies should examine the effects of stimuli used (and context) and how these effects may be mediated by culture.

D-33

THE PROSPECTION AND RETROSPECTION OF EVENTS GOOD AND BAD Paul Stillman, Ohio State University; William Cunningham, University of Toronto, Ohio State University - Both retrospection (remembering the past) and prospection (imagining the future) are important for our understanding of motivation and emotion. Both of these processes are necessary for building our affective trajectories and generating our plans for the future (Cunningham, Dunfield, & Stillman, in press), as well as helping motivate future action (Seligman et al., in press; Packer & Cunningham, 2009). Both of these perspectives, however, crucially implicate not only whether one is looking to the past or future, but the valence of these events. For example, when negative affect is coupled with a past time perspective it is associated with sadness, but when coupled with a future perspective it can create fear and dread (Kirkland & Cunningham, 2012). Similarly, different motivations may arise depending on the valence and time perspective: we

may be drawn towards a positive future or propelled from a negative past (Seligman et al., in press). While prospection and retrospection have received a great deal of attention, in the present study we examine not only the processes of prospection and retrospection, but we examine how these processes interact with the valence of the imagery. Participants were first asked to generate positive and negative experiences that either happened to them in the past or could plausibly happen to them in the future. Participants then imagined those events while undergoing fMRI. In a 2×2 design, participants imagined 10 events of each type (future/past and positive/negative) for 32 seconds each. Replicating previous findings, positive imagery was associated with medial orbitofrontal cortex (OFC) and negative imagery with lateral OFC and insula (Cunningham, Johnsen, & Waggoner, 2010). Furthermore, our results suggest greater medial prefrontal cortex activation for past events versus greater ventral lateral PFC activation for future events. Critically, we found a time perspective by valence interaction in dorsal-medial PFC, medial OFC, and subgenual cingulate. These interactions were such that there was greater activation for past negative than past positive events, but greater activation for future positive than future negative events. This indicates that these areas are most active when imagining past-negative or future-positive events. These results may suggest an increase in activity in regions particularly important for motivational and emotional processing. One possible interpretation is that these regions may be more sensitive to events that are likely to produce motivational experience: past negative events and future positive events may serve to motivate people more than future negative and past positive, which might generate feelings of despair and complacency, respectively (Kirkland & Cunningham, 2012).

D-34

NEURAL ACTIVITY FOR THEORY OF MIND AND ITS RELATIONSHIP TO DAY-TO-DAY SOCIAL FUNCTIONING IN INDIVIDUALS AT FAMILIAL HIGH-RISK FOR SCHIZOPHRENIA David Dodell-Feder, Harvard University; Sarah Hope Lincoln, Harvard University; Laura M. Tully, Harvard University; Lynn DeLisi, Brockton VA Medical Center; Christine I. Hooker, Harvard University - The ability to attribute and reason about the mental states of others, otherwise known as theory of mind (ToM), is foundational for effective social interaction. Individuals with schizophrenia exhibit marked impairment in this ability, along with the concomitant neural substrates including temporo-parietal junction (TPJ), medial prefrontal cortex (MPFC), and precuneus (PC). The clinical and pathophysiological significance of these findings are considerable given the strong relationship between ToM deficits and real-world social functioning deficits in schizophrenia. Increasing evidence has documented similar, although more subtle ToM deficits in unaffected first-degree relatives of individuals with schizophrenia (i.e., those at familial high-risk [FHR]). In these individuals, ToM deficits may act as an additional vulnerability factor that contributes to the onset of illness by creating additional social stress. However, many of

these behavioral findings are inconsistent and virtually nothing is known about the neural bases of this ability in FHR. Here, we ask whether the underlying neural network for ToM is disrupted in FHR, and how these neural differences may contribute to day-to-day social functioning. FHR and matched nonFHR controls underwent functional magnetic resonance imaging while performing the False-Belief task, and an additional ToM task that required participants to read about a story character's thoughts, emotions, or physical appearances. After scanning, participants completed a 28-day long daily online questionnaire that asked participants to report on ToM engagement and aspects of social functioning including perspective taking, affective empathy, social motivation, social contact, positive socializing, negative socializing, and amount of conflict. Whole-brain and individually tailored region-of-interest analyses revealed that FHR demonstrated less recruitment of key aspects of the ToM network including right and left TPJ. Furthermore, across all participants, greater recruitment of ToM brain regions for mental state information (thoughts and emotions) versus non-mental state information (appearances) predicted daily engagement in ToM and aspects of social functioning. Together, these data demonstrate that familial risk for schizophrenia is associated with disruption to the underlying neural network for ToM. Furthermore, neural activity for ToM is related to daily social functioning, suggesting that impaired brain function may act a vulnerability factor in the development of psychopathology.

D-35

TOGETHER IS BETTER: STUDYING THE PHYSIOLOGY OF INTERPERSONAL SYNCHRONY

Yulia Golland, IDC Herzliya; Uri Alon, Weizmann Institute of Science; Nava Levit-binnun, IDC Herzliya; Lior Noy, Weizmann Institute of Science - In recent years much research has focused on a specific pattern of social coordination - interpersonal synchrony. Studies have shown that fine-grained temporal coordination between two people occurs automatically and has specific dynamical properties (e.g. Schmidt et al., 2011), and that interpersonal synchrony promotes various forms of pro-social behavior, such as enhanced cooperation and compassion (e.g. Valdesolo et al., 2011). While the dynamic properties and the social consequences of interpersonal synchrony are well studied, the biological processes associated with interpersonal synchrony are still poorly understood. The goal of the current study was to explore the ongoing physiological processes underlying profound interpersonal synchrony in an open-ended creative task. We recently developed a paradigm to measure synchrony in a creative task based on a theater exercise called the mirror game, where two actors mirror each other, producing jointly synchronized motion (Noy et al., 2011). We studied a simplified version of the game, in which players produce linear motion traces by moving handles along parallel tracks. Using a kinematic analysis of the players' motions we revealed a characteristic leader-follower pattern in which the follower shows 2-3Hz oscillations around the leader's smooth trajectory.

Importantly, we also detected periods during the game in which the players enter a state of profound interpersonal synchrony, showing smooth and highly synchronized motion traces, without the characteristic leader-follower pattern. We suggested that during these co-confident motion periods players act as two leaders creating the motion together. Here, we hypothesized that during such co-confident motion periods in the mirror game, both the behavioral and the physiological systems of the two players become tightly coupled. Accordingly, we expected that during these periods their physiological activity would exhibit temporally coupled, joint response patterns, that is, physiological coupling. To test this hypothesis, we recorded the ongoing cardiovascular activity of players during the mirror game, using a dyadic physiological measurement setup. Six pairs of expert improvisers played two games, composed of six two-minute rounds. For each game round, we quantified the rate of co-confident motion and the level of physiological coupling, defined as the correlation of ongoing cardiovascular activity of the two players. Although players' motion was synchronized throughout the game, their physiological coupling showed vast variability across different game rounds. In accordance with our hypothesis, we found high significant correlation between the rate of co-confident motion and the level of physiological coupling. This result suggests that co-confident periods in the mirror game, that are behaviorally characterized by high synchrony and a lack of leader-follower pattern, are also physiologically characterized by enhanced levels of cardiovascular coupling between the two players. The mirror game is used in the performing arts to enhance moments of togetherness experienced by improvising performers. We suggest that periods of co-confident motions in the simplified version of the mirror game are associated with such moments. If so, the presented research might provide the first step toward a physiological description of the state of togetherness.

D-36

NEURAL AND COGNITIVE MECHANISMS UNDERLYING THE ONTOGENY OF SOCIAL DECISIONS DURING CHILDHOOD

Nikolaus Steinbeis, Max-Planck Institute for Human Cognitive and Brain Sciences; Boris C. Bernhardt, Max-Planck Institute for Human Cognitive and Brain Sciences; Tania Singer, Max-Planck Institute for Human Cognitive and Brain Sciences, University of Zurich - Human social development during childhood is marked by considerable changes. For instance, children typically display a tendency towards increased pro-sociality with age. The neurocognitive mechanisms underlying this change however remain poorly understood. In two studies we examine the functional role of age-related changes in impulse control and emotions arising out of social comparison, such as envy and Schadenfreude in bringing about observed changes in social behavior. In the first study we investigated strategic social behavior using two economic games in two groups of children (N = 146 and N = 28) aged 6 to 14 years and a group of adults, both in- and outside the scanner. We found a significant age-related increase in strategic social behavior, which was

mediated by developmental changes in an independent measure of impulse control and associated brain functions of the left dorsolateral prefrontal cortex (DLPFC). Further, age-independent individual differences in brain structure of the same portion of left DLPFC also predicted individual differences in strategic behavior in the children as well as the adult sample. In the second study we examined whether developmental changes in the experience of social emotions can account for changes in a social preference known as inequity aversion. Using a novel monetary reward-and-punishment task in 182 children aged 7-13 years we managed to induce feelings of Schadenfreude (i.e. feeling better when winning and seeing a competitor lose instead of also winning) and envy (i.e. feeling worse when losing and seeing a competitor win instead of also losing). Importantly, levels of envy and Schadenfreude decreased with age. Furthermore, we found that this development change in social emotions significantly mediated an age-related decrease in spiteful decisions made separately in the context of three equity-related economic games. The data from both studies suggest that age-related changes in impulse control and associated activity in late maturing cortical areas, as well as social emotions constitute two distinct mechanisms which can account for changes in social behavior during ontogeny.

D-37

THE NEURAL CORRELATES OF MORAL UPDATING

Jordan Theriault, Liane Young; Boston College - When we judge an agent, we often encounter additional information that leads us to update our initial impression and change how we represent the mental states and motivations of the agent. One signature of "moral updating" (Monroe & Malle, in prep) then may be change in neural activity within regions for social cognition or theory of mind (ToM). To investigate moral updating, we created scenarios featuring distinct moral tradeoffs. Taboo tradeoffs typically pitted economic benefit over people's well-being (e.g., saving money for the hospital versus a patient's life). Tragic tradeoffs typically pitted two sacred values against each other (e.g., saving one patient's life versus another). In the "reframed" conditions, taboo and tragic tradeoffs were reframed as tragic and taboo respectively (i.e., taboo-tragic, tragic-taboo) with the addition of new information about the implications of the protagonist's choice (e.g., saving money would allow other patients' lives to be saved; saving one patient would lead to his family's donating money to the hospital). In the control conditions, new filler information was provided (i.e., taboo-filler, tragic-filler). Scenarios were presented to participants in the scanner in cumulative segments; each story segment appeared for 10 seconds before the next segment was presented. Each participant viewed 24 scenarios; each scenario appeared in only one condition for each participant. All four conditions (taboo-tragic, tragic-taboo, taboo-filler, tragic-filler) were distinguishable in the final segment of the story. Participants rated each scenario on a 4-point scale, i.e. "How wrong?" We focused on regions of interest (ROIs) for theory of mind (ToM). Using an independent task, we localized right/left temporo-

parietal junction (RTPJ/LTPJ), right/left superior temporal sulcus (RSTS/LSTS), precuneus, and dorsal medial prefrontal cortex (DMPFC). When moral dilemmas were first introduced, only LSTS differentiated between tragic and taboo tradeoffs, showing greater activity for taboo tradeoffs. However, as new information was introduced, precuneus showed greater activation for both reframed conditions (taboo-tragic, tragic-taboo) compared to the matched control (filler) conditions. LTPJ showed a similar effect: greater activation for tragic-taboo over tragic-filler. Multi-voxel pattern analyses (MVPA) allowed us to examine whether condition differences could be distinguished by the within-region spatial pattern of activity across voxels. When scenarios were reframed, taboo-tragic versus taboo-filler was distinguished in the LTPJ, RTPJ, and LSTS, whereas the tragic-taboo versus tragic-filler distinction was not encoded in any region. All condition differences were encoded in the DMPFC when participants delivered moral judgments. These regions thus appear to be sensitive to whether information demands moral updating or not. At the broadest level, the current results suggest that brain regions for ToM support moral updating. The precuneus is recruited robustly when moral updating is demanded, consistent with prior work on the neural correlates of impression formation, whereas other regions show neural discriminability in their spatial pattern of activity.

D-38

PAIN, PAIN GO AWAY: VISUAL PERSPECTIVE AND THE EMBODIMENT OF IMAGINED SENSORY EXPERIENCES

Brittany M. Christian, University of Aberdeen; Carolyn Parkinson, Dartmouth College; Thalia Wheatley, Dartmouth College; Lynden K. Miles, University of Aberdeen; Neil Macrae, University of Aberdeen - The uniquely human capacity to mentally transcend the 'here and now' affords the opportunity to relive former pleasures or preview the perils of things to come. These imaginary sensory experiences take on a realistic form, faithfully reproducing the neural, cognitive and behavioural consequences that accompany their actual occurrence. This embodiment makes mental simulations an adaptive training ground for future behaviour. However, there are occasions when physiological responses to imaginary events are problematic. Embodying the pain of a tooth extraction, for instance, could have aversive emotional and behavioural outcomes. Might we be able to buffer ourselves from this by altering the characteristics of the mental simulation? While previous work has demonstrated that the perception of pain is decreased when imagining it is happening to another person, the current study focused on the potential efficacy of third person self simulations at reducing the extent to which imaginary painful scenarios are embodied. Using fMRI we measured the spontaneous neural response to hypothetical painful scenarios across three distinct visual perspectives (First Person Self, Third Person Self, Unfamiliar Other). Additionally, participants rated the perceived pain and disembodiment associated with each vantage point. Whole brain contrasts revealed that first person self simulations resulted in greater

activation of regions associated with experiencing and observing pain (e.g., right insula), compared to equivalent third person self simulations. Participants' reports supported these findings, explicating significant differences between first and third self conditions in ratings of perceived pain and disembodiment. Taken together, the current results emphasize the effectiveness of utilizing a third person self perspective as a distancing technique to reduce the embodiment of imaginary pain. Further, they suggest that visual perspective is a unique boundary condition that moderates the embodied nature of imaginary sensory experiences.

D-39

SOCIAL INFLUENCE REGULATES EMOTIONAL REACTIVITY *Rebecca E. Martin, Peter J. Franz, Kevin N. Ochsner; Columbia University* - Famous experiments like the Asch line paradigm have examined how group behavior can shape an individual's beliefs and perceptions. Few studies, however, have focused on how social influence can serve to regulate an individual's emotional state. In the current study we examined how social influence impacts emotional reactivity. To accomplish this we used two tasks aimed at eliciting two distinct types of affective responses: (1) appetitive reactivity to food and (2) emotional reactivity to positive, negative, and neutral social scenes. In the appetitive task, participants rated images of food on a 1 to 7 scale to indicate how much they liked the taste of that food. In the social task, participants rated positive, negative, and neutral images of social situations on a 1 to 7 scale to indicate how bad or good the image made them feel. In both tasks, following their rating, participants either received feedback and were shown what they believed to be a group rating from a normative sample of 100 peers, or they received no feedback at all. After a rest period participants then rated the images a second time, this time without peer feedback. We assessed social influence by comparing the degree to which ratings changed as a function of the peer ratings. For both tasks, we found a robust conformity effect, i.e. participants significantly changed their ratings to conform to the peer ratings. Interestingly, in both tasks, there was a positivity bias such that ratings changed the most when peer ratings were more positive. There was no significant change in ratings when participants received no peer feedback, nor when their ratings matched the peer ratings. Future directions include examining developmental differences in sensitivity to peer influence. Additionally, we will use fMRI to assess how conformity might attenuate or enhance neural regions associated with appetitive reactivity (e.g. ventral striatum) and emotional reactivity (e.g. amygdala).

D-40

DEFAULT NETWORK PHASE LOCKING MODULATES PERFORMANCE PERCEPTIONS UNDER STEREOTYPE THREAT *Jordan B. Leitner, Kelly Jordan, Adam Magerman, Chad E. Forbes; University of Delaware* - Stereotype threat is a situational pressure that stereotyped targets experience when they fear their

actions may confirm a negative group stereotype. Stereotype threat has been shown to increase anxiety, bias performance monitoring, and decrease performance. Less is known, however, about how individual differences in self-oriented processing, and default states of neural activity associated with self-oriented processing, buffers stigmatized individuals from negative perceptions often experienced under stereotype threat. We investigated the role of self-oriented processing in stereotype threat by examining neural synchrony between default network (DN) regions prior to performance. The DN is a brain system comprised of multiple brain regions that exhibit collective increases in neural activity when individuals are more internally focused, and decreases in neural activity when individuals are more externally focused. An emerging hypothesis is that the DN increases cognitive flexibility, and thus the ability to cope with upcoming events before they happen. Supportive of this hypothesis, greater DN activity has been linked to an enhanced ability to envision the detail and emotional content of future events. Given such relationships between the DN and internal mentation, the DN may play an integral role in the extent to which stigmatized individuals interpret their performance under stereotype threat. We hypothesized that differential synchrony between regions in the DN biases stigmatized individuals' performance monitoring perceptions under stereotype threat. Continuous EEG was recorded from 43 Whites and 49 racial minorities during a five minute rest period. DN synchrony was indexed by calculating the phase locking between left lateral parietal cortex (LPC), posterior cingulate cortex (PCC) and ventral anterior cingulate cortex (vACC) over 400ms epochs in theta, alpha, beta and gamma frequency bands. After the rest period, participants completed a probabilistic learning task that provided comparable amounts of positive and negative feedback. To prime stereotype threat, all participants were told that the probabilistic learning task was diagnostic of their natural intelligence, and were asked to indicate their race. Following the task, participants estimated the number of errors they thought they made on the supposed intelligence task. Error estimations were converted to an accuracy index that accounted for the number of errors participants actually made. Participants also reported the degree of doubt they were experiencing, and their SAT scores. Results indicated that DN phase locking at rest differentially modulated the extent to which Minorities and Whites perceived their performance under stereotype threat. Whites with greater DN phase locking (in all frequency bands) reported making more errors than they actually made. In contrast, Minorities with greater DN phase locking reported making fewer errors than they actually made. Greater DN phase locking also predicted decreased post-task doubt for Minorities only. Finally, greater DN phase locking was related to increased math SAT scores for Minorities, but not Whites. These findings suggest that individual differences in DN phase locking and self-related processing can attenuate or exacerbate the negative performance perceptions experienced in stereotype threatening situations and have implications for performance on tests of intellectual merit.

D-41

PRIMING RELIGION ERASES PREFERENCES FOR GROUPS: AN N400 STUDY *Julian Wills, Jamie Morris, Lane Beckes; University of Virginia* - Prior research demonstrates that priming religion reduces temptation and increases generosity, yet the mechanisms of these findings remain unclear. One hypothesis is that religion suppresses selfishness and stimulates group-level cooperation, or "groupishness." Using event-related potentials, the present study sought to confirm whether priming religion increases group preferences. Once primed, participants viewed sentences that either endorsed groups over individuals (group-affirming) or endorsed individuals over groups (group-denying). Whether a sentence was group-affirming or group-denying hinged on the final word (e.g. "prioritizing groups over individuals is necessary/wrong"). By presenting sentences one word at a time, we examined the N400 component after the final word of each sentence was displayed. The N400, a negative deflection occurring roughly 400ms after a stimulus, is a reliable index of semantic incongruity - a larger N400 is produced if a sentence ends unexpectedly (e.g. "I take my coffee with cream and sugar/dog"). Moreover, studies indicate that moral statements can produce larger N400s depending on one's political party: liberals will elicit larger N400s after viewing statements that endorse conservative opinions, and vice versa. Thus, if religion increases groupishness, we predicted that priming religion would increase the N400 amplitude after viewing group-denying sentences. We discovered a main effect whereby all participants, regardless of the prime, elicited significantly larger N400s after viewing group-denying statements compared to group-affirming statements. Moreover we discovered an interaction in the opposite direction as predicted: compared to unprimed participants, primed participants produced significantly smaller N400s after viewing group-denying sentences. Exploratory analyses revealed that primed participants also exhibited N400 latency differences. Prior research has shown that priming religion may impact self-control processes, and therefore it is possible that our results are due to differences in motivation or attentiveness to the task. As a result, we are now conducting a follow-up study to test whether priming religion may impact self-regulatory neural processing.

D-42

AN ASSESSMENT OF WORKING MEMORY AND REWARD LEARNING IN SCHIZOPHRENIA USING THE N-BACK TASK AND A PROBABILISTIC REWARD-LEARNING PARADIGM *Sergio Francis M. Zenisek, Jenna Reinen, Edward Smith; Columbia University* - Schizophrenia involves abnormalities in dopamine signaling and is characterized by affective and motivational deficits, which make it more difficult for patients with the disease to work toward obtaining rewarding outcomes. Patients with the disease also show working-memory deficits. Teasing apart these different effects can be a challenge, because deficits in affect and motivation and deficits in WM can both impair performance on tasks. The n-back task is one commonly

used cognitive assessment involving continuous recognition and updating of information. In it, subjects are presented a series of stimuli and asked whether the current stimulus matches the one presented "n" items previously. Because it necessitates dynamic interaction with stimuli with the goal of maintaining a changing set of information, the n-back task has become widely used as a WM measure. Reward learning, on the other hand, can be assessed using a probabilistic learning task. This type of learning is thought to rely upon dopamine signaling, and may underlie some forms of motivated and goal-directed behavior. Some data suggest that abnormal dopamine signaling in patients with schizophrenia results in deficits in planning and goal-oriented behavior. In addition, WM deficits are related to PFC function and may be related to dopaminergic deficits. Because of this, we aimed to examine the relationship between performance on the n-back task and performance on a reward-learning task in healthy subjects. In order to examine the relationships between symptoms, WM, and RL ability in schizophrenia and to investigate the relationship between motivation and WM, we tested schizophrenia patients (n=26) and healthy controls (n=22) on these two task types. We had participants perform a reward-learning task in which they had to learn which of two stimuli was more likely to lead to a reward, either money in the gain portion or a reduced penalty in the loss portion. Participants were also tested on a classic n-back task (2- and 3-back) and these results were compared. Performance was compared to symptom ratings for the patients. Results show that controls performed better than patients on the n-back task overall ($p < 0.05$), which is consistent with prior evidence. Further, affective-flattening symptom ratings in patients correlated with longer n-back reaction times ($p < 0.05$), which may be indicative of a motivational deficit. Comparisons with the RL task show that reaction time on the n-back task was strongly negatively correlated with optimal choice performance on the RL task in the loss condition for healthy controls only ($p < 0.01$), also suggesting that motivational deficits in schizophrenia are related to planning and reward-seeking deficits in patients. Together, these results suggest that aspects of the n-back task may differentially predict components of reward-learning ability. In sum, these data suggest that there are significant interactions between WM capacity as measured with the n-back task and reward-seeking ability as assessed using an RL task.

D-43

ASSOCIATIONS OF THE OXYTOCIN RECEPTOR GENE (OXTR) POLYMORPHISMS WITH BRAIN RESPONSE DURING READING OF FACIAL EMOTIONS IN YOUNG AND OLDER ADULTS *Natalie C. Ebner, University of Florida; Gabriela Maura, University of Florida; Lars Westberg, University of Gothenburg; Håkan Fischer, Stockholm University, Karolinska Institute* - The ability to correctly read emotions in others is central for successful social interaction. Still, relatively little is known about the processes underlying this important social skill. In the present study, we used a genetics, functional brain imaging, and cognitive-behavioral approach to examine

associations of the oxytocin receptor gene (OXTR) with brain activity and behavioral response during reading of facial emotions in samples of young and older adults. OXTR has been implicated as a candidate gene for interindividual differences in various social phenotypes. Twenty-five young (aged: 20-31 years) and 28 older (aged: 65-74 years) participants underwent functional magnetic resonance imaging (fMRI) while identifying expressions in happy, neutral, and angry young and older faces. Participants were genotyped for 15 OXTR SNPs (single nucleotide polymorphisms), which have previously been shown to be associated with social behavior. Of these, the most promising associations were found in relation to rs237887. Twenty (10 young and 10 older) participants were identified as carriers of two A-alleles (AA) and 33 (15 young and 18 older) participants as carriers of at least one G-allele (GA/GG) regarding rs237887. Examination of associations between these genotypes and brain activity during facial emotion identification demonstrated that individuals carrying a G-allele compared to AA-genotype carriers showed increased activity in left fusiform gyrus, right inferior frontal gyrus, and right middle frontal gyrus during reading of emotional expressions in happy compared to angry faces, while also showing decreased activity in bilateral anterior cingulate cortex. In addition, G-allele compared to AA-genotype carriers were slower labeling happy (but not angry) faces and reported greater attention to and clarity of their own feelings and emotions in a Likert-type self-report measure. Intriguingly, in this context, rs237887 has previously been demonstrated to be associated with susceptibility for autism spectrum disorder (Liu et al., 2010), prosocial behavior (Israel et al., 2009, but see Apicella et al., 2010), and face recognition (Lori et al., 2012). Looking at young and older participants separately, several of these observed associations were more pronounced in older than young participants. This is an interesting finding given broad evidence of preferential processing of positive over negative information in older compared to young adults (Mather & Carstensen, 2005). To our knowledge this is the first study that considers young and older participants in a genetic-neuro-behavioral examination of facial emotion processing. Results will be discussed in the context of OXTR gene function and brain regions involved in face and emotion processing (Haxby et al., 2000, 2002). These findings shed light on interactions between genetics, psychological processes, and neural structures involved in socioemotional functioning. They also importantly contribute to the still very sparse and inconclusive literature on age-related changes in oxytocin function in social-affective contexts.

D-44

CORTICAL ACTIVATION DURING A FOOD DECISION-MAKING TASK CORRELATES WITH WILLINGNESS TO PAY TO AVOID CONTROVERSIAL FOOD TECHNOLOGIES

J. Bradley C. Cherry, University of Missouri-Kansas City; Jayson L. Lusk, Oklahoma State University; Brandon R. McFadden, Oklahoma State University; John M. Crespi, Kansas State University; Laura E. Martin, University of Kansas Medical Center;

Amanda S. Bruce, University of Missouri-Kansas City - Objective: Little is known about consumer decision-making between foods produced using new, controversial food technologies and those produced using more conventional alternatives. In this study, we examined the relationship between participants' cortical activations during a food decision-making task and their willingness to pay (WTP) to avoid controversial food technologies, including the use of artificial growth hormone (rBGH) to produce milk. We hypothesized that, when participants made decisions about whether to purchase low-priced milk produced using rBGH or high-priced milk produced without using rBGH, higher activation levels in areas associated with risk assessment and deliberate decision-making would correlate significantly with higher WTP to avoid milk produced using rBGH. Methods: We recruited 47 healthy participants (23 females; aged 18-55 years; M = 31.9 years) from the Kansas City area to undergo two event-related functional magnetic resonance imaging (fMRI) scans. During these scans, participants performed a food decision-making task in which we presented them with a total of 84 choices between two types of milk. The two options presented in each choice differed according to three experimental conditions: a "price" condition, in which the price of one option was high, and the other low, but the technologies used to produce them were the same; a "technology" condition, in which the technology used to produce one option was controversial, and the other conventional, but their prices were the same; and a "combination" condition, in which the prices of the two options differed, as did the technologies used to produce them. Analysis: We used BrainVoyager QX to conduct a whole-brain analysis contrasting participants' cortical activations during combination choices versus price choices. We then used SPSS and SAS to estimate participants' WTP to avoid milk produced using rBGH. Activation levels were measured in terms of percent blood-oxygen-level-dependent (BOLD) signal change, while WTP to avoid milk produced using rBGH was measured in terms of United States dollars. We again used BrainVoyager QX to conduct a whole-brain correlation of participants' activation levels and WTP to avoid milk produced using rBGH. Results: Activation levels correlated significantly ($p < .01$, cluster threshold = 15 voxels) with WTP to avoid milk produced using rBGH, with a positive correlation being observed along the right central insular sulcus, spreading both anteriorly and posteriorly (BA 13; $x = 35$, $y = -5$, $z = 9$; $r = 0.55$). Discussion: Consistent with our hypothesis, we observed a significant correlation between higher activation levels in areas associated with risk assessment and deliberate decision-making (i.e., right anterior and posterior insula) and higher WTP to avoid milk produced using rBGH. Similar activation levels in the right insula have been observed by studies examining cortical activations during decision-making tasks involving risk assessment. Limitations to this study include the use of a single food product and, according to eight participants, the use of somewhat unrealistic prices. Future studies may use a wider variety of both food and non-food products, as well as a more realistic range of prices.

D-45 *SANS Poster Award Winner

EFFECTS OF PRENATAL AND POSTNATAL SEX STEROID HORMONES ON THE DEVELOPMENT OF AUTISTIC TRAITS IN CHILDREN AT 18-24 MONTHS OF AGE

Bonnie Auyeung, University of Cambridge; Jag Ahluwalia, Rosie Maternity Hospital; Lynn Thomson, Rosie Maternity Hospital; Kevin Taylor, Addenbrooke's Hospital; Gerald Hackett, Rosie Maternity Hospital; Kieran J. O'Donnell, McGill University; Simon Baron-Cohen, University of Cambridge - Background: It has been suggested that autism may be an extreme manifestation of specific (but not all) male-typical traits, both in terms of cognition and neuroanatomy. Studies of prenatal exposure to sex steroid hormones during critical periods of development are related to specific (but not all) sexually dimorphic aspects of cognition and behaviour. However, it is not known whether postnatal exposure to these hormones has a similar effect. The critical periods for sexual differentiation of the brain are thought to be when sex differences in serum levels of sex steroids (e.g., testosterone) are highest. During human development, there is a prenatal surge in testosterone at around weeks 8-24 of gestation and a postnatal (neonatal) surge is also thought to occur shortly after birth when the child reaches 3-4 months of age. Objectives: To examine how prenatal and postnatal sex steroid hormone levels are associated with individual differences in autistic traits in 18-24 month old children. Methods: Fetal testosterone (fT) and fetal estradiol (fE) levels were measured in amniotic fluid using radioimmunoassay from pregnant women following routine second-trimester amniocentesis in n=129 toddlers. Saliva samples were collected from a subset of these children (n=35) when they reached 3-4 months of age. Salivary samples were assayed (without separation or extraction) for neonatal testosterone (nT) levels using commercially available immunoassay protocols. When the children reached 18-24 months of age, mothers were asked to complete the Quantitative Checklist for Autism in Toddlers (Q-CHAT), a measure which has been shown to be effective in detecting the presence of autistic traits. Results: fT levels were positively associated with scores on the Q-CHAT. For the smaller subset of children for which nT was measured, nT levels showed no significant sex differences and no relationships with fT levels or with Q-CHAT scores. The same subset retained the relationship between fT levels and Q-CHAT scores, despite the smaller sample size. Conclusions: These findings are consistent with the hypothesis that prenatal (but not postnatal) androgen exposure (coinciding with a critical phase in sexual differentiation of the brain) is associated with the development of autistic traits in 18-24 month old toddlers. The present results should be followed up in a larger sample to examine whether individuals with clinical diagnoses of autism had elevated levels of fT.

D-46

COGNITIVE EMPATHY MODULATES THE PROCESSING OF PRAGMATIC CONSTRAINTS DURING SENTENCE COMPREHENSION

Sai Li, Xiaoming Jiang, Hongbo Yu, Jie Hu, Xiaolin Zhou; Peking

University - Previous studies showed that brain regions for mentalizing, including temporoparietal junction (TPJ) and medial prefrontal cortex (mPFC), are activated in understanding the non-literal meaning of sentences. A different set of brain regions, including left inferior frontal gyrus (IFG), is activated for dealing with pragmatic incongruence. Here we demonstrate that individual's cognitive empathic ability modulates the brain activity underlying the processing of pragmatic constraints during sentence comprehension. The "dou" construction in Chinese (similar to English even) normally describes an event of low expectedness; it also introduces a pragmatic scale against which the implicature of an underspecified event can be inferred. By embedding underspecified or highly likely events in the construction, we created underspecified and incongruent sentences and compared both with control sentences in which events of low expectedness were described. Imaging results showed that 1) left TPJ was activated for the underspecified sentences, and the activity in ventral mPFC correlated with individuals' fantasizing ability; 2) anterior cingulate cortex (ACC) was activated for the incongruent sentences, and the activity in bilateral IFG correlated with individuals' perspective taking ability. These findings suggest that brain activations in making pragmatic inference and in dealing with pragmatic failure are modulated by different components of cognitive empathy.

D-47

COORDINATED LARGE-SCALE NETWORKS UNDERLIE AFFECTIVE EXPERIENCE ACROSS DISCRETE EMOTION CATEGORIES

Christine Wilson-Mendenhall, Northeastern University, Massachusetts General Hospital; Gal Raz, Tel Aviv Sourasky Medical Center, Tel Aviv University; Alexandra Touroutoglou, Massachusetts General Hospital; Shir Atzil, Northeastern University, Massachusetts General Hospital; Yael Jacob, Tel Aviv Sourasky Medical Center; Gadi Gilam, Tel Aviv Sourasky Medical Center, Tel Aviv University; Tamar Lin, Tel Aviv Sourasky Medical Center, Tel Aviv University; Tal Gonen, Tel Aviv Sourasky Medical Center, Tel Aviv University; Roei Admon, Tel Aviv Sourasky Medical Center, Tel Aviv University; Talma Hendler, Tel Aviv Sourasky Medical Center, Tel Aviv University, McLean Hospital; Lisa Feldman Barrett, Northeastern University, Massachusetts General Hospital - Psychological construction approaches to emotion suggest that interacting neural systems produce countless possible emotional experiences. Because emotions emerge from more basic domain-general "ingredients" in this view, a straightforward neural hypothesis is that common neural systems should contribute to the subjective experience of different discrete emotions (e.g., sadness, anger, fear). In this work, we examined the connectivity between large-scale networks during emotional experiences cultivated as participants watched film clips 5-10 minutes in length. Film clips are ideal for inducing emotions in an experimental context because they elicit strong subjective and physiological changes by introducing dynamic, real-world social situations. Across several studies, participants either viewed two sadness-inducing clips, an anger-inducing clip, or a fear-inducing clip during an

fMRI session. They then watched the clip a second time while making continuous intensity ratings of the target emotion (e.g., intensity of sadness on a moment-to-moment basis). To examine the brain networks contributing to the dynamic emergence of emotions during the films, we used newly developed analysis techniques for assessing functional connectivity within and between networks across time. The resulting “cohesion” indices reflect both the strength of average correlations between signals in a group of regions and the variation about this average (i.e., higher values indicate correlations that are narrowly distributed about a high average) across specified time windows. We hypothesized that the cohesion between large-scale resting state networks identified in our previous work would increase as participants’ continuous emotional intensity ratings increased in each of the four film clips (and across three discrete emotion categories). More specifically, we assessed the cohesion between an insula-based “salience” network (e.g., anterior insula, anterior cingulate) that is anatomically positioned to coordinate attention, awareness, and action and an amygdala-based network (e.g., amygdala, ventromedial prefrontal cortex, ventral striatum) that is anatomically positioned to coordinate affective changes grounded in the body. As hypothesized, the strength of connectivity between these networks predicted sadness intensity ratings, anger intensity ratings, and fear intensity ratings during the film clips that targeted these emotions. We suggest that these networks coordinate when signals from the body influence attention to a self-relevant situation in the world, which is subjectively experienced as heightened emotional intensity across discrete emotion categories. In the case of film clips, the social situation becomes self-relevant through the viewer’s vicarious connection with the characters. Moving beyond investigations that focus on discriminating prototypical discrete emotions, our findings suggest that it is productive to examine how basic neural systems coordinate to produce the diverse experiences that characterize human emotional life.

D-48

REWARD SENSITIVITY TO FACES VERSUS OBJECTS IN CHILDREN: AN SPN STUDY

Katherine Kuhl-Meltzoff Stavropoulos, Leslie J. Carver; University of California, San Diego - Social behavior is partially motivated by the rewards we experience when engaging with others. Understanding the neural underpinnings of the reward system is crucial for knowing how social behavior develops, and how social systems sometimes fail. One method to study the reward system is event related potentials (ERPs). The stimulus preceding negativity (SPN) ERP component occurs when subjects anticipate feedback about performance on a task in which correct responses yield a reward. The SPN is thought to reflect the expectation of reward, and related activity of the dopaminergic reward system (van Boxtel & Bocker, 2004). Adult studies have elicited the SPN component during a guessing task with monetary rewards, finding larger SPNs when subjects felt control over the outcome (Masaki, Yamazaki, & Hackley, 2010), and were highly motivated. Although the SPN has been studied in adults,

it has yet to be examined with children. Further, in previous studies, monetary rewards were compared directly with social rewards (e.g., pictures of faces) (Ditchter et al., 2012). This could lead to differences between conditions that are due to differences in characteristics of the rewards, ones not related to their value as social stimuli (e.g., perceptual differences between symbols that represent monetary reward versus faces or cognitive differences between the expectation of gaining money versus simply seeing faces). In the current study, we examined SPN activity in children, while controlling for the rewards between conditions. As in previous studies, we used a guessing task to elicit the SPN. However, the reward in the present study was consistent across trials, but was accompanied by an incidental stimulus that was either social or nonsocial in nature. Participants were told that correct answers would be signaled by a ring of intact goldfish crackers (which served as the reward), and incorrect answers would be signaled with a ring of goldfish crackers with X’s drawn through them. In the social condition, there was a face inside the ring of goldfish that was either smiling (for correct answers), or frowning (for incorrect answers). In the nonsocial reward condition the directions were identical. However, an arrow comprised of scrambled faces was inside the ring of goldfish (the arrow pointed upwards for correct answers and downwards for incorrect answers). Our results (N = 11, 5 female 6 male, mean = 7.44 years) suggest two noteworthy findings: 1. The SPN is elicited in children during a guessing game task, and 2. In children, the SPN is larger in blocks where feedback is accompanied by a social stimulus compared to those with nonsocial incidental feedback ($p = .039$). These results provide important evidence that even when the reward is identical across conditions, and the social and nonsocial rewards are incidental, the SPN is larger to feedback paired with social stimuli. This line of research is important for advancing our current understanding of social motivation in typically developing children, as well as raising interesting questions for how this component might be altered in children with social deficits, such as autism.

D-49

RECRUITMENT OF COGNITIVE AND AFFECTIVE BRAIN NETWORKS DEPENDS ON THE INTERACTION BETWEEN SEROTONIN TRANSPORTER GENOTYPE AND EMOTIONAL VALENCE DURING BELIEF-BIAS INTERFERENCE IN REASONING

Melanie Stollstorff, University of Colorado Boulder; Marie T. Banich, University of Colorado Boulder; Ryan M. Guild, University of Colorado Boulder; Harry R. Smolker, University of Colorado Boulder; Arielle P. C. Jensen, University of Colorado Boulder; Joseph M. Devaney, Hungarian Academy of Sciences; Yuko Munakata, University of Colorado Boulder - Our genes affect our susceptibility to positive and negative emotional biases which in turn influence our ability to reason logically under different contexts. Specifically, individuals with the long allele form of the serotonin transporter gene (5-HTTLPR) tend to emphasize negatively-valenced context, while those with the short form react to positively-valenced context.

Belief-bias, a common source of error in everyday reasoning, can be heightened by emotional reactivity. While increased belief-bias is associated with reduced activation of the right inferior frontal cortex (rIFC), the neural basis for 5-HTTLPR-mediated differences in the ability to exert inhibitory control over bottom-up biases in reasoning is unknown, an issue investigated in this study. Two groups of healthy adults (based on 5-HTTLPR genotype: "Long", "Short"), underwent fMRI while completing a reasoning task that varied in congruency of task-relevant (logic) and task-irrelevant (beliefs) information and in emotional valence. Results revealed that genotype influenced brain regions engaged depending on emotional valence. While the Long group had increased rIFC and amygdala activity during positive emotional conflict, the Short group recruited these regions during negative emotional conflict. Thus, participants successfully engaged cognitive control regions to overcome bottom-up emotional biases using similar neural circuitry, but the engagement of this circuitry depended on emotional valence and 5-HTTLPR status. Thus, susceptibility to reasoning bias depends on emotional valence and is modulated, in part, by a genetic polymorphism that influences serotonin neurotransmission.

D-50

CORTICAL PROCESSING OF EMOTIONAL VALENCE AND INTENSITY IN HUMAN AND ANIMAL VOCALIZATIONS

Attila Andics, Eötvös Loránd University, Semmelweis University; Márta Gácsi, Eötvös Loránd University; Tamás Faragó, Eötvös Loránd University; Anna Kis, Eötvös Loránd University, Hungarian Academy of Sciences; Ádám Miklósi, Eötvös Loránd University - Emotional voice processing was shown to involve distinct regions along the posterior and anterior superior temporal sulcus (STS), in the inferior frontal cortex (IFC) and the amygdala bilaterally (e.g., Fecteau et al., 2007. *Neuroimage*. 36:480-487; Ethofer et al., 2012. *Cereb Cortex*. 22:191-200). But the exact role of these brain areas in processing vocal emotions is still unclear. It is also not known if there are systematic hemispheric asymmetries for voice processing that can be attributed to emotional content. According to the right-hemisphere hypothesis, the right half of the brain is dominant for processing all emotions. According to the valence hypothesis, positive emotions are processed predominantly in the left hemisphere, and negative emotions predominantly in the right hemisphere. These proposals received considerable attention but little neuroscientific support so far (e.g., Killgore and Yurgelun-Todd, 2007. *Soc Cogn Affect Neurosci*. 2:240-250), and almost none in the auditory domain. Here, twenty-two human listeners were presented with human and dog emotional vocalizations, and nonvocal sounds (all amplitudes normalized) in an fMRI experiment. All vocal stimuli were previously rated for perceived emotional valence and intensity. Stimuli were blocked, every block consisted of four similarly rated stimuli. First, we used parametric modulation analyses to test what brain regions' activity covaries with perceived emotional valence and intensity. Second, we modeled every stimulus block with a separate regressor,

and tested if hemispheric asymmetries in specific brain regions covary with the perceptual scores. We found that the perceived emotional valence of both human and dog vocalizations positively correlated with activity in bilateral STS, that is, more positive stimuli elicited stronger STS responses. Furthermore, the perceived emotional intensity of human but not of dog stimuli positively correlated with activity in right IFC, that is, emotionally more intense stimuli elicited stronger IFC responses. Systematic hemispheric differences were also identified: the perceived emotional valence of human vocalizations positively correlated with the amount of a leftward bias in neural activity in both the amygdala and the voice-selective STS. That is, more positive stimuli led to relatively more left (compared to right) amygdala and STS activity. Our results confirmed previous findings suggesting that emotional valence and intensity modulate distinct stages of the voice processing hierarchy. Furthermore, we demonstrated here that emotional valence, whether conveyed by human or dog vocalizations, is processed by similar voice-selective superior temporal regions in the human brain. This suggests that the same neural networks that are used to process human voice emotions can be used when processing animal vocalizations. Finally, our study is among the first ones to show neuroimaging evidence in the auditory domain for valence-based functional hemispheric asymmetries. Our findings also demonstrate that the right prefrontal cortex is more sensitive to vocal emotional intensity than the left prefrontal cortex, indicating that the valence hypothesis may not hold for all cerebral regions involved in emotion processing. Therefore, we propose an integrated account, with a crucial role of the voice-sensitive STS and IFC regions in processing vocal emotions.

D-51

INTERACTIONS BETWEEN COGNITIVE LOAD, WORKING MEMORY, AND ONLINE USAGE OF THEORY OF MIND IN ADOLESCENTS AND ADULTS

Kathryn L. Mills, University College London and National Institute of Mental Health; Iroise Dumontheil, University of London; Sarah-Jayne Blakemore, University College London - The ability to use knowledge about another person's mental state has been shown to depend on the availability of cognitive resources. Using a referential communication task, Lin and colleagues (2010) found that adults under high cognitive load were less able to use the knowledge of another individual than those under low cognitive load, suggesting that sufficient cognitive resources are necessary to spontaneously use one's theory of mind. In a separate experiment using the same referential communication task, individuals with high working memory capacity were better at appropriately using theory of mind than individuals with low working memory capacity. This suggests individual differences in cognitive resources affect the ability to use knowledge about another individual's mental states during real-time interactions (Lin et al., 2010). The "Director task" is a computerized version of the referential communication task used by Lin and colleagues, where participants must either use theory of

mind, or follow an arbitrary non-social rule, to move objects in a set of shelves. The ability to use theory of mind in the Director task improves into adulthood, over and above the maturation of other cognitive processes involved, such as response inhibition (Dumontheil et al., 2010). In the present study, we examined how the availability of cognitive resources interacts with theory of mind use in adolescence compared to adults. We used an adapted version of the Director task (Dumontheil et al., 2012) and manipulated cognitive load by asking participants to remember either one or three two-digit numbers before each Director task trial and to retrieve this information at the end of the trial. Participants also completed a backward verbal digit span task as an independent measure of working memory capacity. Data from young adolescents (11-14 years), mid-adolescents (14-17 years), and adults (22-30 years) were analyzed to investigate developmental differences in the interaction between cognitive load and online theory of mind usage, as well as the influence of working memory capacity on both. We examined how cognitive load affected performance on the Director task, how the Director task affected performance on the embedded working memory task, and the influence of working memory capacity on these interactions. The results inform our knowledge of the interplay between social cognition and domain-general working memory processes during development.

D-52

WHY ARE YOU SMILING? IN A STRATEGIC CONTEXT, PEOPLE'S FACIAL RESPONSES REFLECT THE MEANING OF ANDROID FACIAL EXPRESSIONS Galit Hofree, Paul Ruvolo, Christopher Reinert, Marian S. Bartlett, Piotr Winkielman; University of California, San Diego - Facial expressions are essential for human emotional communication. Interestingly, humans, and some other primates, have been found to spontaneously mimic such facial expressions (Dimberg, 1982; McIntosh, Decker, Winkielman, & Wilbarger, 2006; Ross, Menzler, & Zimmermann, 2009). This automatic behavior appears to be important for promoting empathy, recognition of others' emotional states, and generally creating a bond between people (Chartrand & Bargh, 1999; Carr, Iacoboni, Dubeau, Maziotta, & Lenzi, 2003). Our previous work has shown that people spontaneously mimic an anthropomorphic robot, demonstrating that mimicry occurs even when dealing with an automaton, suggesting automaticity of basic mimicry (Hofree, Ruvolo, Bartlett, & Winkielman, in submission). Of course, human emotional expressivity is not only grounded in mimicry reactions to others in our environment. Our emotional reactions to others' expressions also depend on the current context. For example, when playing bridge, you may respond positively to your partner's smile, since this is a sign that you are both winning. Yet, you may respond with a frown when your opponent is smiling, since this smile signals a loss for you. There is some debate on how automatic mimicry processes may interact with other emotive processes. Some evidence suggests that mimicry, as an automatic process, can interfere if our goal is not to mimic (Cook, Bird, Lünsen, Huck, & Heyes, 2012), or at least

slow down non-mimicking reactions (Brass, Bekkering, & Prinz, 2011). However, certain studies suggest that response to even unconscious cues can be modulated by the current context (Tamir, Robinson, Clore, Martin, & Whitaker, 2001). The current research shows that robotic emotional expressivity can elicit human emotional reactions in more complex ways than simple mimicry. Participants were asked to play a game with or against an android. On half of the trials, the android displayed truthful emotional reactions to his own outcome from the current game using his faces. On the other half the outcome of the game was displayed in writing on the computer terminal. Using electromyography (EMG) to measure people's facial reactions, we found that people's expressions are solely a function of participants' own outcome from the game. That is, participants smile when they win and frown when they lose. Critically, this occurs regardless of whether the information about win or loss is communicated by the android's smile or by his frown. Furthermore, the android's expressions elicited greater facial reactions in participants, as compared to their reactions in response to the outcome being displayed on the computer screen. These findings demonstrate that people's facial responses to androids are open to contextual influences, and do not simply reflect mimicry. Overall, the results suggest that simple facial expressions can provide an important and subtle means of communicating emotional information and promoting emotional reactions beyond mimicry in human robot interactions.

D-53

RESISTANCE AND REJECTION: NEURAL MECHANISMS OF SOCIAL EXCLUSION IN ADOLESCENCE Anne Hill, University of Oregon; Shannon Peake, University of Oregon; Lauren Kahn, University of Oregon; Beth Stormshak, University of Oregon; Thomas Dishion, Arizona State University; Jennifer Pfeifer, University of Oregon - Adolescence is a formative period of social development in which individuals become especially sensitive to social cues such as exclusion and rejection. Previous research examining neural responses to social exclusion in early adolescence (Masten et al., 2009) found a network of regions associated with feelings of distress as a result of exclusion, including heightened activity in the insula and lateral prefrontal cortex (IPFC), and diminished activity in ventral striatum (VS) and medial prefrontal cortex (mPFC). In this study, a novel group of 18 participants in middle adolescence (ages 13.8-16.6) experienced an episode social exclusion while undergoing fMRI. Participants played two rounds of 'cyberball,' a paradigm that leads participants to believe they are being excluded from a ball-tossing game by two peers. Immediately following the exclusion, participants reported feelings of exclusion and distress associated with rejection using the Need Threat Scale (NTS). Replicating previous research in early adolescents, greater feelings of distress during exclusion related to diminished neural activity in the VS, mPFC, and IPFC, as well as heightened responses in insula and (unique to this study) hypothalamus. Furthermore, self-reported resistance to peer influence (RPI) was associated with activation in the

dorsal anterior cingulate cortex (dACC), a region thus far found primarily in the adult literature to relate to social rejection (Eisenberger and Lieberman, 2004). In the adult literature, activation in the dACC is thought to reflect visceral experience of social pain. In the current study, higher reports of distress after exclusion (on the NTS) were unrelated to activity in the dACC. However, higher self-reported RPI was associated with lower self-reported threat to participants' sense of belonging (a subscale of the NTS) as a consequence of social exclusion. In addition, participants who showed increased activity in the dACC during exclusion reported a lower sense of belonging after rejection. Together, these results may suggest that resistance to peer influence may act like a buffer to social pain, or that adolescents who experience less pain as a result of social exclusion are less susceptible to peer pressure.

D-54

TRUST ALL, LOVE A FEW: NEURAL CORRELATES OF SOCIAL INTERACTIONS WITH PEERS *Berna Gürofülu, Leiden University, Leiden Institute for Brain and Cognition; Eduard Klapwijk, Leiden Institute for Brain and Cognition, Leiden University Medical Center; Geert-Jan Will, Leiden University, Leiden Institute for Brain and Cognition* - When people interact with other people they have all sorts of expectations about others' intentions guiding their social decisions in everyday life. Previously gained information about the interaction partner or previous encounters with the particular person has been shown to influence social behavior in interactions. For example, people act in more cooperative ways in interactions with those who they believe are morally good (Delgado et al., 2005) and with those who act in prosocial ways (van den Bos et al., 2011). However, little is known how behavior and cognition in social encounters is shaped by actual real-life relationships with personally familiar others. Peer relationships form one of the most significant social context across development; thus, in this study we aimed to investigate the neural correlates of trust related interactions with peers. In the current fMRI study participants had online interactions with personally familiar peers from their classrooms. Participants from vocational universities (N=16, mean age = 20.6 years) were first contacted in their classrooms where they filled out sociometric questionnaires indicating liked and disliked classmates. During the scanning session, they played a repeated Trust Game as the first player with three interaction partners: a friend (i.e., a liked classmate), an antagonist (i.e., a disliked classmate), and an anonymous peer (i.e., the confederate they met before the experiment). In each trial participants made a decision to either divide the stake of 10 coins equally between them and the interaction partner ('no-trust' option), or to 'trust' the other by giving him/her all the stake to divide, which also tripled the stake to 30 coins. Importantly, the interaction partner made a simultaneous decision to either 'defect' by keep all coins for him/herself or to 'reciprocate' by sharing the 30 coins equally. After the participant made a decision, he/she could see the decision of the interaction partner. Although amounts of trust displayed by the participants towards the three

different interaction partners were similar on average, there were differences in mentalizing and reward-related brain regions activated during the interactions. Preliminary findings showed higher insula activation during no-trust choices and higher anterior medial prefrontal cortex activation during trust choices. Two brain regions important for mentalizing, the temporoparietal junction (TPJ) and the dorsal medial prefrontal cortex (dmPFC), were more active during interactions with friends than during interactions with antagonists. Furthermore, brain regions involved in mentalizing (e.g., TPJ) and reward related learning (e.g. lateral orbitofrontal cortex and caudate) were differentially involved in received feedback, showing highest activation during defect feedback following no-trust choices. Taken together, the findings provide insight into the neural basis of feedback processing in social interactions and highlight the moderating role of real-life relationships with interaction partners in social cognition.

D-55

BRAIN-BEHAVIOR CORRELATIONS IN THE CONTEXT OF A PARENT-CHILD MINDFULNESS-BASED INTERVENTION *Lisa M. May, Josh Felver-Grant, Jessica M. Tipsord, Elliot T. Berkman; University of Oregon* Mindfulness meditation practices have been linked to a myriad of positive outcomes related to both physical health (e.g., pain relief, improved immune function, reductions in blood pressure and cortisol levels) and mental health (e.g., improvements in insomnia, anxiety, depression, addiction, and eating disorders, as well as reduced emotional reactivity). However, despite the fact that many of those health-related outcomes have been linked to the quality of an individual's social network, very few studies have examined the effects of mindfulness on social functioning. Here, we seek to test whether mindfulness meditation benefits one key social skill that has been associated with physical health in both animals and humans: parenting behavior. Specifically, the aim of the present study was to examine the effects of a mindfulness based stress reduction program administered to parents and pre-teen children together on parents' outcomes. We hypothesized that the parent's changes in mindfulness would track the child's changes, and that this association would be reflected in the neural activity of the parent. To test this hypothesis, 18 parents (2 male), ages 29 - 57 enrolled in an eight week Mindfulness Based Stress Reduction Program along with their preteen children. The MBSR group met once a week for 90 minutes and emphasized the cultivation of moment to moment non-judgmental awareness of mental states and processes through mindfulness meditation and yoga. Parents performed a mindfulness task while their brain activity was recorded using functional magnetic resonance imaging (fMRI) before the 8 week intervention and then again after completion of the course. Additionally, survey data and total minutes of home mindfulness practice were recorded for parents and children. Results indicated that increases (from before to after the course) in parents' brain activity in the left insula during mindfulness correlated with improvements in their child's score on a commonly used family

relationship scale. This result suggests that parent and child responses to a mindfulness intervention are related in a meaningful way. There may be specific value to involving multiple family members in mindfulness training together, possibly taking advantage of the interconnected nature of the parent-child relationship to support additional improvements in patient health and psychiatric outcomes.

D-56

DEVELOPMENT OF THE FRONTAL LOBE AND ITS RELATIONSHIP TO SELF-REGULATORY ABILITIES IN ADOLESCENTS

Nandita Vijayakumar, Sarah Whittle, Murat Yucel, Nicholas B. Allen; University of Melbourne - Adolescence is a period of significant brain maturational changes in regions associated with self-regulation. While normative patterns of cortical thinning are postulated to underlie adaptive socioemotional outcomes, aberrations of this process are thought to result in poorer self-regulatory abilities and associated psychopathology (Nelson et al., 2005; Marsh et al., 2008, Sowell et al., 2004). This study characterizes the development of two regions known to underlie regulatory processes, the anterior cingulate cortex (ACC) and the dorsolateral prefrontal cortex (DLPFC), during adolescence. The study also examines the relationship between cortical development of these regions with two aspects of self-regulation: i. effortful control, a temperamental measure of self-regulation, and ii. adaptive emotion regulation strategies. Participants were recruited from Australian primary schools (N = 95, 48% male) and examined longitudinally, during early (T1: mean age = 12.66), middle (T2: mean age = 16.43) and late adolescence (T3: mean age = 18.76). Structural MRI scans were obtained at T1 and T2, and cortical thickness was measured using FreeSurfer (Fischl et al., 1999). Effortful control (EC) was also measured at T1 and T2 using the Early Adolescent Temperament Questionnaire-Revised, and adaptive emotion regulation strategies were measured at T3 using the Emotional Regulation Questionnaire (ERQ). Linear mixed models were employed to analyze brain development between T1 and T2, including gender and hemisphere effects. Annualized percentage change in cortical thickness was calculated for each region and used in subsequent mixed models, along with gender, to investigate the relationship between self-regulation and brain development. Results revealed that the ACC and DLPFC exhibited significant reductions in cortical thickness between early and mid-adolescence across both hemispheres. EC was significantly related to left ACC and left DLPFC development, with greater EC associated with increased cortical thinning in both these regions. Analysis of ERQ at T3 identified significant interaction effects between gender and brain development. Post-hoc analysis conducted separately for each sex indicated that reductions in cortical thickness of the left and right DLPFC was associated with more adaptive emotion regulation strategies in females (greater cognitive reappraisal and lower emotion suppression), while increased thickness of the right ACC and right DLPFC was more adaptive in males (lower emotion suppression). The current findings provide support for cortical thinning

of the ACC and DLPFC between early and middle adolescence. Furthermore, those with higher effortful control exhibit greater cortical thinning of these frontal regulatory regions. The findings also highlight gender-specific relationships between cortical maturation and adaptive emotion regulation abilities during late adolescence. While cortical thinning between early and mid-adolescence appears to benefit females' emotion regulation during later adolescence, the inverse relationship is found in males.

D-57

NEURAL BASIS OF SIMULATION AND ITS RELATIONSHIP TO SOCIAL FUNCTIONING IN YOUNG ADULTS AT RISK FOR PSYCHOSIS

Sarah Hope Lincoln; Laura M. Tully; David Dodell-Feder; Christine I Hooker; Harvard University - Understanding the development of social dysfunction, its neural basis and behavioral presentation, and its relationship with the onset of active psychosis is a target for research in psychosis-spectrum disorders. One possible explanation for deficits in social functioning could be explained by impairment in the neural mechanisms of the psychological process of simulation. Simulation is a psychological process requiring the individual, as the observer, to imagine how she or he might feel or behave in the same situation as another individual; it may be a strategic social cognitive process recruited for tasks such as emotion recognition, empathy, or theory of mind. The current study includes both observation of a stimulus and imagination of the stimulus, to directly test whether participants use a network of regions involved in imagining others' experiences in order to understand an experience. A fundamental strength of this current study is the use of a real-world daily sampling measure of individuals' social interactions and their experience of these interactions, in order to test the hypothesis that the degree of simulation may relate to social functioning. The current study addresses gaps in the simulation literature by using a task designed to test the strength of an internally generated representation of a sensation in order to test the hypothesis regarding simulation in both healthy and clinical compromised populations. Going a step further, this study aims to relate the neural basis of simulation to its role in social functioning, a relationship that, to our knowledge, has not yet been explored. 40 volunteers, 21 high risk for psychosis individuals (HR) and 19 healthy controls (HC), ranging in age from 15-35, participated in this study. The task designed specifically for this study was effective in demonstrating the neural activity during the process of simulation. As individuals imagined what an experience would be like for them we saw activation in simulation related regions (e.g. somatosensory cortex and related areas) of the brain. When looking at differences between the two groups, healthy young adults and young adults at clinical risk for psychosis, we found group differences in brain activity in the somatosensory cortex and the calcarine sulcus during the simulation condition, with the HC group showing greater activity in these regions than the HR group. Activation in the somatosensory cortex was seen in each group separately and was related to social support, social approach,

positive social experiences, empathic concern, and perspective taking. This study suggests that healthy people use the process of simulation when they imagine themselves having the same experience as someone else, and this process is impaired in individuals at risk for schizophrenia. Moreover the process of simulation is related to day-to-day social functioning.

D-58

THE RELATIONSHIP BETWEEN THE COGNITIVE AND AFFECTIVE COMPONENTS INVOLVED IN HUMOR COMPREHENSION AND APPRECIATION

Midori Shibata, Hokkaido University, Keio University; Yuri Terasawa, Keio University, National Institute of Mental Health, Japan Society for the Promotion of Science; Satoshi Umeda, Keio University - The perception of humor evokes a pleasant emotional response in addition to causing laughter or changes in the brain and body via the autonomic and endocrine systems (Panksepp, 1993). Recent neuroimaging studies using a verbal joke have examined the neural substrates involved in humor comprehension (Bekinschtein et al., 2011; Chan et al., 2012; Goel and Dolan, 2001, 2007). These findings have begun to map the cortical regions involved in the cognitive processes of humor comprehension and the subcortical limbic areas underlying the emotional response of humor. However, the relationship between the cognitive and affective components remains unclear. In this study, we used the same target sentences for two conditions (the humor and literal sentence conditions) to identify the specific activation of humor comprehension. The first two sentences and the target sentence (punch line) were identical, while the third sentence differed between conditions. The important difference between the humor and literal sentence conditions was that the punch line (target sentence) in the humor sentence condition induced a perception of funniness, while the use of the same sentence in the literal sentence condition did not. The results indicate that despite using the same sentences, only the punch line in the humor sentence condition induced a perception of funniness and resulted in greater activation in the fronto-temporal region and the mesolimbic reward region. We found that the fronto-temporal regions are involved in processing the semantic aspects of humor comprehension. Further, the punch line in the humor sentence condition showed greater activation in a network of subcortical regions, including the hippocampus, amygdala, ventral striatum, and midbrain, which have been implicated in experiencing positive rewards. In addition, functional connectivity analyses revealed that the activity of the ventromedial prefrontal, inferior frontal (BA 47; pars orbitalis), and middle temporal cortex functionally interacted with that of the mesolimbic reward region. These results suggest that the network including the ventromedial prefrontal, inferior frontal (BA 47; pars orbitalis), middle temporal cortex and mesolimbic region plays a critical role in the interaction between the cognitive and affective components involved in humor comprehension and appreciation.

D-59

THE DURABILITY OF COGNITIVE REAPPRAISAL APPLIED TO AUTOBIOGRAPHICAL MEMORIES

Alisha C. Holland, New York University; Bruce Dore, Columbia University; Lila Davachi, New York University; Kevin N. Ochsner, Columbia University - Cognitive reappraisal is an effective strategy for reducing negative affect when employed during emotional autobiographical memory (AM) recall (Holland & Kensinger, 2013). However, little is known about whether regulation effects are sustained when reappraised memories are recalled in the future or about the factors that may contribute to this durability. One potential factor is the nature of the practice that individuals have with reappraising their memories. For example, repeated practices that are distributed over time may allow for stronger consolidation of reappraised events than repeated practices that occur with little rest. A second factor is the amount of time that individuals spend practicing each reappraisal. We addressed both variables by instructing participants: (1) to reappraise negative AMs twice, with either a 24-hour or 10-minute space between reappraisals (within-subjects factor) and (2) to reappraise at their own pace or with a fixed amount of time (between-subjects factor). One week following a baseline memory generation session, 23 participants received instructions for reinterpreting negative AMs (Decrease Condition) and for recalling AMs as they normally would (Remember Condition). They viewed Decrease and Remember instructions with self-generated titles for a subset of their AMs. Following either a fixed (14 sec) or self-paced ($M = 24.75$ sec; $SD = 11.37$ sec) period, participants rated how much negative affect they experienced during recall. Twenty-four hours later, they completed the identical task with a different subset of memories. When affect ratings from both days were submitted to a 2 (Timing: Self-Paced, Fixed) X 2 (Condition: Decrease, Remember) mixed ANOVAs, only main effects of condition were significant, confirming that memories in the Decrease (vs. Remember) condition were rated as less negative ($p < .001$, $\Delta\hat{p}2 > .57$). After a 10-minute delay, participants again Decreased or Remembered and re-rated the events from the prior day (i.e., Distributed Practice) and from that day (i.e., Massed Practice). Affect ratings were submitted to a 2 (Timing) X 2 (Condition) X 2 (Practice: Distributed, Massed) mixed ANOVA. A main effect of condition confirmed that individuals successfully reappraised their affect for the Decrease condition ($p < .001$, $\Delta\hat{p}2 = .61$). A trending Condition X Timing interaction revealed a greater difference between the Decrease and Remember instructions on the self-paced task, $p = .07$, $\Delta\hat{p}2 = .12$. Following another 10-minute delay, participants re-rated their negative affect for each memory to test the durability of their reappraisals. A 2 (Timing) X 2 (Condition) X 2 (Practice) mixed ANOVA revealed a main effect of Condition, with lower ratings for memories that had previously been reappraised ($p < .001$, $\Delta\hat{p}2 = .59$). A trending 3-way interaction was evident, such that memories with distributed reappraisal practice showed greater durability when regulated at a self-paced rate, whereas memories with massed practice showed greater durability when regulation time was fixed ($p = .09$, $\Delta\hat{p}2$

= .14). Taken together, these results suggest that (1) negative AM reappraisal is durable over a short delay and (2) both the amount of time spent practicing reappraisals and the spacing between those practices may influence this durability.

D-60

FEELING THINNER: HEALTHY PEOPLE UNDERESTIMATE THEIR OWN BODY *Stefania Cannella, Alessia Folegatti, Massimiliano Zampini, Francesco Pavani; University of Trento* - How accurate are we in perceiving body size? The methods commonly used to investigate perception of body size rely on asking participants directly about their perceived body size, to match their body from a range of silhouettes, or to adjust images to match their perceived body size. In the present study, the methods of constant stimuli has been adopted as a less subjective approach to body size estimation. Twenty participants (10 females and 10 males) judged the size of their own body or of the body of a stranger, in a forced-choice task on body stimuli of different size. Images of the Self with different degrees of size distortions (trunk and waists increased or decreased by $\pm 50\%$, $\pm 10.7\%$, $\pm 7.1\%$, $\pm 3.6\%$) were created from a whole body picture of the participant, wearing tight black cloths. Similarly, images of the Other with different size distortions (again trunk and waists increased or decreased by $\pm 50\%$, $\pm 10.7\%$, $\pm 7.1\%$, $\pm 3.6\%$) were created from a picture of an unknown person of the same gender as the participant. Participants built an internal representation of the Other by observing three movies that showed her/his interactions with the environment. Across blocks, participants judged whether the presented body (image of the self, or image of the other) was fatter or thinner than their own body or than the body of the stranger.. For each participants we fitted a logistic function, and we extracted the PSE (point of subjective equality) and JND (just-noticeable difference). ANCOVA on PSE with judgment (self or other), congruency between the judgment and the body presented (congruent or incongruent) and gender (male or female) as independent variables, and Body Mass Index (BMI) as covariate, revealed a significant main effect of Judgment, caused by negative PSE when judging the size of own body but positive PSE when judging the size of the actor body. Furthermore, when judging incongruent bodies (i.e., judging Self while seeing Other) this effect was modulated by BMI. Similar analyses on JND did not reveal any significant effect. These findings reveal a striking underestimation of the own body in healthy people. Unlike previous works (Mohr et al., 2007) we found no difference between males and females. At least two explanations may account for these results. First, these findings may reveal a self-serving body-image bias in the healthy people, which leads to underestimation of own (but not others) body size. Alternatively, they may originate from the body distortion in the somatosensory homunculus, because underestimation was observed for a body part (trunk and waists) that are under-represented in this neural body representation.

D-61

STRONGER THAN GENETICS? ANALYSES OF MURINE MODELS PROVIDES EVIDENCE THAT LIFESTYLE ENRICHMENT CAN OVERCOME GENETIC PREDISPOSITION FOR AGE-RELATED COGNITIVE DECLINE *Vanessa M. Doulames, Sangmook Lee, Thomas B. Shea; University Massachusetts Lowell* - Alzheimer's Disease (AD) manifests from a complex etiology that encompasses multiple risk factors. These include genetic, dietary, environmental and social deficiencies. No single category is sufficient to account for the total prevalence of AD, suggesting that the combinatorial impact of two or more risk factors is required for clinical manifestation of AD. The relative impact of these various factors remains elusive due to their inherent diversity among community-dwelling individuals. However, the reductionist approach afforded by analyses of genetically-engineered murine models maintained under controlled conditions can provide critical insight towards the relative impact of individual risk factors, as well as various combinations of two or more factors. Prior studies from our laboratory and others demonstrate that diets deficient in antioxidant vitamins impair cognitive performance in murine models, while, conversely, diets rich in antioxidants maintain or improve cognitive performance in mouse models (e.g., mice homozygously lacking apolipoprotein E) prone to age-related oxidative stress. Herein, normal mice were provided with "complete" or "deficient" diets (the latter lacking in folate and vitamin E and supplemented with iron as a pro-oxidant). Mice were housed in either a standard cage, or an "enriched" cage [1.5x larger, outfitted with 3 objects of interest (e.g., exercise wheel, tubes, exploratory cubes), with one object changed weekly] that promote exploration and mental stimulation. Cohorts of mice were housed "socially" (2-3 per cage) or individually ("isolated"). Prior to, and 4 weeks after housing under the above conditions, mice were subjected to standard Y maze analyses and Novel Object Recognition (NOR; in which they were housed in an arena with a familiar and novel object, and the amount of time which they explored each object was quantified). Following these analyses, mice were sacrificed and lipid and protein oxidation was quantified in brain tissue. Mice maintained in the enriched environment outperformed those in the standard environment, regardless of diet. Mice housed socially outperformed those housed individually regardless of environmental conditions. Analyses of brain tissue revealed that the enriched environment reduced dietary-induced oxidative stress. These results, coupled with prior studies, suggest that environmental enrichment has a stronger impact on cognitive performance than nutrition or social interaction. Since nutritional supplementation has been shown to compensate for critical genetic risk factors in murine models, extrapolation of these findings to humans suggest that environmental enrichment and social interaction exert powerful influences on age-related cognitive decline that may even overcome genetic risk factors. These findings highlight the importance of environmental and social stimulation during aging and AD.

D-62

ADAPTIVE OBSERVATIONAL LEARNING; THE RELIABILITY AND AMOUNT OF SOCIAL INFORMATION EFFECT INSTRUMENTAL LEARNING TO AVOID PUNISHMENT

Ida Selbing, Björn Lindström, Armita Golkar, Andreas Olsson; Karolinska Institutet - Social learning through observing others' actions can be safe and efficient because it does not incur the potential costs of individual trial and error. Nonetheless, information gained through observation might be less reliable than information gained through direct experience thus making social learning potentially risky. When observing the choice behavior of another individual, information about both the other's choices and the outcomes of these choices is normally available. However, it is unclear how humans use these sources of information to adaptively guide their own choice behavior when the information from the observed other is more or less reliable. To address this, we used a probabilistic two-choice task where subjects attempted to minimize the amount of punishment (electric shocks) by learning to select the stimulus less likely to predict a shock. Apart from being able to use direct learning subjects also observed the choices of another individual that also learned the task. We used a design similarly to the one previously used by Burke et al (2009) where the task was performed under three levels of available observational information; (1) no information, (2) choices only, (3) both choices and choice outcomes. In order to vary how reliable the observational information was, the observed other made choices that were either rational (near optimal) or irrational (random). The results showed that when observing a rational other, information about choices only resulted in similar performance as observing both choices and their outcomes, whereas when observing an irrational other, information about choices only led to performance on par with individual learning (no information condition). Analyses using reinforcement learning (RL) modeling showed that information from both observed choice and observed choice outcome were discounted when the behavior of the observed other was irrational. This is noteworthy because the observed outcomes of these choices could still be used to optimize own choice behavior. The RL model that best explained behavioral data included a reliability-parameter, which reflected the expected performance of the observed other, making observational information (both choice and choice outcome) less influential on own choice when gained from another that performs poorly. The RL model included the computation of (i) an action prediction error, defined as the difference between observed and predicted choice of the other, and (ii) an observational prediction error, defined as the difference between expected and observed outcome following the other's choice. These types of prediction errors have both previously been linked to separate neural correlates during observational learning; the action prediction error with the dorsolateral prefrontal cortex and the observational prediction error with the ventromedial prefrontal cortex. Taken together, the results show that humans estimate the reliability of social information to adapt their individual learning although not necessarily in an optimal manner.

D-63 *SANS Poster Award Winner

UNITED WE STAND: INTEGRATING PERSONALITY, DECISION THEORY AND NEUROSCIENCE TO INVESTIGATE CHOICE MECHANISMS IN A TIME DISCOUNTING TASK

Claudia Civai, Colin G. DeYoung, Daniel R. Hawes, Aldo Rustichini; University of Minnesota - Using a large sample of participants, we investigate the phenomenon of time discounting, testing how neural activation at the moment of perception of the options correlates with individual differences. As part of a study in progress, the current sample of 80 subjects performed a delay discounting task inside an MRI 3T scanner. The choice was between a lower early (e), not always immediate, payment and a higher late (l) payment. The paradigm used allows to distinguish the moment of the perception of e, the moment of the perception of l and the subsequent moment of the choice. Personality traits and intelligence (IQ) were assessed using, respectively, the Big Five Aspect Scale (DeYoung et al, 2007) and a short form of the WAIS-IV. Behavioral data were modeled using the hyperbolic function, where the subjective value (SV) of the reward depends on the objective amount, the delay and an additional parameter k, that represents the rate at which the reward is discounted. Log k was used as the measure of discounting: the higher the k, the higher the discount. Two linear regressions showed that: a) the difference in SV between e and l predicts log k, irrespective of whether e is immediate or not, and b) IQ is the only individual trait that predicts, with a negative sign, log k, meaning that greater intelligence is associated with less impatience (Burks et al, 2009). Two models were used to predict neural activation, and both focused on the moment of the perception of the option. The regressors in the first model accounted for 1) early_immediate (e_i) options, 2) immediate and non-immediate early options (e) and 3) SV, obtained by weighting all the options, both e and l, for their SV (Kable & Glimcher, 2007). Results showed that the activation in medial prefrontal cortex (MPFC), anterior and middle cingulate, ventral striatum and lateral prefrontal cortex (LPFC) increased with the increase of SV; however, although no effect of immediacy was found on behavior, a more ventral area of MPFC and posterior cingulate cortex were specifically activated by e_i. The regressors of the second model accounted for 1) e_i, 2) early non-immediate (e_ni) and 3) l options, all weighted for their SV. The contrast e_i vs l showed, again, a specificity for immediacy in the orbitomedial frontal cortex (OMFC); also, the activation of this area for e_i positively correlated with Extraversion (E), meaning that this trait, although not influencing the choice, increases the sensitivity of OMFC to immediate rewards. Moreover, the opposite contrast l vs e_i showed an increase in LPFC activation that correlated negatively with IQ; specifically, the higher the IQ, the lower the activation in LPFC for l, suggesting that more intelligent subjects need less recruitment of control areas to elaborate late options. Our results suggest that the combination of two possible mechanisms, one that is more sensitive to immediate rewards and the other based on self-control areas, determines the choice; moreover, individual differences, such as E and IQ,

predict both mechanisms differently.

D-64

LINKING WORDS TO OBJECTS: DOES IT MATTER HOW MUCH YOU LIKE THE SPEAKER?

Hannah De Mulder, Iris Mulders, Marijn Struikma, Jos van Berkum; UiL OTS, Utrecht University - Reference resolution, the ability to work out what speakers are referring to when they say things like "this experiment", or "that candle", is fundamental for communication. One powerful heuristic in this process is to take the speaker's perspective in determining the intended referent. For example, when a speaker wishes to draw the listener's attention to one specific object out of several objects, listeners should expect the speaker to only refer to objects that they both can see (i.e. that are shared). Interestingly, listeners are not always particularly good at using the speaker's perspective to determine reference, sometimes getting distracted by things that only they can see (Keysar et al., 2000). For instance, when people hear a speaker refer to 'the small candle' in a situation in which the speaker sees a big and a small candle while the listener sees those two plus an even smaller candle (that is hidden from the speaker's view), listeners are often distracted by the latter, even though they know it cannot have been the candle intended by the speaker. In the current study, we ask whether such a perspective-taking failure depends on whether listeners like the speaker or not, and, furthermore, whether any such effects vary with their prenatal testosterone level, and/or self-reported tendency to "take other people's perspective", as both factors have been shown to influence behaviour in social interactions. 56 female subjects participated in an eye-tracking study that required them to link particular objects to a sentence uttered by either a friendly or an unfriendly speaker. Crucially, the subjects knew that certain objects were only visible to them and that the speaker could thus never refer to those objects. On target trials, subjects had to actively ignore an object that seemed to fit the utterance, but was hidden from the speaker's view. To determine the role of speaker (dis)like in this process, subjects first played a game in which they could win or lose desirable items depending on the speaker's decisions. Prenatal testosterone was determined by calculating the ratio of the right hand index and ring finger; perspective-taking scores were taken from the Interpersonal Reactivity Index self-report scale. As in previous studies, subjects were distracted by hidden objects that seemed to fit the speaker's utterance. Critically, though, the level of distraction depended on subjects' like or dislike of the speaker, in combination with their self-reported tendency to take another's perspective and their prenatal testosterone exposure. Specifically, when listening to the unfriendly speaker, subjects who reported higher perspective-taking tendencies were especially distracted by the hidden object, whereas listening to a friendly speaker showed reduced distraction by this object. Additionally, subjects with lower prenatal testosterone exposure experienced significant distraction by the hidden object when listening to the friendly speaker. Surprisingly, these results thus suggest that under certain

conditions, speaker (dis)like actually influences listeners' ability to engage in a very basic aspect of human language processing: identifying what a particular word actually refers to even when the communication is about a simple, neutral visual scene.

D-65

IMPULSIVITY AND REAL-LIFE RISK TAKING ARE ASSOCIATED WITH DECREASED TENDENCY TO SHOW STANDARD FRAMING EFFECTS AND INCREASED REWARD PROCESSING FOR RISKY CHOICES IN THE GAIN FRAME

Christina F. Chick, Valerie F. Reyna, Oren N. Jaspan, Jeremy D. Ojalehto; Cornell University - Framing effects illustrate inconsistency in decision making and are a standard example of human irrationality. When choosing between two options of equal expected value, people tend to prefer the sure option when options are described as gains, but the risky option when options are described as losses. In this study, 32 participants completed a risky choice framing task in an fMRI scanner. Framing problems were presented as gains or losses, and participants chose either a sure or a risky option (e.g. in the gain frame, 600 lives at stake and choice between 200 saved for sure or 1/3 chance 600 saved and 2/3 chance no one saved). Individual differences in impulsive sensation seeking and in real-life risk taking were measured using the Impulsivity subscale of the Sensation Seeking Scale (Zuckerman-Kuhlman, Joire & Kraft, 1993) and the Adolescent Risk Questionnaire (ARQ, which has been validated for use with adults; Gullone, Moore, Moss & Boyd, 2000), respectively. Participants high in impulsive sensation seeking were less likely to show the standard framing effect, and they showed increased activation in the left dorsal striatum (putamen and caudate) as well as the right inferior frontal gyrus when choosing risky options in the gain frame. Participants who took more risks in real life were also less likely to show the standard framing effect, and they showed increased activation in bilateral insula, bilateral dorsal striatum (putamen and caudate), and left orbitofrontal cortex when choosing risky options in the gain frame. These results upend common assumptions about the mechanisms of framing effects, suggesting that framing is not driven by impulsivity, lack of impulse control, or hyper-responsiveness to reward. Rather, these qualities lead to reverse framing, a preference for the risky option in the gain frame (for which the magnitude of potential gains is higher, since the options are constrained to be equal in expected value) and the sure option in the loss frame (for which the magnitude of potential losses is smaller). These findings are consistent with the mechanism of reverse framing proposed by Reyna, Estrada, DeMarinis et al. (2011) and question the interpretation of framing effects as the hallmark of irrationality, since individuals who are less rational in real life show a decreased propensity for standard framing effects.

CEREBELLAR CONTRIBUTIONS TO THE DIMENSION OF DOMINANCE IN AFFECTIVE PROCESSING

Alyson Negreira, David Gansler, Matthew Jerram; Suffolk University - Emotion is a dimensional construct, comprised of valence, arousal, and dominance. Neuroimaging studies of emotion have primarily studied the neural correlates of valence and arousal, leaving dominance neuroanatomically unexplored. As a result, the role of the cerebellum in the perception and experience of dominance has not been studied to date. In the current emotion regulation study, sixteen male participants viewed images from the International Affective Picture System (IAPS) while undergoing functional magnetic resonance imaging (fMRI). Four conditions were created using IAPS normative ratings: (1) passive viewing of negative valence, negative dominance, (2) passive viewing of neutral valence, neutral dominance, (3) top down processing of neutral valence, neutral dominance where the participant was instructed to make the image more negative, and (4) top down processing of neutral valence, neutral dominance where the participant was instructed to make the image more dominant. Functional and structural MRI data were analyzed using the standard processing stream of the Martinos Center for Biomedical Imaging (<http://surfer.nmr.mgh.harvard.edu>). When engaging in top down processes to make the image more negative, relative to more dominant, reduced activity was observed in the cerebellum (MNI coordinates: 31, -73, -23). Overlap analyses suggest that this cerebellar region is implicated in the cerebellar representation of the default mode network (Buckner et al., 2011). Studies of affective processing have focused on the dimensions of valence and arousal, and have restricted analyses to cortical and sub-cortical brain regions. Further research is needed to elucidate the cerebellar contributions in affective processes and specifically to that of the dimension of dominance in affective processing.

THE ROLE OF MOOD CONGRUENCY IN IMPLICIT PROCESSING OF EMOTIONAL FACIAL EXPRESSIONS: AN ERP STUDY

Zoe Kleiman-Tapley, Erik Arnold, Colin Quirk, Jane Couperus; Hampshire College - Affective neuroscience research has found that congruency between a participant's current emotional state and the emotional valence of presented visual stimuli affects the processing of faces and facelike objects. Studies of inattention blindness have found that participants more often notice unexpected face or facelike stimuli when the expression of the unexpected face is congruent with the participant's current emotional state (Becker & Leininger, 2011). Additionally, behavioral studies show that a mood manipulation exercise can yield a faster and more accurate discrimination of mood congruent faces vs. mood incongruent faces (Hietanen & Astikainen, 2012). ERP research has shown that the face-sensitive N170 component is modulated by emotional facial expressions when the processing of a face is a non-explicit part of the task (Blau, Maurer, Tottenham, & McCandliss, 2007), which mimics real-world instances of

emotion recognition. The current study used a mood-manipulation writing exercise to induce happy or sad emotional states in 14 participants. Post-mood manipulation, all subjects were shown a series of photographs of happy, sad, and neutral faces, as well as images of circles and squares, and were asked to respond when they saw a geometric shape rather than a face. The N170 component showed a significantly larger amplitude after presentation of mood incongruent faces in both happiness induction ($p=.001$) and sadness induction ($p=.003$) conditions. These results are consistent with research on the cross-race effect and inversion that have shown an augmented N170 in response to unfamiliar or out-group faces (Freeman, Ambady, & Holcomb, 2010; Jacques & Rossion, 2007), indicating a cognitive in-group bias toward mood congruent faces, which in this study was present regardless of race. This study could have significant real-world implications for the facilitation of empathetic response, as well as providing electrophysiological evidence of neurological processes potentially correlated with affective empathy.

Poster Session H

Saturday, April 13, 2:45-4:15pm

H-01

AFFECT OF ENVIRONMENTAL VALUATION *Nik Sawe, Brian Knutson; Stanford University* - Environmental economists have often employed contingent valuation as a method of deriving people's willingness-to-pay (WTP) for intrinsic, nonmarket services of environmental resources, most famously to establish damages from the Exxon Valdez oil spill. Affective response plays a large role in generating this WTP, at times confounding contingent valuation measures by creating "protest zeroes" due to outrage over environmentally destructive land uses. Using functional magnetic resonance imaging (fMRI) and a charitable giving WTP task, we examined neural activation during environmental valuation in order to establish potential neural correlates of the decision process. This study was performed both in fMRI (n=14) and behaviorally (n=30) on healthy volunteers using a GE 3.0 T scanner (32 channel head coil, echoplanar pulse sequence, voxel size = 2.9 mm cubic, TR = 2000 msec). In 72 incentive-compatible trials, subjects were shown park land under threat of various new developmental land uses, and asked if they would donate from their endowed \$24 to avert the use. From survey data (n=66), parks were classified as iconic (e.g., archetypal) or non-iconic, and proposed uses as destructive or conservative. Subjects displayed increased activity in the nucleus accumbens, a region recruited in incentive processing, with increasing iconicness of the park ($p < 0.001$, uncorrected). The interaction of iconicness with the destructiveness of the use as well as the requested donation amount correlated with greater activity in the medial prefrontal cortex ($p < 0.001$, uncorrected), frequently characterized as an information integration region for incentive processing. Additionally, the interaction of destructiveness of the use and requested donation amount was correlated with increased activity in the anterior insula ($p < 0.001$, uncorrected), which responds broadly to aversive stimuli. These findings implicate reward/incentive circuitry for the processing of environmental valuation information during WTP tasks. With further study, fMRI may be a useful complement to surveys in assessing nonmarket valuation of environmental resources.

H-02

EFFECTS OF INSTRUCTED KNOWLEDGE ON AVERSIVE LEARNING *Lauren Y. Atlas, New York University; Bradley Doll, New York University; Jian Li, Peking University; Nathaniel Daw, New York University; Elizabeth A. Phelps, New York University* - In humans, expectations reflect both explicit knowledge and associative learning. For example, if an individual receives an electric shock every time she hears a tone, she will come to expect the shock upon tone presentation after several pairings. Alternatively, if she is simply informed about the contingencies, she will expect a shock even upon the first tone presentation. Most formal models of associative

learning assess responses as a function of reinforcement history regardless of explicit knowledge. However, recent studies of reward learning suggest that when participants are instructed about stimulus contingencies, the dorsolateral prefrontal cortex (DLPFC) inhibits learning-related signals in the striatum (Li et al., 2011; Doll et al., 2009). The aim of the present study was to understand how instructed knowledge modulates brain responses during aversive learning. Participants (n=64) were randomly assigned to one of two groups: the Instructed Group or the Feedback Group. All participants performed the same Pavlovian aversive learning reversal paradigm during fMRI scanning, wherein two visual cues were presented. One cue (the CS+) was paired with a shock on 30% of trials, whereas the second (the CS-) was never paired with a shock. The Instructed Group was informed about the original contingencies, whereas the Feedback Group received no explicit information. Following 8 presentations of each unreinforced CS and 4 presentations of the US (i.e. 20 trials), the contingencies reversed: The original CS- became the new CS+. There were three such reversals across the session. Upon each reversal, the Instructed Group was informed that contingencies reversed, whereas the Feedback Group received no explicit information. We examined responses in participants who showed successful fear acquisition, as measured by differential skin conductance responses (SCRs) between the CS+ and CS- prior to the first reversal (n=40). Fear expression tracked contingency reversals in both groups: Participants showed larger SCRs for the current CS+ than the current CS- throughout the task. We used between-groups t-tests to examine the effects of instructed knowledge on brain responses during aversive learning, focusing on differential fear responses (i.e. [current CS+ > current CS-]). We found group differences in right DLPFC, such that the Instructed Group showed greater DLPFC activation to the CS+ relative to the CS-, whereas the Feedback Group did not show differences in this region. Instructed knowledge also modulated responses in bilateral hippocampus: The Instructed Group showed hippocampal increases to the current CS- relative to the current CS+, and these differences were not observed in the Feedback Group. Our results indicate that instructed knowledge influences brain responses during aversive learning in humans and support a key role for the DLPFC in maintaining instructed cue contingencies.

H-03

BROODING PREDICTS SUSTAINED ATTENTION TO ERRORS AND HINDERS FEMALES' REBOUND FROM FAILURE OVER TIME *Ronald C. Whiteman, Alexander Shusterman, Jennifer A. Mangels; Baruch College, The CUNY Graduate Center* - Rumination is a persistent style of thinking that is characterized by evaluative self-reflection in response to negative mood and outcomes. Despite claims that rumination is helpful for solving problems and reducing negative affect, experimental and clinical studies have often shown otherwise. Indeed, ruminators tend to not only exhibit an attentional bias towards negatively-valenced stimuli, but they also seem to have difficulty disengaging from this material, perhaps because of repeated introspection on its perceived self-

relevance. Neuroimaging studies corroborate these findings, revealing that rumination is associated with increased and prolonged amygdala activity in response to negatively-valenced stimuli, as well as increased activity in the default mode network. Nonetheless, not all kinds of rumination may be bad - while being a "moody brooder" is maladaptive, especially for females, a more "reflective pondering" type of rumination may be adaptive. One context in which these ruminative tendencies may become active is in the face of academic failure. Surprisingly, no work has explored whether and how rumination may impact rebound from failure, especially as a function of gender or as failures compound over time. Here, we employed a challenging (65% errors) general knowledge test-feedback-retest paradigm to examine whether undergraduates' scores on the Ruminative Responses Scale (RRS) would influence the neural response to negative feedback, the ability to use that feedback to correct errors, and self-reported thoughts and feelings throughout the task. In particular, we looked at whether RRS scores would predict the amplitude of the Late Positive Potential (LPP), a centro-parietally maximal event-related potential (ERP) that has been shown to index controlled visual attention and sustained arousal processes in response to emotionally evocative stimuli. The LPP can be contrasted with the earlier frontal Feedback-Related Negativity (FRN), which indexes more automatic orienting to worse than expected outcomes. We predicted that brooding would hinder, but reflection would facilitate, rebound from failure, especially for females. Furthermore, we expected that brooding would predict more negative thoughts and feelings, coupled with an enhanced LPP (but no enhancements in the FRN) following negative feedback. These responses should become more pronounced as the task progresses and failures accumulate. Indeed, as the task progressed, females' brooding RRS scores (over and above depression) predicted increased negative thoughts and feelings, coupled with poorer encoding of corrective information. However, there was evidence that reflective rumination could buffer this effect, at least earlier in the task. The behavioral effects of rumination were largely mirrored in the neural response to the performance feedback. Again, for females only, brooding was significantly associated with an enhanced LPP to errors by mid-task, although by task's end this relationship was only marginally significant. Neither RRS subscale showed any relationship to the FRN. Taken together, these results suggest that females' tendency to exhibit moody brooding undermines their rebound from failure over time, potentially because of heightened, prolonged attention to error-related feedback. This pattern may be somewhat ameliorated by the extent to which females tend to exhibit reflective pondering, but these benefits are shorter-lived, suggesting that they can be depleted in the face of repeated failure.

H-04

NEURAL RESPONSES DURING EMOTION REGULATION ASSOCIATED WITH SUICIDAL IDEATION IN BORDERLINE PERSONALITY DISORDER *Alexa Hubbard, Columbia University; Jennifer*

A. Silvers, Columbia University; Jocelyn Shu, Columbia University; Hedy Kober, Yale University; Emily A. Biggs, New York State Psychiatric Institute; Eric Fertuck, Columbia University, New York State Psychiatric Institute; Jochen Weber, Columbia University; Kevin N. Ochsner, Columbia University; Barbara Stanley, Columbia University, New York State Psychiatric Institute - Borderline personality disorder (BPD) is characterized by deficits in emotion regulation as well as high rates of suicidal thoughts and behaviors. Neuroimaging research is beginning to uncover the neural correlates of emotional dysfunction in disorders such as BPD. However, the way in which emotion dysregulation, and its neural bases, relates to suicidal tendencies in BPD is currently unclear. The present study sought to examine the relationship between emotion regulation, as assessed during an fMRI task, and the clinical symptoms of BPD, including suicidal thoughts and behaviors. Forty-seven women diagnosed with BPD were scanned while performing a cognitive reappraisal task that asked participants to view aversive images while taking an immersed, emotional perspective or an objective, distanced perspective. Ability to regulate was measured by the drop in self-reported negative affect participants reported on 'distance' trials in comparison to 'close' trials. Individual differences in suicidal tendencies were measured by subjective self-reports of suicidal ideation and objective records of suicide attempts. We found that suicidal ideation predicted a greater number of suicide attempts as well as lesser ability to down-regulate negative affect and reduced activation of subgenual anterior cingulate cortex (sgACC) during the reappraisal task. The sgACC has been implicated in depression, autonomic control, and emotional responding. As such, these data suggest that suicidal tendencies in BPD are linked to changes in behavioral and neural indices of emotion regulation ability.

H-05

EXAMINING THE SAFETY SIGNAL VALUE OF SOCIAL SUPPORT: AN INVESTIGATION OF PREPARED SAFETY STIMULI *Erica Hornstein, *SANS Graduate Student Travel Award Winner, Naomi Eisenberger; UCLA - Research has consistently highlighted the benefits of social support for mental and physical health, but the mechanisms underlying these benefits are not well understood. In this research, we combine social support research with well-established models of fear conditioning and safety signaling in order to examine whether social support figures act as "prepared safety stimuli" during times of threat, naturally signaling safety and reducing threat-related stress, leading to an inhibition of fear learning. We hypothesize that social support reminders, in the form of images of close others, will interfere with fear learning such that individuals less easily associate fear with their close others. To examine this, we used a classic fear-conditioning paradigm, investigating the strength of conditioned fear for 3 different types of stimuli: social support stimuli (images of social support figures), stranger stimuli (images of strangers), and neutral stimuli (images of flowers and mushrooms). For each subject, images from each set were first paired with shock, during an acquisition phase, and*

then presented without shock, during an extinction phase, in order to test the strength of fear associations. Results showed that individuals formed typical fear associations for stranger and neutral stimuli, strong conditioned fear after acquisition, as measured by higher galvanic skin response (GSR), that were reduced but still present after extinction, as measured by marginally significant differences. Social support stimuli, however, did not produce any conditioned fear after acquisition, and, because there was no initial conditioning, no response was present after extinction. These results show that people do not form fear associations for their social support figures, suggesting that social support figures act as prepared safety stimuli, inhibiting fear learning and reducing threat-related stress, offering insight into the links between social support and well-being.

H-06

PERFORMANCE-RELATED SOCIAL DOWNWARD COMPARISON IS CHARACTERIZED BY INCREASED AND COUPLED ACTIVITY IN THE VENTRAL STRIATUM AND THE ANTERIOR CINGULATE CORTEX Lindner M., University of Bonn; Kuss K., University of Bonn; Birg R., University of Bonn; Falk A., University of Bonn; Weber B.134, University of Bonn, University Hospital Bonn; Fliessbach K.124, University of Bonn, University Hospital Bonn - The effect of social comparison on brain processes has mainly been studied in the context of monetary rewards. In this study we investigated whether social comparison processes exclusively based on non-monetary, performance-related information yield similar effects on brain processing. Thirty medical students performed multiple-choice tasks on medical knowledge, and after receiving feedback on the correctness of their answer they additionally received the information how many medical students from an independent reference group solved the task correctly. Results show that in case of correct answers BOLD activity in the ventral striatum and the dorsal anterior cingulate / medial prefrontal cortex was negatively related to the number of reference group members who solved the task correctly (social downward comparison effect). This means activity in these brain region was the higher the more the individual performance deviated positively from the average comparison group's performance. A similar reference group dependency was not found for incorrect trials (social upward comparison). An analysis of functional connectivity further showed an increased interaction between the ventral striatum and the anterior cingulate cortex during social downward (but not upward) comparison. This study identifies brain regions involved in social downward comparisons for non-materialistic, performance-related information.

H-07

THE IMPACT OF SOCIAL STIMULUS VALUE ON GOAL-DIRECTED AVERSIVE REINFORCEMENT LEARNING Björn Lindström, Armita Golkar, Andreas Olsson; Karolinska Institutet - Associations between stimuli with intrinsic negative value (e.g., threatening faces) and naturally aversive events (e.g., electric shocks) are more

easily learned than between stimuli lacking such value. Such preferential learning has mainly been shown in the context of classical conditioning. In spite of its importance to real-world behavior, it is unclear if this learning bias generalizes to goal-directed reinforcement learning in humans. In the first experiment, we used a paradigm where participants learned to choose the option (pictures of angry or happy faces) that minimized the amount of electric shocks they received. We manipulated the risk of electric shocks for each option using a 2 (Phase: Initial/Reversal) \times 2 (Group: HappyToAngry/AngryToHappy) design, where the happy face for one group initially represented the optimal choice ($P(\text{Shock}|\text{Happy}) = .25$), but subsequently changed to be the sub-optimal choice ($P(\text{Shock}|\text{Happy}) = .75$) during the reversal phase. This design allowed us to disentangle stimulus-driven and goal-directed processes in their impact on reinforcement learning. The results showed that the value inherent in the stimuli powerfully impacted reinforcement learning. As predicted, we observed facilitated learning when the angry face was most predictive of electric shocks, relative to when the happy face was most predictive of electric shocks. In the second experiment, we extended these effects to the social group domain. This was accomplished by using the same reinforcement paradigm, but with stimuli signifying social group belonging (emotionally neutral male black and white faces shown to white participants). The results showed that performance was superior when the out-group (black) face was most predictive of electric shocks, relative to when the in-group (white) face was most predictive of electric shocks. These results extend previous findings of preferential fear learning to out-group faces in classical conditioning (Olsson et al, 2005), by showing that also goal-directed behavior is influenced by the stimulus's social group belonging. The results from both experiments could be reproduced by a simple reinforcement learning model where the value of the instrumental action (avoiding electric shocks) and the stimulus identity (Exp.1 : Angry face. Exp.2: Out-group face) was additive. This model parsimoniously explains how the observed behavior can result from the congruency or incongruence between an action (e.g., avoiding shocks) and stimulus value. Furthermore, by positing separable valuation components for the instrumental action and the stimulus value, the model hints that these processes likewise could be separable in the neural substrate. Previous research has shown that amygdala-striatal interactions underlie avoidance learning (Delgado, Jou, LeDoux & Phelps, 2009), suggesting that similar mechanisms might be recruited by our experiment. For example, the instrumental value could be represented by the medial prefrontal cortex and the dorsal striatum, whereas the amygdala might represent negative stimulus value. Taken together, these experiments show that the value of social stimulus can have a powerful impact on goal-directed reinforcement learning.

H-08

NEURAL MECHANISMS UNDERLYING REVERSAL LEARNING IN REWARD AND PUNISHMENT CONTEXTS

Feng Xue, Vitaliya Droutman, Gui Xue, Stephen Read; University of Southern California - Adaptive decision-making in social and physical situations requires the ability to quickly adjust responses to changing environments. This flexibility is often measured using a reversal-learning paradigm, in which participants need to effectively overcome established associations and learn new ones based on feedback. Although a number of neural regions have been implicated in reversal learning, the specific functional contribution of each in this context remains unclear. A typical reversal-learning paradigm involves at least three components: the detection of contingency change, the reconfiguration of stimulus-response mapping, and the expression of new behaviors under the continuing interference of old associations. The current study separates these components, by focusing on contrasting reversal learning with initial acquisition (general reinforcement learning). It also examines whether the neural mechanisms involved are different for reward and punishment. We used a learning paradigm adopted from Ghahremani, et al (2010), where subjects learn whether a novel image was associated with the left or right key through deterministic feedback. The contingency was then reversed and subjects learned the new image-key association over 5 repetitions to high accuracy. Each participant performed two sets of the task on different days: one with monetary reward and one with moderate electric shock as feedback in a counterbalanced order. Forty-one men participated in the study as part of a large-scale project examining the behavioral and neural mechanisms of risky sexual decision-making among young gay men. The present functional imaging study identified three distinct neural networks for reversal learning. Specifically, the dorsolateral prefrontal cortex showed strong activity when comparing the first reversal error trials with initial acquisition error trials, suggesting its role in detecting contingency change. In contrast, the dorsal medial PFC and the left parietal lobule showed strong activity when comparing the first correct response after reversal with the first correct response during acquisition after the initial guess, suggesting their role in reconfiguring the stimulus-response mapping and response switch. The right OFC and insula were also found in this comparison. The right OFC and insula were also found in the contrast between subsequent reversal trials and initial learning trials, consistent with their role in inhibiting the old contingency and expressing relearned behaviors under interference. These networks were highly overlapping for the reward and punishment conditions. Behavioral results show higher accuracy under the reward condition during learning but not in the reversal phase. Decision-making was faster under reward condition for both phases. By comparing the brain responses at various stage of learning between initial acquisition and reversal, we have clearly dissociated subprocesses specific to reversal learning, including the detection of contingency reversal, stimulus-response remapping, and the expression of new behavior under interference from prepotent responses.

Furthermore, the feedback manipulation revealed overlapping mechanisms for reward and punishment reversal learning. These results provide deeper insight into the neural mechanisms of reversal learning, which could help to understand the impulsive behaviors in risky populations, such as drug use and risky sex.

H-09

INDIVIDUAL DIFFERENCES IN RESPONSE CAUTION ADJUSTMENT: EVIDENCE FROM A MODEL-BASED NEUROSCIENCE APPROACH

Frini Karayanidis, University of Newcastle; Elise L. Mansfield, University of Newcastle; Andrew Heathcote, University of Newcastle; Birte U. Forstmann, University of Amsterdam, Max Planck Institute for Human Cognitive and Brain Sciences - Cortico-basal ganglia networks have been shown to underpin flexible trial-by-trial adjustment of response threshold, a latent diffusion model parameter that is used as an index of response caution. Using a cued-trials task-switching paradigm, Mansfield et al. (J Neurosci 2011, 31,14688-14692) showed that, consistent with distinct cortico-basal ganglia networks for risky vs. cautious decisions, response threshold setting was directly related to BOLD activation in striatum for repeat trials and inversely related to BOLD activation in subthalamic nucleus for switch trials. In this study, we use diffusion weighted imaging (DWI) to examine whether individual differences in preference for a more risky or more cautious response strategy are associated with structural differences in cortico-basal ganglia networks. Separate fronto-striatal networks were associated with adopting an overall more risky or more cautious response threshold. Specifically, preference for a riskier approach was associated with higher fractional anisotropy (FA) in the pre-supplementary motor area and the external capsule, while preference for a more cautious strategy was associated with higher FA in inferior frontal gyrus and anterior limb of the internal capsule. In addition, FA in these striatal regions mediated the relationship between response threshold and the amplitude of the cue-locked switch-positivity that is associated with advance preparation. These findings are consistent with the striatum being involved in setting both overall and trial-by-trial response caution.

H-10

SELF-CONTROL TRAINING GENERATES INCREASES IN NEURAL ACTIVITY RELATED TO PREPARATION AND EXECUTION OF RESPONSE INHIBITION

Lauren E. Kahn, Junaid S. Merchant, Elliot T. Berkman; University of Oregon - When our goals are not aligned with our habitual behavior, we are challenged to regulate our behavior. In cases like these, employing self-control allows us to override our habits in order to act in accordance with our goals. This type of self-control plays a role in many aspects of daily life, including financial transactions, health-related behaviors, and social interactions. An open question is whether such self-control can be improved with training, and what neural systems support such improvements. In our study, sixty adults underwent functional magnetic resonance imaging

(fMRI) in two sessions spaced three weeks apart, while completing the stop-signal task (SST). In between the two scanning sessions, half of the participants completed ten six-minute SST training sessions and the other half completed a control task. At each time point, self-control capacity for each participant was quantified as his/her stop-signal reaction time (SSRT), or the minimum time required for the participant to inhibit the prepotent motor response with 50% success when signaled to stop. The training significantly improved inhibitory control: those who completed the training sessions had greater improvements in their SSRTs than those in the control group. Furthermore, we compared brain activity during Stop versus Go trials, and found that the extent of right inferior frontal gyrus (rIFG) activity increased with respect to the slope of SSRT improvement over the ten training sessions. Additionally, we looked at the Cue period preceding the arrow stimulus - a period during which participants are preparing for a trial that may or may not require them to stop - and we found that activity in a more anterior region in the right middle frontal gyrus (rMFG) similarly increased with respect to the SSRT improvement slopes. Thus, self-control improvement outside the scanner, calculated as the SSRT slope, was associated with increases in the activity two separate brain regions (rIFG and rMFG), during two distinct portions of response inhibition (execution and preparation). These results may thus be elucidating two components of the self-control improvement process: an increase in the actual recruitment of self-control, as well as an increase in the preparation of such recruitment.

H-11

AFFECTIVE PRIMING OCCURS DURING CONTINUOUS FLASH SUPPRESSION

Regina C. Lapate, University of Wisconsin-Madison; Bas Rokers, University of Wisconsin-Madison, Utrecht University; Richard J. Davidson, University of Wisconsin-Madison - Continuous flash suppression (CFS; Tsuchiya & Koch, 2005) is an interocular suppression method that reliably precludes conscious awareness of visual stimuli for long durations (e.g., ~1000ms) relative to other more commonly used visual masking techniques, such as backward masking (~16.7-33ms). Given its robustness and reduced restrictions in stimulus presentation times, CFS could lend itself to a variety of paradigms in affective neuroscience that seek to describe the function and neural basis of conscious awareness in social-emotional information processing. However, prior studies adopting interocular suppression techniques such as binocular rivalry (Zimba & Blake, 1983) and CFS (Kang et al., 2011) have failed to find evidence of semantic priming by the invisible stimulus. This raises the possibility that during interocular suppression, stimulus processing is relatively shallower compared to in backward masking paradigms, where semantic analysis has been convincingly demonstrated (e.g., Dehaene et al., 1998). Nonetheless, because prior studies examining priming during interocular suppression employed neutral words as the invisible primes, it remains plausible that simpler, biologically relevant pictorial stimuli, which may have more direct access to meaning representations (Kouider &

Dehaene, 2007), could evoke priming. Thus, we here sought to verify whether affective priming by emotional faces occurs during CFS. Specifically, we conducted a 2 (Invisible Prime: Fearful vs. Neutral) x 2 (Visible Target: Fearful vs. Neutral) factorial within-subjects experiment, whereby individuals were asked to indicate the emotion displayed in a visible target as quickly as possible using a 2-button response box. Fearful or neutral primes were rendered invisible via CFS for 2 consecutive 1000ms intervals, after which they were followed by a visible fearful or neutral target for a maximum of 2000ms (or until the participant made a forced-choice target-emotion categorization). Importantly, primes and targets did not overlap in identity or in size, and primes were never shown in the absence of CFS. Fifty-five individuals were run, 46 of whom were unaware of the suppressed primes as indexed by their performance in a 2-alternative forced choice stimulus identification task, $P(\text{difference from chance}) > .1$. Only correct target-emotion identification trials were analyzed (93.1%), and reaction time (RT) data were log-transformed to correct for skewness. The analysis of participants' RTs revealed a significant prime by target interaction, $F(1,45) = 5.8, P = .019$, indicating that when visible fearful targets were preceded by invisible fearful primes, participants were faster to identify fear in the target, relative to when fearful targets were preceded by invisible neutral primes, $P = .004$. Therefore, this study further establishes the utility of CFS as a technique to successfully manipulate visual awareness while enabling the processing of emotional valence of facial expressions. In addition, these data suggest that the neural circuitry upon which affective priming depends may differ from the one supporting semantic priming.

H-12

THE ROLE OF MENTALIZING IN FACE MEMORY

Robert G. Franklin, Jr., Brandeis University; Reginald B. Adams, Jr., The Pennsylvania State University; Nancy A. Dennis, The Pennsylvania State University - Mentalizing, or determining what another is feeling or thinking, and face memory are two critical skills for social interaction. Extensive work has examined how these processes work individually, but little work has looked at the relationship between these two social processes. Previously, we found that faces that naturally evoked deeper mentalizing were better remembered, indicating a possible behavioral relationship between the two processes (Franklin & Adams, 2009). However, no work has shown if experimentally eliciting greater levels of mentalizing leads to better memory or if there is a neural relationship between the mechanisms involved with mentalizing and face memory. Thirty participants completed two runs of an encoding task while being scanned using fMRI, with each run followed by a retrieval task. In each run of the encoding task, participants viewed 48 faces each for 2.5 seconds in an event-related design. Preceding each face, a mental state adjective was displayed for 1s and following each face, participants were shown a scale for 4s where they were asked to indicate the degree to which the adjective matched what the person was feeling or thinking. The adjectives preceding the faces were one of six adjectives that indicated a complex mental state (e.g.,

depressed, reflective) or one of six adjectives that indicated a basic mental state (e.g. bored, tired). Complex and basic mental state adjectives were selected based on ratings from pre-raters. Following each encoding run, participants completed a retrieval task where they saw all 48 previously seen faces along with 42 novel faces and indicated whether each face was a new or old face and whether they were highly confident in their judgment or had low confidence in their judgment. We found that faces encoded with complex adjectives were better remembered than those encoded with basic adjectives, supporting the assertion that greater mentalizing leads to better memory. Neural data were analyzed using SPM8 with a random-effects 2(encoding success: high confidence hits (HCH) versus misses) X 2(mentalizing condition: complex versus basic) ANOVA to examine whether complexity of mentalizing moderated neural activation involved with memory. We specifically examined the interaction contrasting activation for complex HCH to all other conditions (complex misses and HCH and misses encoded with basic adjectives). This interaction revealed increased activation in regions involved with mentalizing, including the dorsal and ventral medial prefrontal cortex (mPFC) and inferior frontal gyrus as well as activation in regions involved with face memory, including the left medial temporal lobe and right fusiform gyrus. In addition, connectivity analyses found that activation in the ventral mPFC was correlated with activation in the hippocampus for complex adjectives, indicating a neural relationship between these two sets of activation, further supporting the influence of mentalizing-related regions on face memory. These findings indicate that the neural mechanisms involved with mentalizing are associated with face memory and suggest that neural mechanisms involved with mentalizing can moderate face memory. This relationship specifically indicates the importance of social messages contained within a face and how those messages meaningfully influence the encoding of identity.

H-13

CAN ANGER MAKE YOU SMILE? HOW SOCIAL POWER MODULATES SPONTANEOUS FACIAL MIMICRY RESPONSES TO HIGH- AND LOW-STATUS OTHERS *Evan W. Carr, Piotr Winkielman, Christopher Oveis; University of California, San Diego - Mimicry, the often nonconscious process of replicating others' actions, is critical in forging and strengthening social bonds. Research has shown that social power—the capacity to influence others—reduces deliberative actions and consciously experienced feelings associated with rapport, such as affiliation, empathy, and perspective-taking. Yet, no study has examined how power influences positive and negative emotional mimicry. To test this, we measured facial electromyography (fEMG) from the zygomaticus major (“smiling muscle”) and corrugator supercilii (“frowning muscle”) while participants watched happy and angry videos of high- and low-status targets after being induced into different feelings of power. High-power participants reduced smiling mimicry toward high-status targets, whereas low-power participants returned smiles to all targets in a deference*

response. With frowning mimicry, all conditions displayed a more differentiated mimicry pattern to high-status targets. The results are the first to demonstrate that both power and status interact to affect low-level emotional mimicry processes.

H-14 *SANS Poster Award Winner

THE ROLE OF MEDIAL PREFRONTAL CORTEX BEYOND THE SELF: A COMPARISON OF SOCIAL VS. ACADEMIC APPRAISALS *Jordan L. Livingston, University of Oregon; Lauren E. Kahn, University of Oregon; Matthew D. Lieberman, UCLA; John C. Mazziotta, UCLA; Mirella Dapretto, UCLA; Jennifer H. Pfeifer, University of Oregon - The precise role of medial prefrontal cortex (mPFC) in social and affective processing currently remains unclear. Studies investigating self-referential processing have now demonstrated that self-appraisals are strongly associated with activation in mPFC. However, activation in mPFC has also been implicated in more general social cognition tasks. To further probe the broader role of mPFC, the current study tested whether this region shows preferential activation for social appraisals vs. academic appraisals, and if so, whether this activation is stable over development. Specifically, we analyzed data from the first longitudinal, within-subjects fMRI study that investigated self and other appraisals across domains. Typically-developing children and adolescents (N=27) were recruited for a longitudinal study at age 10 (time 1) and again at age 13 (time 2). In fMRI sessions at both time points, participants listened to evaluative phrases in both the social and academic domain and judged the extent to which each phrase was descriptive of the self and of another target, Harry Potter, about whom the participants had substantial knowledge. Data was preprocessed (including realignment, coregistration, normalization to the MNI template, and spatial smoothing) in NeuroElf and was modeled at the single subject and group level using SPM8. Results demonstrated an overall preferential activation in cortical midline structures (mPFC and medial posterior parietal cortex) as well as in right temporoparietal junction for social vs. academic information. A “logical and” conjunction analysis revealed all of these regions to be active above threshold in the social vs. academic contrast for both self and other appraisals and at both time 1 and time 2. Overall, results highlight the important role that social vs. academic information plays in activation of mPFC. We explore reasons why mPFC might show preference for social information, particularly in a developing population.*

H-15

DETECTING FACIAL EXPRESSION PROCESSING DEFICITS FOLLOWING ORBITOFRONTAL CORTEX DAMAGE *Megan L. Willis, Australian Catholic University, Macquarie University; Romina Palermo, ARC Centre of Excellence in Cognition and its Disorders, University of Western Australia; Ky McGrillen, Royal Prince Alfred Hospital; Laurie Miller, ARC Centre of Excellence in Cognition and its Disorders, Royal Prince Alfred Hospital, University of Sydney - Patients who have sustained damage to the*

orbitofrontal cortex (OFC) often exhibit changes in their emotional and social functioning. One deficit that may underlie abnormal emotional and social functioning is impaired facial expression recognition. However, evidence of deficits in facial expression recognition abilities in patients with OFC damage has been found in some, but not all previous experimental investigations. The aim of the current study was to determine if these inconsistencies may be a consequence of certain facial expression processing tasks being more sensitive in detecting deficits than others. We examined the performance of individuals with damage to the OFC on four different tasks assessing facial expression processing. The group of seven OFC patients demonstrated an impaired ability to label negative facial expressions (i.e., anger, disgust, fear and sadness) shown for a short time (500ms) when compared to a group of six control patients with frontal lesions that spared the OFC and a group of 25 healthy controls. When facial expressions were shown for a long time (5000ms), the OFC patient group's performance did not differ significantly from the non-OFC patient group or the healthy control group. The OFC patient group also exhibited an impaired ability to match subtle negative facial expressions, compared to both the patient and healthy control groups. However, no such deficit was observed when the OFC patient group matched prototypical facial expressions. The deficits recognising negative facial expressions presented for a short duration and of reduced intensity were evident despite the OFC patients displaying intact emotional conceptual knowledge and low-level perceptual processing of faces. The results suggest that tasks that are not readily amenable to the use of cognitive strategies appear to be sensitive to facial expression recognition deficits following damage incorporating the OFC. We propose that the results provide support for the suggestion that the OFC plays an important role in linking the perceptual representation of a facial expression to the conceptual knowledge associated with the signaled emotion.

H-16 *SANS Poster Award Winner

SOCIAL CLOSENESS AND DECISION CONTEXT MODULATE RISK-TAKING BEHAVIOR *Kamila E. Sip, David V. Smith, Mauricio R. Delgado; Rutgers University* - Risky decision making is modulated by a myriad of social factors. Little is known, however, about how input from close friends affects risk taking in economic decisions. To investigate whether social feedback from a close friend modulates risk taking, we employed a financial decision-making task that has been used to study framing effects (cf. De Martino et al., 2006, Science). On each trial, participants (N=31, 15 females) were presented with a monetary endowment (\$50 or \$100) before choosing between sure and gamble options. The sure option was framed such that the participant could keep (gain frame) or lose (loss frame) a fixed proportion of the endowment. The gamble option did not differ according to frame and was represented by a pie chart reflecting the probability (20, 40, 60, and 80%) of winning or losing the entire endowment. On half the trials, participants received occasional positive (e.g., "Man, you are great at this!") or

negative (e.g., "Come on, you can do better!") feedback from a gender-matched friend observing their choices. Consistent with a framing effect, we found that participants gambled more in the loss frame compared to the gain frame. Social feedback also affected gambling behavior, where participants gambled less in the gain frame following positive social feedback. We evaluated this interaction further by examining whether the change in gambling behavior was specific to social feedback or the frame of the preceding trial. We found that positive social feedback attenuated the framing effect only for trials that were preceded by a gain frame. These behavioral effects were modulated individual differences in social closeness: higher social closeness predicted increased risk-taking behavior in the loss frame. Preliminary neuroimaging analyses indicated that the receipt of social feedback in contrast to no social feedback evoked activation in regions such as bilateral anterior insula, inferior frontal gyrus, temporal poles and dorsolateral prefrontal cortex, which have been previously implicated in the process of understanding intentions of other. Using ventromedial prefrontal cortex as a region of interest, we also found that social closeness influenced the effect of frame and social feedback, where social feedback only affected activation evoked by frame for individuals reporting low social closeness to their friend. These results highlight the power and diversity of social influence on decision making, potentially pointing to the mechanisms that help shape our interpersonal choices.

H-17

UNDERSTANDING OTHERNESS *Lisa Aziz-Zadeh, Sook-Lei Liew, Tong Sheng, Mona Sobhani, Glenn Fox; University of Southern California* - Individuals can differ from the self on a multitude of dimensions, including having a different body, ethnicity, gender, personality, or degree of likability. In a series of fMRI experiments we explore the neural correlates of how we understand individuals who are dissimilar from the self. First we explore the most dramatic difference - having a different body than the self. In this study, we investigated how a congenital amputee (D.D.) process actions made by body parts they do not have and actions that are impossible for them, even with another effector. We find that when the action is possible for D.D., the inferior frontal/inferior parietal action observation network is active. However, when the action is impossible for D.D., mentalizing regions are additionally recruited. We also find that when D.D. views pain in a body part that she does not have as compared to one she does, there is activity in the insula and ACC, but not the somatosensory cortices. Thus she may "feel" the other's pain, but may not be able to localize it. Next we consider the neural correlates of how we understand a body that is both different from our own and we have never seen before. In this study, typically developed individuals viewed actions made by the residual limb of individuals with amputations. We find increased activity in the posterior parietal cortex when viewing novel, residual limb actions as opposed to more familiar hand actions. Interestingly, this effect is modulated by visual training and life experience with

individuals with residual limbs. In addition, we discuss data on observing dislikable individuals. In this study, Jewish individuals watched dislikable Neo-Nazis perform an action or experience pain. Data indicate modulation of the frontal component of the action observation network and the pain matrix based on likability. During pain processing, modulation was functionally correlated with activity in the prefrontal cortex. Finally we discuss the effects of race and familiarity on action understanding in a study where Chinese individuals view Caucasians make familiar or unfamiliar actions. We find increased mentalizing activity for familiar actions and increased parietal activity for actions made by individuals of the same race as the viewer. Putting this data together, a neural model for understanding dissimilar others will be discussed.

H-18

CHANGES IN SUBCORTICAL AREAS OF INTEREST SEEN IN PANIC DISORDERED POPULATIONS POST PSYCHOTHERAPEUTIC TREATMENTS

Inga Korsgaard, Andrew Gerber, Barbara Milrod Weill Cornell, Bradley Peterson; Columbia University - MRI is invaluable for studying the neurobiological mechanisms of psychiatric disorders and biological markers of treatment response. In this 2-site study, we performed MRI scans on subjects before and after undergoing three psychotherapies (Panic-Focused Psychodynamic Psychotherapy, PFPP, Cognitive Behavioral Therapy, CBT, and Applied Relaxation Training, ART) for DSM-IV Panic Disorder (PD). We also scanned a fourth group of healthy, matched controls across the same time interval. We aimed to demonstrate pre-treatment brain abnormalities in PD patients compared with healthy controls. Additionally, we explored changes specific to each of the three psychotherapies. We hypothesized that PD emerges from a combined disorder of inappropriate activity in subcortical fear circuitry (predominantly from the amygdala and hippocampus) and insufficient cortical control over the ensuing affective state. We used surface analyses to study sub-regions of the amygdala and hippocampus involved in these emotional processes. Functional MRI studies of self-regulatory control and affective processing elaborated the functional roles of the prefrontal cortex (PFC), amygdala, and hippocampus in our model. We hypothesized that psychotherapy works by improving cortical control over excessive subcortical activity. In this study we used the Simon Spatial Incompatibility task and the Affective Response and Control task fMRI paradigms. The utility of fMRI depends critically on the choice of task and control conditions and how well their comparison isolates a mental process that is of central interest to the pathophysiological process under study. We analyzed fMRI data from the first 17 baseline pilot scans in panic patients and compared them to 13 age, sex, and race matched controls who completed the same tasks. On the Simon task subjects with panic disorder showed greater activity in the amygdala and posterior attentional circuitry (premotor, parietal cortex bilaterally) during incongruent trials that activate prefrontal control in comparison with healthy controls. These findings suggest

that anxiety interferes with performance and forces more recruitment of attentional circuitry in panic subjects. On the Affect task subjects with panic disorder showed less of the association found in healthy controls between extreme ratings of valence (either positive or negative) and increased activity of the posterior cingulate/parietal cortex. This suggests a difficulty in the panic subjects in the judgment of emotional salience of affective stimuli. We have preprocessed and analyzed fMRI data from 5 subjects scanned pre and post psychotherapy in the panic disorder study. During the Simon task patients showed greater activity in brain regions after therapy associated with cognitive control of emotion but less activity in regions closely linked to the experience of emotion. On the Affect task patients showed less association after therapy between amygdala activity and ratings of valence. These preliminary findings suggest that psychotherapy can boost cognitive and attentional control and further disengage affective systems linked to emotional salience as seen compared to baseline activity. Successful refinement of these models will allow us to advance our understanding of PD, to develop new pharmacologic and psychotherapeutic treatments targeted to individual aspects of the disorder, and to predict which treatments will work best for which individuals.

H-19

INDIVIDUAL DIFFERENCES IN EMPATHY MODULATE NEURAL ACTIVITY CORRESPONDING TO SUBJECTIVE AGREEMENT OF POLITICAL INFORMATION

David Chou, Vijeth Iyengar, Roberto Cabeza; Duke University - While there have been a number of studies examining both the individual differences and neural correlates characterizing those of differing political ideologies, political interest or sophistication, (Kaplan et al., 2007; Amodio et al., 2007; Knutson et al., 2006; Gozzi et al., 2010), less research has focused on how individual differences in empathy interact with political judgments (but see Falk et al., 2012). To address this and other issues, we scanned participants in an alternating encoding-retrieval memory task. During encoding, participants viewed unfamiliar faces paired with political statements (e.g. Believes social security should be abolished) and rated the statements on a 4-point scale ranging from "strongly disagree" to "strongly agree." During retrieval, participants made intact or recombined judgments for previously encoded faces paired with either the original statements (intact trials) or with statements previously paired with other faces (recombined trials), along with confidence ratings. After the study, participants completed a battery of follow-up questionnaires assessing individual differences on a variety of measures including empathic concern (as measured by the interpersonal reactivity index (IRI)). Consistent with the enhancing effect of emotion on memory encoding, behavioral findings showed a U-shaped function with better memory for statements with which participants strongly agreed/disagreed in contrast to those eliciting more moderate agree/disagree ratings. When collapsing levels of agreement/disagreement and subsequently contrasting activity for trials endorsed with an agree response versus

those trials endorsed with a disagree response (Agree > Disagree), activity was evoked in a set of regions including the medial prefrontal cortex (mPFC). When interrogating the reverse contrast (Disagree > Agree), activity was observed in a set of regions that included a more dorsal region of the mPFC. Critically, it was observed that neural activity in areas within the mPFC, our functional region of interest, determined from the contrasts described above, were modulated by the extent to which participants engaged in empathic constructs critical for mentalizing, as measured by the IRI. These preliminary findings add to an already large body of evidence attributing the role of the mPFC in cognitive processes of emotional evaluation, self-referential processing, and autobiographical memory. They also add to a growing literature wherein findings have emerged, linking differences in empathy and activity in a network of regions, including the mPFC, reliably associated with mentalizing (Wagner et al., 2011). Ultimately, these preliminary findings may further highlight the role of individual differences in mentalizing on the neural processing of information that are either in line or in opposition to one's own beliefs.

H-20 *SANS Poster Award Winner

A SOCIAL DIMENSION TO THE AFFECTIVE CIRCUMPLEX Shir Atzil, *Northeastern University*; Ajay Satpute, *Northeastern University*; Tor Wager, *University of Colorado at Boulder*; Lisa Feldman Barrett, *Northeastern University* - Emotion is often experienced in social context.

Motivation to socially interact with others is a fundamental feature in evolution (for example in parenting and reproduction behaviors). Does that mean that specific brain regions or networks have emerged to support social functions? An alternative explanation would suggest that basic components interact to manifest social behaviors, and that there is no categorical distinction between social and non-social brain functions. Hence, the repertoire of neural responses to social and non-social stimuli could represent the two ends of one axis, rather than rely on separate brain mechanisms. In this study, our goal was to review the consistent characteristics of the "social affective brain" and compare it to non-social affective brain responses. We surveyed the neuroimaging literature for studies that used social or non-social cues to induce positive or negative affect. We then pooled across 401 contrasts and performed a meta-analysis using the Multi-Kernel Density Analysis method. We separately analyzed four conditions: A) social cues that induced positive valence (such as a loved person), B) non-social cues that induced positive valence (such as food), C) social cues that induced negative valence (such as fearful people), and D) non-social cues that induced negative valence (such as spiders). Results show that consistently across the literature, brain responses to social cues involve three components: visual perception regions (including the fusiform face area), a social-motivation/affiliation network (Bickart et al., 2012) (including the ventral striatum, medial amygdala and ACC), and a salience network (Downar et al., 2001) (including the IFG insula). Interestingly, the ventral striatum was involved in the response to social cues,

whether the valence was positive or negative. This result is consistent with recent work that gives a key role to dopamine secretion in the nucleus accumbens in exertion of effort and motivation, rather than mediating a hedonic pleasure response (Salamone et al., 2012). Additionally, many regions that have been implicated in social cognition, such as the ACC, insula, amygdala and IFG were also consistently activated in non-social positive valence paradigms. On the other hand, unique activations included the extra-striate cortex (also known as the extra-striate body area [Downing 2001]) in the social positive condition, the fusiform in the social conditions regardless of valence, and SMA and motor regions to positive valence regardless of the social value of the stimuli, possibly suggesting an appetitive approach response. Our results, consistently with the conceptual act model, support the hypothesis that different qualities of a stimulus, such as valence and sociality, are present in the brain as continuum axes, rather than have a dedicated brain region that has specifically evolved to process them. According to this hypothesis, domain-general networks are performing basic psychological functions, and the mental states required by different tasks are constructed from their interaction. Such approach offers a different dissection of neural brain responses, and searches for continuous changes to describe different psychological phenomena, as appose to a localized and functionally-categorical approach to affective neuroscience.

H-21

BE NICE IF YOU HAVE TO - A CAUSAL ROLE FOR THE DLPFC IN STRATEGIC FAIRNESS Sabrina Strang, *University of Bonn*; Jörg Groß, *Maastricht University*; Teresa Schuhman, *Maastricht University*; Arno Riedl, *Maastricht University*; Alexander Sack, *Maastricht University*; Bernd Weber, *University of Bonn*; Armin Falk, *University of Bonn* - Humans have the remarkable ability to inhibit their selfish impulses for the sake of socially valued goals. Every favor one is asked for implies a comparison between self-interests and social norms and usually we opt for the socially appropriate option (Glimcher et al. 2009). In order to make this kind of socially appropriate decisions it is necessary to control impulses associated with self-interest. The strain between selfish goals on the one hand and socially valued goals on the other hand is illustrated in the Ultimatum Game. In the Ultimatum Game one participant has to divide a sum of money and the other participant is asked to either accept or reject this allocation. Most people reject unfair offers (that are very unequal allocations), which ultimately leads to a loss for both participants. When deciding how to split a given amount of money, it is therefore important to anticipate these fairness concerns and control the selfish impulse to allocate most of the money to oneself. In a parametric version of the Ultimatum Game (a Dictator Game with punishment opportunity), Spitzer et al. (2007) showed that participants allocated significantly more money to the other players when the other player had the possibility to reject (punish) unfair offers compared to a situation in which the other participant could only accept. This 'strategic fairness' was correlated with higher activity in the rDLPFC. Here we test whether the DLPFC plays a

causal role in the ability to control selfish impulses and act strategically fair. Participants had to make allocations in a Dictator Game with and without punishment option. While making these decisions either the right or the left DLPFC was disrupted using transcranial magnetic stimulation (TMS). In a third additional condition we used sham TMS to either left or the right DLPFC. Assuming that the right DLPFC plays a causal role in anticipating fairness concerns and/or controlling selfish impulses, disrupting the rDLPFC should lead to an overall decrease of offers and a smaller degree of strategic fairness adaption (as measured by the difference in offers between punishment and no-punishment treatment). Both hypotheses are supported by our data.

H-22

ON THE EVOLUTION AND DISSOLUTION OF TRUST BETWEEN OUTGROUP MEMBERS *Adam Magerman, Matt Deegan, Kelly Jordan, Eric Hehman, Sam Gaertner, Mike Kuhlman, & Chad Forbes* - Interpersonal trust, or the extent to which individuals trust each other, is the foundation of human society. Whether an individual places their life in the hands of a doctor or hopes their hairdresser is competent, people are constantly deciding whom to trust and when. Despite the importance of understanding how we learn to trust others, little is known about how these mechanisms develop, or are undermined, over time as a function of who the other person is and how they are behaving. Further complicating matters is the degree to which preexisting biases, e.g., stereotypes or prejudice, may undermine the evolution of trust between two strangers. According to Dovidio et al. (2010), whites tend to report less chronic trust towards ethnic outgroup members and greater implicit bias in general, indicating that the development of trust between whites and novel ethnic outgroup members may be inherently complex, sensitive and prone to dissolution. We examine this question directly using a social neuroscience approach. Two studies were conducted to test the hypothesis that trust towards ambiguously behaving outgroup members evolves differently over time compared to ingroup members. Study 1 examined whether white participants' trust toward a Black confederate was dependent on how the confederate was actually behaving. To test this hypothesis, white participants took part in a coin flip game with a Black Confederates via teleconferencing software (this was actually pre-recorded video). In the coin flip paradigm, the reporter (who was always the black confederate) supposedly views a simulated coin flip, and is tasked with reporting the outcome of that coin flip to the player (who was always the white subject). Participants were told that at various points throughout the game it would be monetarily beneficial for the reporter to lie. The player is then asked to either trust what the reporter is telling them or not. Participants completed 10 blocks of 10 trials. The reporter was programmed to behave ambiguously but skew towards trustworthy (behaving in a trustworthy manner on 55% of the trials) or untrustworthy (behaving in an untrustworthy manner on 55% of the trials) behaviors. This allowed us to examine interpersonal trust on a trial-

by-trial basis. Results revealed a high variability of trusting behavior among white participants, regardless of whether the confederate behaved in a more trustworthy manner or not. Specifically, while all participants exhibited trusting behaviors initially, this trust quickly dissolved, spiked and ultimately decreased to outright non-trusting behaviors at below chance levels. Study two examined the neural correlates underlying these behaviors and whether trust towards ingroup members was more stable. Continuous EEG activity was recorded while white participants completed the coin flip game with either a white or black confederate. EEG Results revealed interesting dynamics between medial and lateral regions of the brain and areas important for person perception. Together these findings indicate that interpersonal trust between outgroup members is irascible and independent of outgroup members' actual behavior. These perceptions manifest at the neural level to alter how regions important for person perception interact on the order of milliseconds.

H-23

AUDIBLE SMILES AND FROWNS DURING SENTENCE COMPREHENSION *Anne van Leeuwen, Hugo Quené, Jos van Berkum; Utrecht Institute of Linguistics OTS, Utrecht University* - We often smile (and frown) while we talk. Listeners to such affective speech have to integrate the affective and the linguistic cues in the speech signal. Following up on earlier work (see Quené et al., 2012), we investigated whether and how affective phonetics (i.e. vocal expressions such as smiling) and affective semantics (sentence-level meaning) interact during spoken language comprehension of sentences and how perspective modifies these interactions. We explored this by presenting phonetically and semantically manipulated spoken Dutch sentences to listeners while collecting behavioral and neural (ERP) measurements. The target materials consisted of utterances that contained a positive or negative content word. Additionally, perspective was taken into account so that sentences were in first person ('ik') or in third person ('hij' or 'ze'). Utterances were phonetically manipulated using Praat's LPC analysis and resynthesis. Between analysis and resynthesis, the formant frequencies were manipulated (upwards or downwards shift: 10%) to imitate the spectral effects of facial expressions while talking (Ohala, 1980; Quené et al., 2012). This resulted in affective congruent realizations (positive - smiling, negative - frowning), or affective incongruent realizations (negative - smiling, positive - frowning). An example of an incongruent item would be 'Ik heb een prijs gekregen' ('I have got a prize') spoken with a frown. In the EEG study, participants just listened to the utterances while we measured their brain response 200 ms before until 1000 ms after the onset of the critical word. In the behavioral study, two different groups of participants were asked to judge whether the utterance (truncated at the offset of the critical word) was positive/negative (in terms of meaning), or smiling/frowning (in terms of articulation). The general predictions were that incongruent sentences were responded to more slowly and eliciting a greater N400 component than congruent sentences. We were especially

interested in the effect of perspective: would listening to first person perspective result in a qualitative and/or quantitative different response than the responses to third person perspective? We hypothesized that perspective would modify the effects because in the case of first person perspective the speaker's expression and unfolding sentence meaning both convey direct information about the affective state of the speaker, while in the third person case this link between expression and utterance meaning is less clear. Results will be discussed in the light of affective processing and how smiling and frowning influence the way listeners process speech. We will also discuss perspective and how perspective modifies responses to affective stimuli. References (1) Quené, H., Semin, G. R., & Foroni, F. (2012). Audible smiles and frowns affect speech comprehension. *Speech Communication*.

H-24

TRANSIENT PHASE-LOCKING OF PARIETAL RESPONSES TO REPEATED FACES: NEUROIMAGE EVIDENCE OF SUBLIMINAL MERE EXPOSURE *Ruei-Jyun Hung, National Yang-Ming University; Li-Fen Chen, National Yang-Ming University; Yong-Sheng Chen, National Chiao Tung University* - Affect has been recognized as an important factor of judgment and decision making. Numerous studies have demonstrated the effect of mere exposure, repeatedly presenting a stimulus to an individual, on creating her/his positive attitude or preference for that stimulus. One speculation of this phenomenon is that repeated exposure modulates one's affective state toward positive through enhanced familiarity. Broaden-and-build model was proposed that positive emotion advantages individuals to explore novel objects, which implicates that individuals with negative characteristic tends to behave more conservatively and towards things with higher familiarity. However, the neural mechanism underlying mere exposure effect (MEE) and how personalities affect the formation of MEE are still unclear. This study aimed at elucidating temporal dynamics of formation of mere exposure effect and in which cortical extent of that this effect subsequently correlates with personalities. We hypothesized that repeated exposure increases positive affect through cortical regions involving the frontal and parietal cortices related to familiarity processing and the changes of brain activities positively correlate with negative personalities. To test these hypotheses, we conducted a subliminal experiment with a 2 (exposure; single vs. repeated) \times 2 (emotion; happy vs. neutral) factorial design, including four sessions and 72 face images in total. During the exposure period, subjects were presented each face for 17 ms and subsequently masked with a scrambled face image. Subjective liking ratings for each exposed face and implicit affect ratings for unexposed neutral object images were measured by a four-point response pad after face exposure session. Thirty-three healthy volunteers were recruited in this study. Their magnetoencephalography (Vectorview, Elekta Neuromag, Finland) were recorded and analyzed by estimating neural synchrony using phase-locking factor together with permutation test. Repeated effect was tested using a paired t-test and

emotion induction effect was tested using a two-sample t test. Behavioral results showed that repeated exposure to neutral faces significantly increased positive emotion feeling ($t(31) = 2.639$, $p = .013$). The early MEE was observed at 20-30 ms post-onset over parietal regions. Subjects with relatively stronger emotion induction effect evidenced higher phase-locked responses in the parietal regions, correlating positively with level of anxiety ($r(17) = 0.48$, $p = .044$). Our findings suggest that parietal regions would play an important role in formation of MEE, which may associate with personality.

H-25

BRAIN SYSTEMS INVOLVED IN MAKING UTILITARIAN JUDGMENTS IN MORAL DECISION-MAKING *So Young Choe, University of Colorado Boulder; Scott Schafer, University of Colorado Boulder; Tor Wager, University of Colorado Boulder; Kyoung-Min Lee, Seoul National University* - The affective/intuitive system of moral judgment has been more emphasized than the reasoning/deliberative system recently. Although recent research has emphasized emotion's role in utilitarian judgments, the neural basis of the traits of individuals that contribute to those judgments has not been focused on. Two functional magnetic resonance imaging (fMRI) studies and a behavioral study were conducted to examine differences in the neurobiological mechanisms between subjects who are either high in utilitarian judgments ("High Utilitarian"), who tend to endorse more harmful actions for the greater good, or low in utilitarian judgments ("Low Utilitarian"), who do not endorse harmful actions, even when such actions would serve the greater good. Using personal moral utilitarian judgment scenarios (Greene, Sommerville, Nystrom, Darley, & Cohen, 2001), previous research found ventromedial prefrontal cortex (vmPFC) damage increased utilitarian judgment (Koenigs, Young, Adolphs, Tranel, Cushman, Hauser, et al., 2007). In our studies, groups pre-selected from a large sample to be High Utilitarian subjects vs. Low Utilitarian subjects make judgments about whether to opt-in to harm another for the greater good in three types of scenarios: High-benefit scenarios involve a difficult decision between the 'greatest good' and the emotional aversiveness of the action (e.g., pushing a man off a bridge) that must be taken to obtain it. Low-benefit decisions involve a similar aversive action, but without a clear 'greater good.' We found that High Utilitarian participants (relative to Low Utilitarian participants) show increased activation in vmPFC for high-benefit compared to low-benefit choices. This finding suggests that vmPFC activity is not necessarily related to the emotional impact of the scenario, as the greatest activation is shown by those who are most resistant to the emotional impact. Rather, it may be a marker for the difficulty of decisions involving approach/avoid conflicts in the social domain. Consistent with this view, Low Utilitarian participants show decreased activation in left anterior insula for high-benefit compared to non-moral choices. Additionally, Low Utilitarian subjects had decreased activation in right anterior insula compared to High Utilitarian subjects for when comparing moral to non-

moral judgments. These results suggest that low and high utilitarians approach utilitarian moral judgments in markedly different ways.

H-26

OBJECTS ASSOCIATED WITH SELF THROUGH IMAGINED OWNERSHIP LATER SPONTANEOUSLY ENGAGE BRAIN AREAS RECRUITED DURING EXPLICIT SELF-REFERENCING *Kyungmi Kim, Marcia K. Johnson; Yale University* - The concept of self can extend beyond activities of mind and the sense of body, for example, when self-relevant people or objects are included into one's sense of self (extended self: Belk, 1991). Neural support for the notion of extended self was recently provided by a study using an imagined ownership procedure: even when objects were transiently associated with the participants through imagined ownership, medial prefrontal cortex (MPFC), a brain area typically recruited during explicit self-referencing, showed greater activation when people imagined objects belonging to them compared to someone else (Kim & Johnson, 2012). Based on these findings of MPFC activity during ownership imagination, the current study investigated whether self-relevant objects spontaneously engage MPFC subsequent to the ownership manipulation. We hypothesized that to the extent that MPFC involvement during ownership imagination reflects acquiring associations between self and objects, self-associated objects should later spontaneously engage MPFC and possibly other cortical midline structures (e.g., posterior cingulate cortex [PCC]) even when the task does not require explicit self-referencing (cf., implicit self-referencing for personal semantic facts, Moran, Heatherton, & Kelley, 2009; for self-schema-relevant stimuli, Rameson, Satpute, & Lieberman, 2010). During fMRI scanning, participants performed a color oddball detection task where they were instructed to respond only to object pictures with a specific frame color (i.e., oddball). Critically, there were 4 object types: objects imagined prior to the scan to belong to the participants (Mine) or to someone else (Other), previously unseen non-oddball objects (Neutral), and previously unseen oddball target objects (Oddball). Preference ratings for the objects were obtained pre-ownership and post-scan to measure pre- vs. post-ownership preference change (i.e., mere ownership effect; Beggan, 1992). Also, during the post-scan phase, participants retrospectively rated how well during the pre-scan phase they could imagine owning each of the Mine items. The results showed that for Mine items, those objects that the participants were more successful at imagining owning showed greater activation compared to Other in MPFC as well as in PCC, suggesting that self-reported strength of association between oneself and objects modulated activity in these self-referential brain regions. In addition, increased preference (mere ownership effect) for the objects assigned to self, another behavioral manifestation of self-object associations, was also reflected in greater activity in MPFC. Overall, by demonstrating (1) spontaneous engagement of MPFC and PCC by objects associated with self through imagined ownership and (2) greater activity in MPFC for objects rated as more successfully imagined as belong to oneself

and for objects showing mere ownership effect, the present study provides strong neural evidence for the incorporation of personally relevant external stimuli into one's sense of self.

H-27

WHEN THE BRAIN GETS THE UPPER HAND: THE EFFECTS OF MOTOR ACTION ON EMPATHY *Shaham G., Hebrew University of Jerusalem; Perry A., University of Haifa; Aovizer H., Hebrew University of Jerusalem; Bentin S., Hebrew University of Jerusalem* - Introduction: Performing a motor action and viewing the same action performed by another produces similar brain activations. This phenomenon has been termed "motor resonance" and theories suggest that it is one of the mechanisms enabling empathy. However, support is usually limited to correlational data, not allowing to infer causality. If one could experimentally manipulate motor resonance, it would be possible to test its causal connection to empathy. Continuous muscle contraction elicits far reaching cognitive effects that can last up to several minutes after the motor manipulation. These effects are attributed to the spreading of Mu-rhythm desynchronization over central and frontal brain areas. Interestingly, during action observation, motor resonance is thought to be indexed by similar Mu rhythm desynchronization. It is possible then, that the muscle contraction paradigm can also affect motor resonance. Hypothesizing that such modulation can indeed occur, we explored the possibility of affecting empathic ability by activating the motor system. Methods: Participants were instructed to either squeeze a ball with their left hand, right hand or both their hands or simply to rest their hands on their knees for 4 minutes. Then, participants rated the valence and arousal of their reaction to emotional facial expressions and completed a test of emotion recognition. Individual differences in trait empathy were also evaluated using the Interpersonal Reactivity Index (IRI). Results: Accuracy in emotion recognition was related to the Perspective Taking subscale of the IRI. Emotion recognition was modulated by motor activation in a complex pattern, depending on gender and trait empathy. Conclusions: Motor activity may affect emotion recognition. This paradigm has the potential of providing an easy, yet powerful technique to investigate the long hypothesized causal role of motor resonance in empathy.

H-28

MAKING SENSE OF OTHERS: THE NEURAL CORRELATES OF PERCEIVING SOCIAL INTERACTIONS *Susanne Quadflieg, NYUAD; Francesco Gentile, University of Louvain; Bruno Rossion, University of Louvain* - How social expectations shape our perception of people surrounding us has long been considered a core issue in vision science. What has not yet attracted widespread empirical attention, is the question of how perceivers make sense of others who are not encountered in isolation. Put differently, whether people shake hands, take a walk, or have a conversation, they are often witnessed in each other's company. At what stage in the

person perception process does sensitivity to such interactions (and their inherent narrative) arise? To explore this issue, we used functional magnetic resonance imaging to measure neural activity while participants viewed images of two people presented on a uniform background. The shown agents were either interacting socially (e.g., involved in a marriage proposal or saying goodbye to each other) or not interacting. Non-interactions were created by presenting the exact same agents as in the interaction condition but not facing each other or by randomly pairing agents facing each other. Compared to these two control conditions, meaningful social interactions elicited reduced activity in cortical areas associated with person perception (e.g., the posterior temporal sulcus) and person understanding (e.g., the dorsomedial prefrontal cortex). In line with neural models of predictive coding facilitating information processing, these results support the view that social expectations shape the way our brains make sense of interacting others not only at an inferential level but also at a perceptual processing stage. More generally, these findings begin to elucidate the perception of person interactions in the human brain.

H-29

FUNCTIONAL CONNECTIVITY IN OBESE VS. HEALTHY WEIGHT YOUTH

William R. Black, University of Missouri-Kansas City; Rebecca Lepping, University of Kansas Medical Center; Joshua N. Powell, University of Kansas Medical Center; Amanda Bruce, University of Missouri-Kansas City; Cary R. Savage, University of Kansas Medical Center; W. Kyle Simmons, Laureate Institute for Brain Research - Background and Purpose: Rates of pediatric obesity have nearly tripled in the past few decades (Ogden 2002), and current estimates suggest that nearly 30% of children in the United States are obese or overweight (Ogden 2008). Recently, research has identified brain networks that might contribute to obesity. Areas in the limbic and paralimbic system such as ventral striatum, orbitofrontal cortex (OFC), and hippocampal formation have been linked to emotional reward processing and medial, dorsolateral, and inferior prefrontal cortex have been associated with behavioral control (Del Parigi, 2002; Hare et al., 2009). Although few studies have evaluated these networks in obese children compared to healthy weight children, recent work has demonstrated childhood obesity-related differences in prefrontal regions related to cognitive control (i.e. Bruce et al., 2010). The present study builds on this earlier work by evaluating differences between obese and healthy weight children in resting state functional connectivity between prefrontal cortex and OFC regions previously implicated in reward processing. Method: Nine healthy weight (Mage = 12.33 years; SD = 1.41; BMI < 85%ile) and nine obese youth (Mage = 11.67 years; SD = .87; BMI > 95%ile) were scanned after fasting for at least four hours. Resting state data were collected after two task-based functional scans in which children viewed food and non-food advertising logos. Region of interest analyses were conducted using AFNI, and 2mm diameter seed regions were placed in bilateral middle frontal gyrus (BA10) (42, 44, -5; -42, 44, -5). Seed regions were selected as areas showing

differential activity between obese and healthy weight children in the logo-viewing task (Bruce et al., in press). We next conducted between-groups comparisons of functional connectivity between the seed regions and two regions of interest (ROIs) previously implicated in the representation of reward: the medial and lateral OFC. Voxel-wise analyses were conducted within the anatomic masks, and multiple comparisons were corrected individually using small volume cluster correction. Results: Obese children exhibited greater functional connectivity compared to healthy weight children between the left middle frontal gyrus seed and the left medial OFC (7, -21, -14; 288 voxels; $t = -5.03$), as well as the left lateral OFC (31, -33, -4; 95 voxels; $t = -5.44$). Discussion: These findings demonstrate that obese children exhibit greater task-independent functional connectivity between reward/motivation regions (OFC) and cognitive/self-control regions (PFC), a finding that accords well with earlier work demonstrating that activity in OFC when viewing food stimuli is positively correlated with BMI in adolescents (Yokum, Ng, & Stice, 2011). The present findings were identified while children were not actively involved in a task, which may indicate that obese children are more sensitive to rewarding stimuli such as food than healthy weight children, and may be more hedonically driven in general than healthy weight children. These networks should be further evaluated in larger samples of obese and lean adolescents, and in children of different ages.

H-30

THE BRAIN'S VIRTUOUS CYCLE: AN INVESTIGATION OF GRATITUDE AND ETHICAL HUMAN CONDUCT

Glenn R. Fox, David Herman, Bosco Tjan, Hanna Damasio, Antonio Damasio; Brain and Creativity Institute, Dana and Dornsife Cognitive Neuroscience Imaging Center, University of Southern California - When we are the beneficiaries of good human conduct, we experience a concert of positive emotions ranging from relief to elation. These emotions can in turn motivate us to expend great sums of energy to reward those near the source of the good conduct, creating, quite literally, a virtuous cycle. If this cycle has a fuel or catalyst, it goes by the name of gratitude. As a topic of philosophical inquiry, gratitude has received volumes of attention, but empirical studies of gratitude are notably rare; gratitude's neural and physiological correlates are only just beginning to be investigated. In this study, we investigate the neural correlates of gratitude using an interdisciplinary method. We use functional magnetic resonance imaging (fMRI) combined with a powerful resource: testimony from survivors of the Holocaust, housed in the Shoah Foundation Institute's Visual History Archive at the University of Southern California. The archive is comprised of over 50,000 videotaped testimonials from survivors of the Holocaust. We have watched hundreds of these testimonies, from which we have compiled a collection of scenarios in which the survivor receives a gift. In the experiment, participants read these scenarios while we perform fMRI. For each scenario, participants take the perspective of the survivor as they read the story and imagine themselves as the recipient of the gift. The

gifts vary by nature. Some are based on stories where the survivor receives an insignificant gift, whereas other stories involve gifts that are lifesaving. For each gift, the participants rate how much gratitude they felt for the gift, along with how much effort it took to provide the gift and how much they needed the gift. These ratings are used to classify the gifts into separate conditions. We also use multiple regression analyses to correlate these ratings to each participant's brain activity. The participants report that the experience of going through the experiment changed how they view the Holocaust, and that they have a deeper empathy for the tragedy. Insofar as brain activity patterns, we hypothesized that gifts eliciting high levels of gratitude will be marked by increased activity in reward regions, such as the nucleus accumbens and the ventral medial prefrontal cortex, as well as regions associated with social bonding and joy, such as the subgenual cingulate cortex. Gifts that do not elicit gratitude, or elicit lower levels of gratitude, will elicit activity in a mix of regions associated with perspective taking, such as the temporoparietal junction and the posteromedial cortex, and regions associated with physical pain, such as the somatosensory cortex and the anterior cingulate cortex. Thus far, the study has revealed preliminary data in line with our predictions. The concert of brain activity accompanying the feeling of gratitude encompasses areas of the brain known for feeling happiness and interpersonal bonding. Gifts that elicit low levels of gratitude are marked by activity in regions of the somatosensory cortex associated with the experience of physical pain. Taken in sum, these findings form the neural underpinnings of gratitude and ethical human conduct.

H-31

RESTING CORTISOL AFFECTS THE RELATION BETWEEN ATTENTION AT ENCODING AND ACTIVATION DURING EMOTIONAL MEMORY RETRIEVAL

Kelly A. Bennion, Boston College; Jessica D. Payne, University of Notre Dame; Katherine R. Mickley Steinmetz, Wofford College; Elizabeth A. Kensinger, Boston College - Introduction: While many studies have shown that high levels of cortisol and/or stress during learning have an enhancing effect on emotional memory, others have found an impairing effect. In attempting to reconcile these discrepant findings, we have shown that cortisol affects not only attention at encoding and consolidation, separately, but also the relation between the two. Resting cortisol enhanced the relation between how long subjects looked at negative objects during encoding and their subsequent retention (Bennion et al., under review). Interestingly, this occurred only when subjects slept during the consolidation interval, suggesting that elevated cortisol may 'tag' attended information as important to remember, enabling sleep-dependent consolidation processes to solidify that salient information in memory. Here we investigated the neural correlates behind this finding, focusing on cortisol's influence on the relation between attention at encoding and activation during emotional memory retrieval, asking whether it differs if one sleeps versus remains awake during the encoding-retrieval delay. Methods: To assess

cortisol, subjects gave a saliva sample before viewing 124 negative and neutral objects within scenes, either in the morning or evening. To measure overt attention, subjects' eye gaze was tracked during encoding. To manipulate consolidation-phase processes, subjects either remained awake or slept (to optimize consolidation) during a 12-hour retention interval before recognition testing during fMRI. Results: Neural activity during retrieval of subsequently remembered negative objects was analyzed, examining the effect of subjects' cortisol levels when entered as a regressor. For those who slept during the consolidation interval, those with higher cortisol showed a stronger relation between looking time at encoding and successful retrieval-related activity in regions implicated in emotion processing, including the amygdala and vmPFC. For those who remained awake during the consolidation interval, this activity in the emotional network was not present; rather, those with higher cortisol showed a stronger relation between looking time at encoding and hippocampal activity during retrieval. Discussion: After a period of sleep, increased cortisol at encoding leads to a stronger relation between looking time at encoding and amygdala and vmPFC activity at retrieval, while following a waking delay, increased cortisol leads to a stronger relation between looking time and hippocampal activity during retrieval. The absence of hippocampal activity for the Sleep group is consistent with prior work showing that memories, initially dependent on the hippocampus, often transition to the neocortex during sleep-dependent consolidation. These results parallel behavioral findings from our lab, further supporting a modulating role of endogenous cortisol on the interaction between attention at encoding and emotional memory consolidation. In the present work, fMRI during retrieval has elucidated the mechanisms behind this finding, such that an interaction between sleep and cortisol is necessary for longer looking times to track with activity in emotional memory regions during successful retrieval. Because higher cortisol at encoding was also correlated with better negative object memory, again only for the Sleep group, this interaction between cortisol and sleep within the emotional memory network may enhance emotional memory consolidation.

H-32

EXPLAINING BEHAVIOR: PERSON PERCEPTION AND BIOLOGICAL MOTION BRAIN NETWORK DIFFERENCES DURING HELPFUL AND HARMFUL ACTIONS FROM HUMAN AND NON-HUMAN AGENTS

Beatrice H. Capestany, Lasana T. Harris; Duke University - People can quickly extract intentional and causal attributions for actions and behaviors originating from human (Fiske & Taylor, 1991, 2007) and non-human agents (Heider & Simmel, 1944) using mental state inference processes. The brain has adapted systems to support these inference processes, recognizing whether agents are animate (Blake & Shiffrar, 2007) so that we can determine the originator of action. This allows people to explain and predict the behaviors of an agent. Here, we assess the extent to which people use the same language to explain the behavior of human and non-human agents, and the extent to which person perception and biological

motion brain networks respond to animate action from a variety of human and non-human agents. While in the fMRI scanner, participants explained non-random, “meaningful” motion in a series of animated video clips showing three different human and non-human agents (greebles, shapes, human faces) engaging in matched helpful or harmful actions (Heider & Simmel, 1944). Results demonstrate remarkable similarities in the use of mental state inferences across the three different agents. Moreover, brain systems implicated in biological-motion detection and person perception were differentially engaged depending on the type of agent (human, non-human) and valence of behavior (helpful, harmful). Specifically, mental state inferences during harmful behavior drive activations in both systems, particularly when involving human agents. This dissociates the influence of brain networks engaged in social cognition beyond self-report behavior, hinting at categories of stimuli and behaviors that maximally drive these brain systems consistent with evolutionary theories about human behavior.

H-33

A NEURO-COMPUTATIONAL MODEL OF GUILT

Luke J Chang, *University of Colorado*; Alec Smith, *California Institute of Technology*; Martin Dufwenberg, *University of Arizona*; Tor D. Wager, *University of Colorado*; Alan G Sanfey, *Donders Institute for Brain, Cognition, and Behavior at Radboud University* - Emotions can be considered motivational states resulting from a combination of cognitive appraisals and physiological processes that act to influence behavior. Social emotions are particularly important for shaping social interactions, but are difficult to study from a neuroscientific perspective using animal models or standard affective imaging paradigms. In this study, we offer a novel approach to studying the experience of an emotion by combining a computational model of guilt with a real social interaction. Participants played as the second player in a single shot trust game while undergoing fMRI. After deciding how much money to return, participants were handed down their partner’s actual expectations. Our formal model of guilt, which posited that people would experience more guilt if they returned less than their partner expected, successfully predicted participant’s subjective ratings of guilt. A machine-learning algorithm identified a multivariate pattern of voxels that predicted our computational model of guilt using leave one subject out cross-validation. The results indicate that disappointing a relationship partner was associated with decreased activity in the ventral striatum and increased activity in the amygdala, insula, and anterior cingulate cortex. This pattern of results was also found when the algorithm was trained to predict guilt ratings, suggesting that our model was successfully capturing the experience of guilt. These results are consistent with the notion of guilt being a negative affective experience resulting from a negative social prediction error and demonstrate how the neural processes associated with an affective state can be uncovered using a computational approach.

H-34 *SANS Poster Award Winner

DELAYING GRATIFICATION DEPENDS ON SOCIAL

TRUST Laura Michaelson, *University of Colorado Boulder*; Alejandro de la Vega, *University of Colorado Boulder*; Christopher H. Chatham, *Brown University*; Yuko Munakata, *University of Colorado Boulder* - Delaying gratification is hard, yet crucial to individual and societal success. Prominent accounts of delaying gratification focus on sensitivity to reward magnitudes, relative to delay durations, and associated neural mechanisms in the nucleus accumbens, cingulate cortex, and prefrontal cortical regions (e.g., Ballard & Knutson, 2009). However, social trust may also play a central role. That is, delaying gratification may only make sense in a trustworthy social context, where individuals are confident that they will actually receive the delayed reward in the future if they opt to wait for it. Despite rapidly growing literature related to mechanisms of delaying gratification, social factors remain relatively unexplored. Limited evidence is consistent with a role of trust (e.g., Kidd, Palmeri, & Aslin, 2013; Mahrer, 1956), but could alternatively be interpreted in terms of other known factors, such as self-control, or more general reward effects. Thus, the trust factor may be of broad theoretical relevance, both for cognitive and neural frameworks. The present work tests whether social trust, manipulated in the absence of reward, influences choices about whether to delay gratification. Two studies were conducted in an online survey format, via Amazon’s Mechanical Turk, a website that allows users to complete small tasks for pay. Trust was manipulated using vignettes about fictional characters (Experiment 1, N = 18) and accompanying faces that varied in perceived trustworthiness (Experiment 2, N = 113). Delay of gratification was assessed using intertemporal choice questions, in which participants were asked if they would prefer a smaller, immediate reward or a larger, delayed reward from the character they read about. Across both experiments, trust influenced participants’ willingness to delay gratification. In Experiment 1, where trust was manipulated within subjects, participants were less likely to delay gratification in the untrustworthy condition, relative to the trustworthy and neutral conditions, $b = .38$, $SE = .04$, $z = 7.812$, $p < .0001$. Ratings of perceived trustworthiness suggested our trust manipulation was effective, $t(58) = 4.89$, $p < .0001$, and trustworthiness ratings also predicted probability of delaying, $b = .37$, $SE = 0.05$, $z = 7.65$, $p < 0.0001$. Similarly, in Experiment 2, where trust was manipulated between subjects, participants’ preferences for delayed rewards (as indexed by k) were significantly lower in the untrustworthy context, relative to the trustworthy and neutral contexts, $t(111) = -3.62$, $p < .001$. Ratings of perceived trustworthiness again varied by condition, $t(105) = 4.29$, $p < .0001$, Cohen’s $d = 0.8$, and perceived trustworthiness predicted k -values, $t(111) = -2.49$, $p < .05$, such that greater trustworthiness predicted greater delay of gratification. These results demonstrate an important and surprisingly overlooked role of social trust in delaying gratification. Social factors are largely absent from the burgeoning literature on neural mechanisms supporting delay of gratification; thus, such findings highlight the need to

revise prominent theories to incorporate the role of trust. Testing such possibilities for the role of trust, and investigating how trust and other social factors interact with established neural mechanisms, may greatly advance our understanding of the fundamental ability to delay gratification.

H-35

HOW TEMPERAMENT INFLUENCES HUMOR APPRECIATION IN CHILDREN

Pascal Vrticka, Stanford University; Michelle Neely, Stanford University; Elizabeth Walter, Stanford University; Jessica M. Black, Stanford University, Boston College; Allan L. Reiss, Stanford University - Emerging evidence from functional magnetic resonance imaging (fMRI) studies suggest that humor appreciation is a specific and well-differentiated higher-order human cognitive function. Humor mainly involves the resolution of conflict or incongruity through juxtaposition of mental states, and a positive feeling state related to mirth and/or reward. Because such patterns have not only been observed in adults but also in young children, humor appreciation appears to already be operational at early developmental stages. In order to further our understanding of the development of humor appreciation, this fMRI study focused on elucidating the association between child temperament and patterns of neural processing of humorous movie clips in 22 children aged 6 to 13. Temperament was chosen because it refers to personality traits that appear early during ontogenesis, display moderate stability, and involve distinctive biological manifestations. Here, temperament was assessed with the Emotionality Activity Sociability (EAS) questionnaire completed by the children's parents, which included a Shyness subscale. Data were controlled for age and IQ. Our results revealed that activation for humor appreciation was diminished in anterior superior temporal gyrus and midbrain in children scoring high on shyness, a temperament feature thought to reflect inhibition to the unfamiliar as well as feelings of tension and distress during social interactions (comparable to behavioral inhibition / fear in adults). In turn, humor appreciation was increased in bilateral superior temporal gyrus / temporo-occipital junction and midbrain in children with high (negative) emotionality scores, a trait that is usually associated with a general negative mood state and greater intensity of emotional reactions (comparable to neuroticism in adults). Such findings are of potential clinical relevance, because intra- as well as inter-individual variation in brain response to humor may serve as a biomarker of risk for particular psychological/psychiatric disturbances.

H-36

INCREASED REWARD-RELATED NEURAL ACTIVITY TO SOCIAL IMAGES PREDICTS EVERYDAY SOCIAL BEHAVIORS

Katherine E. Powers, Dartmouth College; Richard B. Lopez, Dartmouth College; Wilhelm Hofmann, University of Chicago; William M. Kelley, Dartmouth College; Todd F. Heatherton, Dartmouth College - Previous research has demonstrated that individual differences in reward-related neural activity can predict

real world behavioral outcomes. For example, prior research in our laboratory found that activity in the ventral striatum to food and sexual images predicted weight gain and sexual behavior over six months, respectively. Here, we sought to determine whether a similar neural mechanism might extend to social behavior. Specifically, we combined functional neuroimaging and experience sampling technology to examine whether reward-related neural activity in response to social images predicted the frequency of daily social behavior. During fMRI scanning, participants (N = 31) viewed a series of images of people, food items, and nature scenes in a standard cue-reactivity paradigm. The fMRI session was followed by an intensive week-long experience sampling period in which participants carried mobile devices and reported on a variety of social behaviors and situational factors, including their present location. This allowed us to determine whether individuals tended to spend more time in social situations (e.g., a fraternity) or nonsocial situations (e.g., one's own dorm room). Individuals showing higher activity in the ventral striatum and medial orbitofrontal cortex, regions reliably implicated in reward processing, when viewing positive social images spent more time in social settings on a daily basis. These findings show that heightened reward-related activity to social images predicts daily social life, and implicate specific brain regions in motivating day-to-day social behavior.

H-37 *SANS Poster Award Winner

AGE-RELATED DIFFERENCES IN FUNCTIONAL CONNECTIVITY DURING COGNITIVE EMOTION REGULATION

Eric S. Allard, Elizabeth A. Kensinger; Boston College - Successful emotion regulation partly depends on our capacity to modulate emotional responses through the use of cognitive strategies. Older age is sometimes associated with enhanced emotion regulation ability; however, age differences in the successful implementation of cognitive regulatory strategies is mixed. The current study examined age differences in neural activation patterns when cognitively regulating negative affect via two strategies: selective attention and reappraisal. We used psychophysiological interaction analyses to examine functional connectivity with a region of rostral ACC showing an age-related reversal in activity in response to the two regulation conditions: greater activity during selective attention for younger adults and reappraisal for older adults. Functional connectivity with this region was more robust for reappraisal relative to selective attention for both age groups. Younger adults demonstrated functional coupling of rostral ACC and medial prefrontal cortex (mPFC) while older adults demonstrated a more distributed network of activation that covaried with rostral ACC in posterior parietal regions and lateral prefrontal cortex (IPFC). We discuss our results in terms of how functional connectivity analysis help offer additional insight into our understanding of age differences in the successful implementation of cognitive emotion regulation strategies.

H-38

CUTENESS AFFECTS EMOTIONAL RESPONSES

Jessika Golle, Fred W. Mast, Janek, S. Lobmaier; University of Bern - Infants are among the most fragile, endearing, and valuable beings. They need protection and care. According to Konrad Lorenz, the Kindchenschema functions as an innate releasing mechanism that triggers care-taking behavior (Lorenz, 1947). The Kindchenschema is described by specific features that characterize infants such as large eyes, a high forehead, and relatively short and thick extremities. Previous studies found that infants that conform to the Kindchenschema are perceived cuter (e.g. Sternglanz et al., 1977) and evoke more affectionate interactions with their mothers compared to less cute infants (Langlois et al., 1995). In the current study we explored possible neurobiological underpinnings of the preference for cute infant faces. Particularly, we assumed that very cute infant faces elicit stronger emotional responses than less cute faces and neutral stimuli. We used pupil size and skin admittance responses as indicators of emotional arousal and facial muscle activity (corrugator supercili, zygomaticus major) as indicator for emotional valence. We recorded psychophysiological data of 60 participants (30 male, 30 female) while they were passively viewing 20 very cute and 20 medium cute infant faces, as well as 20 neutral objects (sugar pots). In addition, all participants evaluated the cuteness of each presented infant face and filled out an empathy questionnaire. We found stronger positive emotional reactions towards cute infant faces compared to less cute faces and neutral stimuli. Our results highlight the impact of facial cuteness on the activity of the autonomous nervous system, and suggest that stronger reactions contribute to the preference of cute infants and more affectionate interactions with them.

H-39

PERSON ATTRIBUTIONS UNDER STRESS

Jennifer Kubota, New York University; Rachel Mojdehbakhsh, New York University; Candace Raio, New York University; Tobias Brosch, University of Geneva; Jim S. Uleman, New York University; Elizabeth Phelps, New York University - When determining the cause of a person's behavior, perceivers often emphasize dispositional explanations and minimize situational explanations, an error known as the Fundamental Attribution Error (FAE). The FAE occurs in part because dispositional explanations are relatively automatic, whereas considering the situation requires additional cognitive effort. This model is supported by a recent brain imaging study, finding increases in dorsolateral prefrontal activity (DLPFC), a region linked to cognitive control, when individuals make situational attributions (Brosch et al., in press). If incorporating situational information requires DLPFC-related cognitive control, manipulations that have been shown to impair DLPFC function should result in more dispositional attributions. Acute stress impairs prefrontal cortical functioning and negatively affects cognitive control. To explore the effects of stress on attributions, participants were physiologically stressed or not before completing an attribution task and cortisol samples were collected

throughout. Compared to individuals under no stress, we found that stress resulted in increased cortisol and exacerbated the FAE so that individuals made more dispositional than situational attributions. These findings imply that individuals are more likely to commit the FAE when stressed.

H-40

NEUROENDOCRINE AND INTERGROUP DYNAMICS IN THE 2012 US PRESIDENTIAL ELECTION

Pranjal H. Mehta, Smrithi Prasad, Bethany Lassetter; University of Oregon - Testosterone and cortisol levels fluctuate when individuals compete for status in dominance contests. However there is little known about hormonal, psychological and behavioral changes in large-scale societal dominance contests. To address this gap in the literature, we tracked these changes in voters' during the weeks surrounding one such societal contest i.e. the 2012 US Presidential Election. 114 participants consisting of 55% Obama supporters, 29% Romney supporters and 16% undecided voters (2-3 weeks prior to the election) were recruited. The study consisted of a five-day naturalistic sampling period where the baseline and diurnal patterns of testosterone and cortisol were measured. Behavioral and attitudinal measures of the participants' political affiliation and inter-group behaviors were tracked using a daily diary and evening surveys. Our statistical analyses focus around two broad goals: (1) identify psychological moderators (e.g., in-group identification) of testosterone and cortisol changes before, during and after the election; (2) examine the consequences of election-related testosterone and cortisol changes for intergroup behaviors, such as out-group derogation (e.g., Romney supporters expressing negative sentiments toward Obama supporters/Democrats) and in-group favoritism (e.g. Romney supporters praising other Romney supporters/Republicans). This study takes a novel social endocrinology approach to study a societal-level dominance contest. The findings have theoretical implications for our understanding of group-based status hierarchies and how social and biological factors shape the political process.

H-41

THE RELATIONSHIP BETWEEN INDIVIDUAL DIFFERENCES IN SENSORY REACTIVITY AND ASPECTS OF SOCIAL COGNITION

Jillian Sullivan, Darci Nielsen, Sarah Schoen, Lucy Miller; Sensory Processing Disorder Foundation - The role of sensory processing in of social cognition is often overlooked but a shaping of the brain by environmental stimuli is fundamental to development. There is some suggestion that increased sensory reactivity may lead to greater social deficits, but findings from other disciplines have highlighted an enhancing effect of increased physiological or behavioral reactivity on social cognition. This study aimed to investigate the relationship between increased sensory reactivity and several aspects of social cognition and behavior in a sample of typically developing adults. Eighty-one adults (21 male and 60 females, aged 19-80 years) completed the Sensory Over-Reactivity inventory,

the Reading the Mind in the Eyes (RMiE) performance task, the Empathy Quotient (EQ), and the Prosocial Personality Battery (PPB) online. Although there was no association between sensory reactivity and the EQ or PPB scales, there was a significant positive correlation with performance on the RMiE task ($r(75)=0.42$). Gender differences may have occluded any significant correlation between sensory reactivity and the EQ and PPB scales however. Increased sensory reactivity promoted emotion recognition performance, but there was little association between sensory reactivity and self-reported indices of social abilities or prosocial behavior. Results are discussed with reference to differences between social cognition aspects and the theoretical and neurological ramifications of these relationships.

H-42

GAMBLING, DISCOUNTING, AND TEMPORAL PERSPECTIVE REVEAL DISSOCIATIONS IN FUTURE THINKING IN EPISODIC AMNESIC INDIVIDUALS *Donna Kwan, York University; Carl F. Craver, Washington University; Leonard Green, Washington University; Joel Myerson, Washington University; R. Shayna Rosenbaum, York University, Rotman Research Institute -* Neuroimaging studies show that imagining future experiences, like recollecting past experiences, activates a set of brain regions including medial temporal lobe structures, in particular the hippocampus. Moreover, compromised hippocampal function causes episodic amnesia (impairment in the ability to recollect past experiences), which is associated with impairment in the ability to imagine future experiences. For example, one individual with extensive medial temporal lobe damage and resulting episodic amnesia described his state of mind as “blank” when asked to imagine any future experiences (Tulving, 1985). Nevertheless, the same individual was able to make future-oriented financial decisions: When offered a small, immediate monetary reward and a larger, delayed monetary reward, he forwent the former in favour of the latter (Kwan et al., 2012). These findings suggest that future-oriented thinking is not a unitary construct, and that some forms of future thinking do not require hippocampally mediated future imagining. The present study extends our analysis of the forms of decision making and future thinking in individuals with extensive medial temporal lobe damage, who (along with matched controls) completed the following measures: an adapted version of the Autobiographical Interview to establish baselines of past recollection and future imagination; a Probabilistic Discounting task to assess tendencies toward high-risk gambling; a Delay Discounting task to assess economic decision making as a function of time delay; and the Zimbardo Time Perspective Inventory to assess personal orientation toward the past, present, and future (Zimbardo & Boyd, 1999). Individuals with medial temporal damage all showed varying degrees of deficits in recollecting past experiences and imagining future experiences, depending on the nature and extent of the damage, but comparisons with matched controls indicated that other aspects of temporal thought and future-oriented decision making were preserved.

Individuals with medial temporal damage did not show a predilection toward high-risk betting on the Probability Discounting task. On the Delay Discounting task, individuals with medial temporal damage chose larger future rewards over smaller immediate rewards and, as in the healthy controls, the degree of discounting decreased as a function of delay. Despite impairments in past recollection and future imagining, ZTPI results showed that the individuals with medial temporal damage had personal orientations toward time that were either biased toward the past or future, but were not bound to the present. This pattern of findings suggests that there are multiple forms of future thinking involving distinct processes that may have evolved for different purposes. These processes are differentially vulnerable to medial temporal lobe damage disruption and its effects on the ability to imagine oneself in the future. We conclude that even extensive medial temporal damage and the resulting episodic amnesia do not preclude prudent decision making, including consideration of future financial outcomes, or personal identification with the past and future.

H-43

BRAIN REGIONS FOR THEORY OF MIND DISTINGUISH BETWEEN COOPERATIVE AND COMPETITIVE INTERACTIONS IN A “ROCK, PAPER, SCISSORS” GAME *Lily Tsoi, James Dungan, Liane Young; Boston College -* Previous work on group membership reveals that we often attribute less mind to those outside our group - i.e., outgroup dehumanization. By contrast, we robustly attribute mental states to close others - i.e., ingroup affiliation. We suggest that while some aspects of theory of mind (ToM) are necessary for cooperation, other aspects may be essential for strategic, competitive interactions. Using functional resonance imaging (fMRI), we investigated whether brain regions for ToM, localized using an independent task, are differentially recruited for competitive versus cooperative interactions and whether this dimension (competitive versus cooperative) is encoded in the spatial pattern of activity across voxels within ToM regions. Participants played a game variant of “Rock, Paper, Scissors” with one other player (actually the computer); players chose between two shapes (circle, square). Every time participants met the trial-specific goal, they won \$1. In “cooperate” trials, each participant was instructed to work with the other player toward the same goal (e.g., to guess the same shape or match the other player); both players won \$1 or not, together, depending on whether they met their shared goal. In “compete” trials, players had opposite goals (e.g., if one player was told to match the other player, the other player was told to mismatch or guess the opposite shape); only one player could win \$1. In control conditions, a random shape (circle, square) was generated and, depending on the shape, either both players would win or lose (mimicking “cooperate” trials), or only one player would win (mimicking “compete” trials). First, region of interest (ROI) analyses revealed greater activation for compete and cooperate trials over control trials in these ToM regions: precuneus, dorsomedial prefrontal cortex (DMPFC), and right

temporo-parietal junction (RTPJ). Second, distinct patterns emerged across ROIs when comparing competitive and cooperative interactions: greater precuneus activity for competitive trials, greater DMPFC activity for cooperative trials, and equally robust activity in RTPJ. Third, multi-voxel pattern analyses (MVPA) revealed that all three regions, including RTPJ, encode whether an interaction is cooperative or competitive. These results suggest that competitive versus cooperative interactions engage different components of ToM with distinct neural substrates.

H-44

THE RELATIONSHIP BETWEEN WHITE MATTER INTEGRITY AND EMOTIONAL PROCESSING IN TRAUMATIC BRAIN INJURY Binder, A., Genova, H., Lengenfelder, J., Sacchetti, D.L., Chiaravalloti, N.D.; Kessler Foundation Research Center - Introduction: Although there is a significant body of research addressing the cognitive impairments in individuals with traumatic brain injury (TBI), deficits in emotional processing remain overlooked and understudied in this population. However, impairments in emotional processing can negatively impact both daily functioning and social functioning in this population and severely affect quality of life. The purpose of this study was to investigate the relationship between white matter integrity and facial emotional processing ability in individuals with TBI. Methods: Within a sample of 16 participants, including 7 TBI and 9 healthy controls (HC), we examined the relationship between fractional anisotropy (FA), as assessed by diffusion tensor imaging (DTI), and performance on the facial emotion recognition task (FERT). The FERT requires participants to identify one of six basic emotions from facial expressions presented in a computer paradigm. We performed a regression analysis to look at the relationship between FA and FERT performance, while controlling for age. Results: The TBI group performed significantly worse than HCs on the FERT. We found a significant positive relationship between white matter integrity in the Inferior Longitudinal Fasciculus (ILF) and performance on the FERT task suggesting that people with lower FA (indicating increased damage) had lower accuracy. Discussion: The relationship between white matter integrity and facial emotion recognition indicates a disruption in neural networks involving the ILF. This disruption may play a role in the emotional processing deficits often observed in individuals with TBI. Although the function of the ILF is not fully known, it has previously been implicated as a direct pathway between the occipital and anterior temporal regions to strengthen the visual processing of emotional stimuli. Future research should focus on examining these neural pathways to address emotional processing issues in TBI.

H-45

CULTURAL EXPERIENCES REDUCE RACIAL BIAS IN NEURAL RESPONSES TO OTHERS' SUFFERING Shihui Han, Xiangyu Zuo; Peking University - Our previous neuroimaging research found that adults showed significantly increased neural activity to perceived pain in

same-race but not other-race individuals. Moreover, manipulations in cognitive strategy and intergroup relationship in laboratory can significantly reduce the racial bias in empathic neural response by increasing neural activity to perceived pain in other-race others. The current study further examined whether real-life cultural experiences with other-race individuals can reduce the racial bias in empathic neural responses to others' suffering. Using functional magnetic resonance imaging (fMRI), we scanned 20 Chinese adults who were brought up in Western countries (the United States, the United Kingdom, and Canada) where Caucasians are the majority of the population. Participants viewed video clips in which either Asian or Caucasian models received painful or neutral stimulation. We found that the neural activity in the pain matrix including the anterior cingulate cortex, anterior insula, inferior frontal cortex and somatosensory cortex was significantly increased in response to painful vs. neutral stimuli applied to both Asian and Caucasian models. Moreover, these empathic neural responses to Asian and Caucasian models did not differ significantly and were positively correlated with each other. Our results indicate that cultural experiences with racial out-group members can increase the neural responses to the suffering of other-race individuals and thus reduce the racial bias in empathy.

H-46

TO CROSS OR NOT TO CROSS: MONITORING DECISIONS BASED ON EVERYDAY LIFE EXPERIENCE IN A SIMULATED TRAFFIC TASK Evelien Kostermans, Radboud University Nijmegen; Renske Spijkerman, Radboud University Nijmegen; Rutger C.M.E Engels, Radboud University Nijmegen; Harold Bekkering; Radboud University Nijmegen; Ellen R. A. de Bruijn, Radboud University Nijmegen, Leiden University - Different theoretical accounts have attempted to integrate ACC involvement in relation to conflict detection, error-likelihood predictions and error monitoring. Regarding the latter, ERP studies have identified the Feedback Related Negativity (FRN) component in relation to processing feedback which indicates that a particular outcome was worse than expected. In addition, according to the conflict-monitoring theory the stimulus-locked N2 reflects pre-response conflict. Although formulated around different principles, these theories share the notion that both conflict and error-signals function as a warning signal to improve behavior. Assumptions of these theories have been made on the basis of relatively simple response-mapping tasks, rather than more complex decision-making processes associated with everyday situations. The question remains whether expectancies and conflicts induced by everyday knowledge similarly affect decision-making processes. To answer this question, participants in the current study had to engage in a simulated traffic task that varied high and low ambiguous situations at an intersection by presenting multiple varying traffic light combinations. The tendency to cross was more pronounced for traffic light combinations that in real-life are associated with proceeding, as opposed to more ambiguous traffic light combinations not uniquely associated with a specific

response. On a neurophysiological level, the stimulus-locked N2 was enhanced on trials that induced experience-based conflict. In contrast, the FRN component was not differentially influenced by everyday expectancies in relation to traffic rules. The current study shows that well-learned everyday rules may influence decision-making processes in situations that are associated with the application of these rules, even if responding accordingly does not lead to the intended outcomes.

H-47

INTEROCEPTIVE SENSIBILITY PREDICTS SENSIBILITY TO OTHER'S EMOTION *Yuri Terasawa, Japan Society for the Promotion of Science, National Center of Neurology and Psychiatry; Yoshiya Moriguchi, National Center of Neurology and Psychiatry, Integrative Brain Imaging Center; Saiko Tochizawa, Keio University; Riko Sato, Keio University; Satoshi Umeda, Keio University* - Objective: The peripheral theory of emotion suggests that subjective experience of emotion and interoception are essentially related. Some previous studies showed that the interoceptive sensibility predicts emotional sensibility and anxiety traits. In fact, we reported that the interoceptive sensibility and social anxiety trait are mediated by the anterior insular cortex (Terasawa et al., 2012, Soc. Cogn. Affect. Neurosci.) and suggested that the level of attention to interoceptive information can impact on subjective feelings of anxiety. In this study, we examined whether the interoceptive sensibility modulates emotional experience in social context, using with facial expressions. Methods: Thirty graduate and undergraduate students participated our study (13 males, 17 females, mean age=21.4 \pm 1.8). The interoceptive sensibility was measured by the heartbeat detection task. In this task, participants were required to report number of heartbeats that they could feel over a period of time. Actual heartbeats were measured by pulsoxymeter. Interoceptive sensibility was evaluated by the levels of dissociation between reported and actual heartbeats (interoception error rate). We selected 5 types of facial expression photos; those were happy, sadness, disgust, anger and neutral. We made morphed continua photos between neutral and each facial expression. We prepared eight steps between neutral-100% and each emotion 100%. Each stimulus was presented in random order and participants judged whether they can feel any emotion from the stimulus or not, and chose the most appropriate emotion when they judged the stimulus have emotional valence. There were 200 trials in total. Individual's threshold to feel the emotion were obtained from their responses against the facial expression photos. Participants completed some questionnaires those were Manifest Anxiety Scale (MAS), Social Anxiety Disorder Scale (SADS), The 20-item Toronto Alexithymia Scale (TAS-20) and The Modified Somatic Perception Questionnaire (MSPQ). Results & Discussion: The stepwise multiple regression analyses on the thresholds to feel the emotion were conducted. Scores of SADS, TAS-20, MAS, resting heart rate and interoception error rate were entered the analyses as candidates of independent variable. The analysis revealed that only the interoception error rate

predicts the thresholds to feel happiness and sadness. On the other hand, the error response rate for the sad stimuli predicted scores of SADS. The results imply that individuals who are sensitive to their own interoceptive information are also sensitive to emotions presented in facial expressions. The results suggest that interoceptive awareness modulates intensity of subjective experience of emotion and affects individual traits concerned with emotion processing.

H-48

UNDERSTANDING LANGUAGE FROM WITHIN: DIFFERENTIAL INVOLVEMENT OF PERIGENUAL CINGULATE, VENTROMEDIAL PREFRONTAL CORTEX, AND INFERIOR FRONTAL GYRUS WHEN PROCESSING SENTENCES DESCRIBING MENTAL STATES *Suzanne Oosterwijk, Northeastern University, University of Amsterdam; Scott Mackey, University of California, San Diego; Piotr Winkielman, University of California, San Diego; Martin P. Paulus, University of California, San Diego* - Language is a common way to communicate mental states such as anger, fear, doubt or hunger. Since most mental states are subjectively felt, it is important to explain how language grounds the internal quality of mental states. According to embodied cognition accounts, language and experience share neural systems for sensory, motor, introspective and bodily states (Gallese & Lakoff, 2005; Glenberg et al., 2005; Barsalou, 1999, 2008). These accounts predict that these neural systems engage in multimodal simulations when people understand linguistic references to mental states. Although neuroscientific research has demonstrated action simulation when processing language (e.g., Tettamanti et al., 2005); evidence for the simulation of internal states when processing language is scarce. Furthermore, little is known about the contextual flexibility of simulation, even though embodied cognition accounts predict that mental states are represented by simulations in different modalities depending on context or perspective (cf. Wilson-Mendenhall et al., 2011; Oosterwijk et al., 2012). In the present fMRI study we examined whether neural regions that are involved in the representation and generation of internal states engage when individuals understand sentences that describe mental states with a focus on internal experiences. Subjects were presented with sentences describing emotional (e.g., fear, joy) and non-emotional (e.g., hunger, thinking) mental states from an internal perspective (i.e., focusing on bodily sensations and introspection) or an external perspective (i.e., focusing on expression and action). Participants judged whether sentences described a mental state or not; non-mental states sentences served as control. We hypothesized that external sentences would engage prefrontal regions associated with action representation (e.g., inferior frontal gyrus) and that internal sentences would engage prefrontal regions associated with internal experience and bodily sensations (e.g., insular cortex, ventromedial prefrontal cortex, anterior cingulate cortex). Region of interest analyses show that external emotion and external non-emotion sentences were associated with greater activation in the inferior frontal gyrus relative to internal sentences.

Furthermore, internal emotion sentences engaged the anterior cingulate gyrus and the ventromedial prefrontal cortex significantly more than all other sentence categories. A similar pattern was found for the insular cortex, although a whole brain analysis indicated that non-emotion sentences engaged the anterior insula to a larger extent than emotion sentences. Together, these findings highlight two important points that are consistent with embodied cognition accounts. First, processing sentences describing emotional and non-emotional mental states engages neural systems associated with internal experience and action. Second, the engagement of these systems varies with perspective, highlighting the flexibility of simulation when processing mental states communicated through language.

H-49

THE RELATIONSHIP BETWEEN EMPATHY AND P300 TO HUMAN FACE *Damee Choi, Mami Uramoto, Shigeki Watanuki; Kyushu University* - Recent neuroscience studies have found that people with high self-reported empathy are more sensitive to social stimuli such as human faces, rather than people with low self-reported empathy (Choi & Watanuki, 2012; Jabbi et al., 2007; Singer et al., 2004). However, it is still unclear whether P300 component of ERP (Event-related Potential) to social stimuli are different on individual empathic characteristics. Therefore, this study aimed to investigate the relationship between self-reported empathy and P300 responses to human faces. Twenty-eight participants were selected through screening with Interpersonal Reactivity Index (Davis, 1980), a self-reported empathy questionnaire, and categorized into high empathy group and low empathy group. P300 was recorded while both two groups watched pictures of human face (as social stimuli) and pictures of flower (as unsocial stimuli) using oddball paradigm. The results indicated that the high empathy group showed greater P300 amplitude at parietal site in response to the pictures of human face. On the other hand, there were no differences in P300 amplitude induced by pictures of flower between the two groups. Given that P300 amplitude is thought to reflect motivational significance of stimuli (Nieuwenhuis et al., 2005), the findings of this study suggest that people with high self-reported empathy regard social stimuli as more valuable information than people with low self-reported empathy do. In addition, the results indicated that high empathy group displayed longer P300 latency in response to pictures of human face rather than pictures of flower, whereas low empathy group did not. Thus, it may suggest that people with high empathy are more careful to classify social stimuli than unsocial stimuli, as latency of P300 has been reported to be positively correlated with time taken to stimuli categorization (Donchin, 1979). In brief, this study showed that P300 amplitude and latency to social stimuli are affected by self-reported empathy. Furthermore, the present results may act as a key to understand how empathy is associated with prosocial behaviors.

H-50

PIECE OF CAKE: AFFECTIVE REACTIVITY TO AND COGNITIVE REGULATION OF FOOD CUES *Nicole R. Giuliani, Rebecca D. Calcott, Elliot T. Berkman; University of Oregon* - Recent research on neural processes underlying eating behavior has focused on reward-related reactivity. However, a recent "seesaw" model of self-regulation proposed that failures result from increases in reactivity, decreases in regulation, or both. In the current study, we apply this model to the consumption of energy-dense foods. In the task, subjects were instructed to passively view healthy or energy-dense foods or engage a process called reappraisal, where they cognitively altered the meaning of the food stimuli by, for example, focusing on the negative consequences of consumption. Behaviorally, energy-dense foods induced greater self-reported desire to eat healthy foods, and reappraisal reduced that desire to a level not significantly different from viewing healthy foods. There was no relationship between self-report and ad hoc consumption of energy-dense foods two weeks later. Neurally, reactivity (look energy-dense > look healthy) induced activation in the occipital lobe (e.g., precuneus, angular gyrus). Reappraisal (regulate energy-dense > look energy-dense) induced activation in the left inferior frontal gyrus (IFG), dorsolateral prefrontal cortex, and a cluster encompassing bilateral dorsal anterior cingulate and the pre-supplementary motor area (SMA). Only reappraisal-related activation of the left IFG and pre-SMA predicted eating behavior, such that those individuals who ate a lot activated these regulatory regions to a greater degree than those who did not eat or ate very little. These findings support the regulation seesaw model, and suggest that, while individuals who consume large quantities of energy-dense foods can self-regulate, they must try harder, thus engaging regulatory brain regions to a greater degree.

H-51

PERSPECTIVE TAKING ENHANCES ENCODING OF COUNTER-STEREOTYPICAL INFORMATION AND SUBSEQUENT PREDICTION ACCURACY FOR OUT-GROUP MEMBERS *Kelly A. Jordan, Adam Magerman, Chad Forbes; University of Delaware* - Extant research suggests our brains are designed for one primary function: prediction. Whether we're calculating what we would like most for dinner or what we should say to facilitate pleasant social interactions, we inherently rely on past experiences, knowledge and situational cues to predict what responses will engender successful navigation through complex social environments. Despite the fundamental importance of prediction accuracy, people tend to be quite inept at predicting other's behaviors. This is particularly likely when predicting out-group behaviors, which can be biased by inaccurate, stereotype-consistent information, associated with out-group members. To the extent that accurate knowledge for out-group members can increase prediction accuracy for out-group behaviors, facilitating efficacious encoding of counter-stereotypic information may be one means of increasing prediction accuracy for out-group behaviors. One way this may be achieved is via perspective taking,

or placing one's self in another's shoes and imagining the world through their eyes. Past research suggests that perspective taking can be an effective means of promoting encoding of counter-stereotypic information, likely via exploiting the well-known self-reference effect, i.e., enhanced encoding of self-relevant information. The present studies examined this question directly by examining whether perspective taking enhanced encoding of counter-stereotypical information for out-group members and subsequently one's ability to accurately predict out-group behaviors. In Study 1, White participants self-identified as either Democrats or Republicans, viewed photos of political and ethnic (Latino) in-group or out-group members. These photos were accompanied by information containing either stereotypic or counter-stereotypic political viewpoints for Republicans or Democrats. Participants were instructed to view and process the information from the perspective of the person in the photo. Participants were then given a surprise memory test and were asked to identify the correct stereotypic or counter-stereotypic information that was presented for each person. Finally, participants were presented with the pictures again and were asked to predict how each person would vote. Results revealed that when White Republicans engaged in perspective taking they exhibited enhanced encoding for all out-group targets (political and ethnic). Conversely, when White Democrats engaged in perspective taking they demonstrated enhanced encoding for ethnic and political in-group members (White Democrat targets) and ethnic and political out-group members (Latino Republican targets). Results of the prediction task provided partial support for hypotheses. White Republican participants exhibited increased prediction accuracy for Latino Republican targets to the extent they encoded counter-stereotypical information pertinent to their ethnic out-group. Democrats demonstrated a similar pattern but it was specific to political and ethnic in-group targets. Study 2 examined the neural correlates underlying these behaviors and whether memory effects were influenced by perspective taking specifically. Continuous EEG activity was recorded while White participants completed a memory and prediction task. Participants viewed the information from either the perspective of out-group members or objectively. Results revealed interesting interactions between brain regions important for person perception. Together these findings indicate that perspective taking is an effective strategy for enhancing memory for counter-stereotypic information and prediction accuracy for out-group members, possibly via promoting interactions between neural regions integral for person perception.

H-52

READING PARENTS' MINDS: ADOLESCENTS' MENTALIZING SKILL AND FAMILY CONFLICT HISTORY MODERATE NEURAL ACTIVATION TO PARENTS' STATE AFFECT *Darby Saxbe, Larissa Borofsky, Jonas Kaplan, Mary Helen Immordino-Yang, Gayla Margolin; University of Southern California* - Adolescence is a time of individuation from parents, and thereby also a time of heightened family conflict. Youths' ability to understand,

and empathize with, their parents' emotions may help promote family functioning. This study examines the neural correlates of youths' evaluating their parents' state affect in conjunction with their history of exposure to aggressive family conflict and their performance on a measure of social sensitivity, the Reading The Mind In The Eyes Test (Baron-Cohen, Wheelwright, Hill, Raste, & Plumb, 2001). We hypothesized that these moderators might affect neural activation in regions associated with social processing, emotional processing, and empathy, including the posteromedial cortices, the medial prefrontal cortex (mPFC), the insula, and the ventral striatum (VS). The VS has been linked to social reward processing, while the insula, which has been implicated in interoceptive awareness, may also play a role in embodying the emotions of others (Immordino-Yang, McColl, Damasio, & Damasio, 2009). In an event-related design, 21 adolescents (11 males, mean age 16.9 years) viewed 5-second silent video clips featuring images of themselves, their mother, their father, or an unfamiliar peer. The clips of the youth and parents came from a previously recorded family discussion. Clips featured only the target person (mother, father, self, peer). After each clip, youth were asked "How did you (or she, or he) feel?" and responded using the button box in the scanner. Participants were recruited from a longitudinal study in which parents and children rated family conflict behavior at two prior timepoints, approximately four years and two years before scanning took place. Ratings of physically aggressive and aversive behavior were combined across reporters and study waves to create a cumulative family aggression index. Additionally, before scanning, youth took the Mind In The Eyes Test, in which participants are shown 36 faces, cropped so only the eye-region is visible, and asked to select one of four adjectives describing the emotion presented in the face (for example, "arrogant," "grateful"). The task has been used widely to assess "mentalizing" ability. The Mind-Eyes score was negatively correlated with history of aggressive family conflict behavior, $r(20) = -.47$, $p = .04$, suggesting that youth from more aggressive families showed less skill in detecting emotional expressions. fMRI data were acquired using a 3T Siemens TRIO scanner and analyzed with FLAME mixed effects analysis using FSL's FEAT (fMRI Expert Analysis Tool), with a cluster corrected threshold of $z = 2.3$, $p < .05$. We contrasted the parent condition (mother and father conditions combined) with a fixation cross baseline and entered the Mind-Eyes score as a regressor. Higher scores were associated with more activation ($p < .05$) in the VS, insula (bilaterally), precuneus, and posterior cingulate (PCC). When aggressive family conflict exposure was entered as a regressor, it was associated with greater activation in the precuneus and mPFC, and decreased activation in the insula (bilaterally), suggesting that youth from more aggressive families may be engaging in less interoceptively-driven processing of their parents' emotions but are activating more of the "mentalizing network" that includes the PMCs and mPFC.

PROTECTIVE FACTORS FOR CHILDREN IN CARE: EVIDENCE DERIVED FROM BRAIN IMAGING, HPA AXIS REACTIVITY AND DEVELOPMENTAL PSYCHOPATHOLOGY

*Vanessa Puetz, University Hospital Aachen, *ICNC Travel Award Winner; Nils Kohn, University Hospital Aachen; Beate Herpertz-Dahlmann, University Hospital Aachen, JARA Translational Brain Medicine; Kerstin Konrad, University Hospital Aachen, JARA Translational Brain Medicine, INM, Research Centre Juelich* - Introduction: Early maternal separation (EMS) experiences can disrupt a child's attachment process and interfere with the psychosocial development of an infant. However, it remains unclear how EMS impacts on children's social perception of day-to-day negative experiences such as peer-rejection and potentially translates into emotional and neuroendocrine dysfunction. This study aims to investigate the effects of past separation and placements, time spent in a stable environment, gender and ethnic background on the neural reactivity to psychosocial stress. Methods: 25 children who were permanently separated from their biological parents before their 3rd year of life (mean age 10.6 ± 1.7 ; mean IQ = 101.87 ± 10.6 ; mean age of separation = $1.3 \text{ years} \pm 1.08$) and 26 children that grew up with their biological parents (mean age = 10.51 ± 1.7 ; mean IQ = 104.96 ± 9.5) underwent a social-exclusion paradigm in MRI to investigate the neural correlates of social exclusion and afterwards indicated their subjective feelings of exclusion and frustration. Salivary morning cortisol levels were collected on three consecutive days. Results: Results indicated that EMS children felt significantly more frustrated and excluded during the exclusion by the other players than never-separated controls [exclusion: $t(46) = -2.61$, $p = 0.006$; frustration $t(46) = -2.24$, $p = 0.005$], regardless of gender, reflecting a social perception bias for negative social experiences. On the neural level, results indicated that EMS children (as compared to controls) showed significantly less brain activity during social exclusion in regions previously associated with the cognitive control of emotion, such as the dorsal anterior cingulate cortex (dACC) and less functional connectivity (PPI) with the prefrontal cortices (dlPFC/mPFC). Conversely, EMS children showed stronger activation in the middle temporal gyrus (MTG). Importantly, no significant differences in the subjective degree of exclusion and frustration or on the neural level were found between German adoptees and adoptees with a different ethnic background ($U(48) = 311.5$, $p = .13$), indicating that the adverse effects of separation on social perception and neural reactivity were rather universal. This reduction in fronto-cingulate activity was significantly related to lower morning cortisol levels (dlPFC $r_s = .456$, $p = .022$; dACC $r_s = .520$, $p = .009$) in EMS children and more transitory secondary placements before the final placement (dlPFC $r_s = -.399$, $p = .024$). Better present relationship quality with the current caregivers was significantly associated with the total time spent in the family since separation ($r_s = .478$, $p = .008$) and those EMS children who resided longer in their family showed significantly less psychopathological behavior ($r_s = -.617$, $p = .001$), independent of gender or ethnicity. Conclusion:

Our data suggest that EMS has long-lasting effects on the neural, endocrine and psychological functioning of children in care and these effects might a) underlie differential reactivity to rejection in everyday life and b) might mediate the path to affective disorders, which are highly prevalent in EMS children. Importantly though, we could demonstrate that time can be a protective factor, as those children in our study who experienced less transitory placements and spent more time in a stable environment showed more typical neural activity, a better relationship quality - and less psychopathological behavior, regardless of gender and ethnic background.

H-54

BODILY RESPONSES AND THE VULNERABILITY TO ANXIETY: AN FMRI INVESTIGATION

Satoshi Umeda, Keio University, University College London; Neil A Harrison, University of Sussex, Sussex Partnership NHS Foundation Trust; Marcus A Gray, University of Queensland, Royal Brisbane and Women's Hospital; Christopher J Mathias, University College London, Imperial College London at St Mary's Hospital; Hugo D Critchley, University of Sussex, Sussex Partnership NHS Foundation Trust - Emotional processes are closely coupled to autonomic bodily responses. Neural centres for the control of autonomic bodily responses are implicated as substrates for normal and pathological emotions. This relationship may underlie constitutional vulnerabilities to affective disorders. Exaggerated patterns of autonomic responsiveness can enhance the expression of panic or anxiety symptoms. Patients with postural tachycardia syndrome (PoTS) are characterized by abnormal autonomic responses, including cardiac reactivity. PoTS patients are overrepresented across stress-sensitive psychosomatic and neuropsychiatric disorders and experience symptoms that overlap with anxiety disorders. We combined emotional challenges with autonomic psychophysiology and functional brain imaging to test the prediction that PoTS patients show abnormal autonomic reactivity to emotional challenges through brain regions implicated in anxiety. We recruited twelve patients with well-characterised PoTS and twelve age-matched healthy controls. Participants completed questionnaire-ratings of anxiety, depression, panic and personality traits and underwent functional magnetic resonance imaging (fMRI) with simultaneous heart rate recording while processing picture stimuli (faces and scenes) spanning five emotional categories (happy, angry, disgust, sad, and neutral). Our sample of PoTS patients scored significantly higher for state and trait anxiety, depressive symptoms and neuroticism compared to controls. Five of the patients had past experience of panic attacks. Physiologically, PoTS patients showed exaggerated heart rate responses to stimulus presentations, independent of emotional type. At the neural level, PoTS patients showed greater deactivation of ventromedial prefrontal cortex to stimuli and enhanced activity within precuneus, middle temporal gyrus and dorsal anterior cingulate cortex, compared to controls. The change in ventromedial prefrontal activity was related to the magnitude of heart rate change, while activity within globus pallidus and putamen correlated

positively with state anxiety score. The degree of functional coupling between these frontal and striatal regions was further predicted by the magnitude of expressed anxiety. Our findings endorse the view that PoTS patients are constitutionally vulnerable to anxiety symptoms through the central generation and control of exaggerated autonomic reactions to external affective challenges. Our study further implicates neural mechanisms involving ventral frontostriatal interaction and has broad relevance to the expression of PoTS within range of psychosomatic and neuropsychiatric disorders.

H-55

CROSS-CULTURAL DIFFERENCES IN CREATIVITY

Maysless, N., Kleinmintz, O., Ivancovsky, T., Kurman, J., Shamay-Tsoory; University of Haifa - Although cultural differences in creativity have been repeatedly reported, there is thus far little evidence for the biological underpinnings of these differences. An abundance of studies that compared levels of creativity between cultures documented lower levels of creativity in non-Western compared to Western cultures. Creativity has been defined as the ability to produce responses which are both novel (i.e., original and rare) and suitable (i.e., adaptive according to the task constraints). We recently proposed a neural model of creativity, according to which the generation phase is mediated by a frontal-posterior network (particularly on the right hemisphere), and the evaluation phase is mediated by a left frontotemporal network where ideas are evaluated and filtered and may be inhibited. In line with the twofold model of creativity, it is possible that differences in the activation of the evaluation system may account for cultural differences in creativity. Indeed, cross-cultural studies pertained to the fact that in East-Asian cultures being different from others is sanctioned and therefore deviance can threaten self-esteem. In the first experiment we show that when subjects are involved in evaluation of originality, a left frontal and parietal network is activated. Additionally, correlation analysis indicated that activity in these left lateralized areas may inhibit original responses by diminishing the number of responses given. In the second study we document behavioral cross-cultural differences in creativity in a group of Israelis and Koreans. Finally, the neuroimaging data support the behavioral findings and show different activations between the two groups.

H-56

SELF REPORT COGNITIVE DEFICITS CORRELATE WITH DEPRESSION IN TRAUMATIC BRAIN INJURY (TBI)

Santana E., Lengenfelder J., Strober L., Persaud U., Chiaravalloti, N.D.; Kessler Foundation Research Center - Objective: Both depression and cognitive impairment are common following TBI. The Perceived Deficits Questionnaire (PDQ) is a widely used screening measure that evaluates self-perceived cognitive impairment. We examined the relationship between self-reported deficits on the PDQ, performance on objective measures of cognitive functioning and depression. Participants & Methods: Participants consisted of 40 individuals with moderate to severe TBI. Memory and executive functions

were measured using the CVLT II, D-KEFS Tower Test (achievement), D-KEFS Verbal Fluency (letter total), D-KEFS Color-Word (inhibition) and D-KEFS Trail Making (switching). Depression was measured with the Chicago Multiscale Depression Inventory (CMDI). We examined relationships among the tests using Pearson Product Moment correlations, examining the relationship between the self-reported cognitive status (PDQ), depression (CMDI) and selected neuropsychological measures. Results: A significant relationship was noted between the CVLT Learning Slope Trials 1-2) and the PDQ ($r=.385$, $p<.05$). No other significant correlations were noted between objective measures of cognitive functioning and self-reported cognitive abilities. Positive correlations were also noted between scores on the CMDI and the PDQ ($r=.45-5.9$; $p<.001$). Conclusions: The only significant relationship noted between objective tests of cognitive functioning and self-reported cognition was between the CVLT Learning Slope for Trials 1-2 and the PDQ. This is consistent with previous work from our lab noting that self-reported memory correlates with only the first exposure of memory stimuli on neuropsychological tasks. Self-reported cognitive abilities was also significantly related to depressive symptomatology. These findings highlight the importance of combining self-report measures of cognitive function with objective neuropsychological testing when assessing cognitive deficits, as well as weighing the influence of emotional symptomatology on self-report.

H-57

CONTEXT-DEPENDENT PREDICTIONS INFLUENCE NEURAL PROCESSING OF OBSERVED GOAL-DIRECTED ACTION

Sasha Ondobaka, Marco Wittmann, Floris P. de Lange, Harold Bekkering; Radboud University Nijmegen - Dominant accounts of action understanding propose that action outcomes are derived by direct mapping of observed movements onto observer's parieto-frontal circuits involved in movement control. From the opposite perspective, movement control is based on Bayesian inference, combining the a priori expectation of the action (prior) and the conditional likelihood of perceiving the executed movement (likelihood). Here, we used an action expectation paradigm in fMRI to examine whether a similar Bayesian principle underlies understanding of others' observed action. Participants inferred whether context-dependent priors matched the subsequently observed grasping movements, which had high or low likelihood of occurrence. Preceding action observation, visual and somatosensory association cortex encoded the prior, by showing larger activity for priors with low probability. During action observation, primary somatosensory cortex encoded movement likelihood that matched prior expectation, while inferior frontal cortex (IFC) showed greater activity when observed movements mismatched the prior. When the likelihood of perceiving the observed movements matched prior expectations, IFC showed enhanced functional connectivity with sensory association cortices that encoded both these quantities. Together, the findings provide support for a Bayesian account of action understanding and expand our knowledge how human brain combines context-

dependent prior expectations with the most likely sensory information about the movement.

H-58

NEURAL REGULATION OF SOCIAL APPROACH-AVOIDANCE BEHAVIOR AFTER TESTOSTERONE ADMINISTRATION *Sina Radke, Radboud University Nijmegen; Inge Volman, Radboud University Nijmegen; Pranjal Mehta, University of Oregon; Veerle van Son, Radboud University Nijmegen; Ivan Toni, Radboud University Nijmegen; Alan Sanfey, Radboud University Nijmegen; Ellen de Bruijn, Leiden University; Karin Roelofs, Radboud University Nijmegen* - The steroid testosterone is an adaptive social hormone involved in a wide range of motivational behaviors. It modulates the perception of social challenges, e.g. threat, and decreases anxiety, which can lead - dependent on the social context - to dominance and competition, but also to prosocial behaviors. Recent administration studies demonstrated that testosterone increases approach behavior to angry faces by means of unconscious eye gaze and automatic social approach-avoidance tendencies (Terburg et al., 2012; Enter et al., in prep). The neural mechanisms of these endocrine modulations of social approach behavior, however, remain largely unclear. Correlational evidence from a male sample (Volman et al., 2011) pointed to an association of higher endogenous testosterone levels and 1) decreased activity of the ventrolateral prefrontal cortex and 2) reduced connectivity between the ventrolateral prefrontal cortex and the amygdala during social motivational behavior. In order to investigate the causal role of testosterone in the modulation of prefrontal activity and coupling with limbic areas, the present study used a randomized, placebo-controlled, double-blind between-subject design. Four hours after having received 0.5mg testosterone or placebo sublingually, 54 healthy females underwent functional magnetic resonance imaging while performing the Approach-Avoidance Task. In this reaction time task, participants responded to happy and angry facial expressions by pulling a joystick towards (approach) or pushing it away from their body (avoid). In addition, endogenous testosterone and cortisol levels as well as personality traits relating to anxiety and motivation were assessed. A selection of behavioral and neuroimaging results will be presented and discussed in the light of previous research on the vital role of social hormones, i.e. testosterone and oxytocin, in regulating social adaptive behavior.

H-59

THE IMPACT OF EMOTIONS ON COGNITIVE CONTROL: A DEVELOPMENTAL ERP STUDY *Laura Vuillier, Denes Szucs, David Whitebread; University of Cambridge* - Introduction: The ability to monitor and control our actions according to our current goals is a complex mechanism that has been defined as cognitive control. The control of such goal-driven behaviour is particularly important in the presence of emotional information, as we are constantly challenged by emotional cues. The development of such function, especially in the context of negative emotion, is crucial for

socio-emotional functioning, particularly during childhood. However, only little research has been looking at the effect of emotion on cognitive control. The current study aims at investigating the development of the ability to maintain cognitive control in the context of interfering emotional information and answer questions such as: What is the effect of emotion on cognitive control? Are we using the same cognitive strategies in an emotional and non-emotional context? Do children have the necessary resources to use the most cost efficient strategies? Methodology: 27 healthy adults and 25 8-year-old children took part in an ERP experiment investigating the effect of emotion and emotion regulation on cognitive control strategies. In this task, the participants were told they would receive a monetary reward that would match their performance on the task. However, the task was designed so that the participants would lose their points, regardless of their performance, which was intended to induce negative emotions such as anxiety, anger, frustration and/or distress. The task also had low and high cognitive demand conditions. In addition to behavioural measures such as reaction time (RT) and accuracy, three ERP components were analyzed, namely the Contingent Negative Variation (CNV), the N2 and the parietal P3 (or P3b). Results: Both children and adults were significantly faster in the emotional condition, whereas the accuracy did not differ and stayed relatively high in both conditions. The adults were significantly faster than children. Both children and adults were significantly faster in the easy compared to the difficult condition. In adults, the N2 was significantly larger in the emotional compared to the non-emotional condition; children did not show any N2 in the non-emotional condition but showed a large negative deviation in the emotional condition. Children did not show any CNV, whereas adults showed a more negative CNV in the emotional compared to the non-emotional condition. In both children and adults, the P3b was larger in the emotional compared to the non-emotional condition. The CNV, N2 and P3b did not differ between the easy and difficult conditions. Conclusion: The behavioural and neural data showed that cognitive control is not fully developed in 8-year-old children. Particularly, the results from the CNV indicate that children do not seem to have developed a proactive control strategy (as used by the adults) and only use a reactive control strategy. The results from the N2 and P3b show that more resources are needed in the emotional condition. This last result is interpreted in terms of a compensatory mechanism that occurs when emotion regulation interacts with cognitive control.

H-60

SPATIAL AND TEMPORAL DISTANCE DECREASES EMPATHIC RESPONSES TO OTHERS' SUFFERING *Diana I. Tamir, Jason P. Mitchell; Harvard University* - Humans respond vicariously to others' pain. Not only do we physically cringe when seeing another person experience pain, but researchers have identified a network of brain structures that responds reliably when both personally experiencing pain and observing others in pain, including the dorsal anterior cingulate (dACC)

and bilateral anterior insula. However, research on psychological distance suggests that our tendency to respond to others' experiences is limited. Such theories suggest that individuals will respond more robustly to proximal suffering—pain that seems nearby or recent—than more distal suffering—pain that occurs on the other side of the world, in the distant past, or to unfamiliar others. Indeed, behaviorally, people donate more after natural disasters that occur close to home than far away (spatial distance) and donations taper off as the disaster recedes further into the past (temporal distance). To test the extent to which spatial and temporal distance diminishes responses to observing others' in pain, we measured spontaneous neural responses using fMRI scanning while participants watched video feeds of two target individuals suffering through painful experiences. The two targets differed in their spatial and temporal proximity to the participant: participants believed one set of videos was being recorded live in a room down the hall from the scanner (proximal target); the other set of videos was previously recorded at a distant location (distal target). Using both wholebrain and region-of-interest analyses, we compared neural responses to the proximal and distal pain events. Analyses revealed greater dACC, but not insula responses while watching the proximal target suffer than the more distal target. Together, such findings suggest that empathic responses diminish as individuals perceive the target of suffering to be further away in spatial and temporal distance.

H-61

IMITATION ACTIVATES THE MIRROR NEURON SYSTEM MORE THAN ACTION OBSERVATION OR EXECUTION IN INDIVIDUALS WITH STROKE *Mona Sobhani, Julie Werner, Carolee Winstein, Lisa Aziz-Zadeh; University of Southern California* - The putative mirror neuron system (MNS) includes motor-related regions that are active both when one performs an action and when one observes the same action being performed by another person. It has recently been proposed that methods in stroke rehabilitation that engage the MNS, for example action observation or imitation, may help to rebuild motor function despite impairments. Recent research has shown that MNS regions affected by stroke do have intact activation during action observation (Garrison et al, in press). Prior research in healthy individuals has shown that the MNS is even more strongly activated for imitation of actions, than for observation of an action or execution of an action alone (Iacoboni, 1999), however this has not yet been examined in individuals with stroke. Here, we investigate whether imitation can engage the MNS significantly greater than action observation or action execution alone in individuals with stroke. Preliminary results suggest that the pattern seen in healthy individuals does extend to individuals with stroke, with imitation more strongly activating the MNS than action observation or execution alone. These results have implications for rehabilitation of motor function after stroke.

H-62

FAIRNESS CONSIDERATIONS IN INCARCERATED INDIVIDUALS WITH AND WITHOUT PSYCHOPATHY: INVESTIGATING THE ROLE OF CONTEXT AND INTENTIONALITY USING A MODIFIED ULTIMATUM GAME *Ellen R.A. de Bruijn, Leiden University; Sina Radke, Radboud University Nijmegen; Inti A. Brazil, Radboud University Nijmegen; Inge Scheper, Radboud University Nijmegen Medical Centre; Berend H. Bulten, Pompestichting, Nijmegen* - Incarcerated individuals with psychopathy have often committed violent crimes against another person. Although these clear violations of social norms may suggest a biased moral reasoning in psychopathy, findings on utilitarian decisions remain unclear. We assessed social decision-making based on different aspects of fairness considerations in 18 criminal offenders with psychopathy, 14 criminal offenders without psychopathy and 18 matched healthy individuals who played the role of responders in a modified Ultimatum Game. Specifically, we focused on the effects of the context in which a particular monetary offer was made and the role of intentionality behind these offers. Selected offers were paired on each trial with a varying unselected alternative, thereby establishing the context in which the offer was proposed. Also, all offers were either made intentional (i.e. the unknown proposer selected one of the two available offers) or unintentional (i.e. the computer randomly selected one alternative). As expected, unfair offers were most often rejected when the alternative offer was fair and when the unfair offer was made intentionally. Offenders without psychopathy did not adjust their decision behavior on the basis of the available unselected alternatives. Importantly however, individuals with psychopathy did demonstrate a similar rejection pattern to that of healthy individuals as both groups took the context in which an offer was proposed into account. Therefore, social decision-making seems to be specifically impaired in offenders without psychopathy. The current outcomes are in line with some of the core features of psychopathy that require knowledge about social conduct and cognitive perspective-taking (e.g., manipulation or deception).

H-63

OXYTOCIN DIFFERENTIALLY AFFECTS PREFERRED INTERPERSONAL DISTANCE OF HIGH AND LOW EMPATHIC INDIVIDUALS *Anat Perry, University of Haifa; David Mankuta, Hadassah Medical Organization, The Hebrew University of Jerusalem; Simone Shamay-Tsoory, University of Haifa* - The space between people creates and defines the social dynamics of our interactions with others. Although different between cultures, within each culture interpersonal distance is implicit but clearly felt, especially if one stands nearer or further than expected. Oxytocin (OT) plays a determining role in social and pair bonding in many vertebrates and increasing evidence suggests it is a social hormone in humans as well. As such, we hypothesized that OT will have a facilitating effect, enabling people to feel more comfortable at a closer distance. Given that individual differences in social distance preference may depend upon empathic abilities,

it was hypothesized that oxytocin may differentially affect low and high empathic individuals. Using a within-subject crossover design, 50 subjects performed an interpersonal distance task following the administration of either placebo or oxytocin, one week apart. We used a modified version of the Comfortable Interpersonal Distance paradigm, in which participants imagine a friend, boss or stranger approaching (visualized on a computer screen) and are asked to stop the figure when feeling uncomfortable. Before performing the experiment, participants completed the Interpersonal Reactivity Index, a well-known validated empathy questionnaire. The results revealed an interaction between one's empathy trait and the OT effect, such that following intranasal administration of OT, highly empathic individuals preferred closer distance, while low empathic individuals preferred standing further apart. These findings suggest a complex role for OT as a modulator of social behavior, questioning its potential therapeutic effects on clinical or sub-clinical populations.

Poster Session J

Saturday, April 13, 5:50-7:20pm

J-01

IMPLICIT AND EXPLICIT EMOTION REGULATION: A COMPARISON OF IMPLEMENTATION INTENTIONS AND REAPPRAISAL STRATEGIES

Laura Martin Braunstein, Columbia University; Esther Kim, Columbia University; Julia Lushing, Columbia University; Peter Gollwitzer, New York University; Gabriele Oettingen, New York University; Jonathan Morgenstern, Columbia University; Kevin Ochsner, Columbia University - Despite over a decade of research on emotion regulation, little is known about implicit and automatic forms of emotion control. Typical cognitive emotion regulation strategies, such as reappraisal, involve explicitly and consciously changing thoughts about an affective stimulus or situation in order to reduce emotional responses to it (Ochsner & Gross, 2008). Such explicit emotion regulation strategies are very effective, but they require effort, conscious monitoring, and prefrontal brain regions involved in cognitive control - features that make them less accessible in certain situations and to individuals with cognitive impairments. Given these limitations of explicit strategies, we sought to examine the efficacy of more implicit means of emotion regulation. We borrowed an implicit technique from the automatic goal activation literature known as implementation intentions. Implementation intentions are simple if-then plans used to increase goal striving (Gollwitzer, 1999). Implementation intention statements consist of a critical cue (the if component) and an action that will be taken in the presence of that cue (the then component). In the current study, we compared the effect of distancing-focused implementation intentions and reappraisals on emotional responses to affective pictures. Participants completed a computer task during which they viewed and rated their scenes of accidents. Prior to beginning the computer task, participants were trained to reappraise the pictures by adopting a distant perspective and were asked to read and remember emotional response to appetitive and aversive pictures such as unhealthy foods and implementation intention statements. The statements took this form: "If I see a dessert, then I will describe it as if I am viewing it from far away." The language of the reappraisal instructions and implementation intention statements were matched, except that the implementation intentions used the if-then format. During reappraisal trials, engagement in distancing was explicitly directed by a visual cue that appeared just before the picture, whereas during implementation intention trials, distancing was activated automatically by the critical pictures themselves. There was no reminder about the implementation intentions during the task. Thus, the critical difference between the reappraisal and implementation intention conditions was how the emotional distancing was initiated - explicitly and externally in the case of reappraisal or automatically and internally for implementation intentions. As expected, both reappraisal and implementation intentions

decreased affective responses to the pictures relative to natural responding. This study is the first to directly compare explicit and implicit emotion regulation. In the future we plan to compare reappraisal and implementation intentions using fMRI in order to understand the neural mechanism of implementation intentions and whether it is distinct from or overlaps with that of reappraisal.

J-02 *SANS Poster Award Winner

CHOOSE AND IT BECOMES PART OF YOU: NEURAL CONSTRUCTION OF INDEPENDENT SELVES

Steven Tompson, *ICNC Travel Award Winner, Hannah Faye Chua, Shinobu Kitayama; University of Michigan - An increasing body of behavioral research suggests that the act of choosing has consequences for personal motivation (Iyengar & Lepper, 1999), social cognition (Savani, Stephens, & Markus, 2011), and developing one's self-concept (Kim & Sherman, 2007). Individuals from Western cultures (e.g., United States) are likely to perceive choice as personally meaningful, and researchers have argued that choices are instrumental in forming an independent self-construal (Markus & Kitayama, 2003). Previous research has found that people with an independent self-construal are more likely to perceive choice as an opportunity to express one's own preferences and beliefs (Savani, Markus, & Connor, 2008). Personal choice may therefore be particularly important in the development of self-concept for individuals from cultures that value holding an independent self. Currently, however, little is known about the neurobiological basis for this process. In this study, we used functional magnetic resonance imaging (fMRI) to test the hypothesis that, upon making a choice, individuals high in independent self-construal would incorporate the chosen item into the neural representation of the self (while excluding the rejected item). 24 American college students rated 120 popular music CDs, chose one CD from each of 60 CD pairs (created by pairing the 120 CDs initially rated), and rated the 120 CDs again. We predicted that participants should show greater activity for chosen (vs. rejected) options in regions related to self-processing, and this difference should be greater for individuals with strong independent (vs. interdependent) self-construals. Consistent with this hypothesis, chosen options showed increased activity during post-choice rating (relative to the rejected options) in posterior cingulate cortex (PCC), medial prefrontal cortex (mPFC), and ventral striatum, suggesting involvement of self-referential processing, as well as reward processing. This replicates previous research which has found that activity in cortical midline structures (i.e., PCC and mPFC) is linked to object ownership and the mere ownership effect (Kim & Johnson, 2010). Perhaps most importantly, this difference in cortical midline activity was strongest for individuals with independent self-construals. Together, these results provide evidence that individual differences in the importance of choice to one's self-concept are reflected (and may even be mediated) by neural activity. Given well-established links between culture and self-construal (Markus & Kitayama, 1991), it is possible that cultural

differences in independent and interdependent self-construal may influence neural representations of choice discussed above. Future research should examine cross-cultural evidence for this hypothesis as well as developmental differences in the tendency to incorporate choices into one's self-concept.

J-03

DYNAMICS OF AMYGDALA RESPONSES ASSOCIATED WITH PERSON DENSITY PERCEPTION: AN MEG STUDY *Nathalie George, CNRS, Inserm, Université Pierre et Marie Curie; Thibaud Dumas, CNRS, Inserm, Université Pierre et Marie Curie; Stéphanie Dubal, CNRS* - What is the affective impact of person density perception? This has become a topical question in crowded urban environments and for the mass public transport that these entail. Numerous studies in the field of ethology, and social psychology have shown a negative impact of high density of persons. A key structure of the medial temporal lobe, the amygdala, known to be involved in emotion and social perception, seems to be involved in the appraisal of interpersonal distance and personal space regulation. However, there has been no study on amygdala involvement in the perception of person density. Here we used magnetoencephalography (MEG) to reveal the dynamics of amygdala responses associated with the perception of person density. Our hypothesis was that the amygdala may be involved in the early stages of the processing of crowded social environments. MEG signals (306 channels whole-head Elekta Triux system, Finland) were recorded in 30 subjects while they viewed photographs of subway passenger cars of variable density. A scrambled version of the stimuli was also included in separate blocks. Each stimulus was presented for 500 ms (inter-trial interval=1-2s). After artifact rejection, event-related fields were averaged for low, medium and high density photographs. Magnetic Resonance Imaging (MRI) was used to obtain the participants' individual brain anatomy. Using an automated method of amygdala segmentation combined with weighted Minimum Norm Estimate (MNE) source imaging using Brainstorm, the sources of magnetic activities were localized in the amygdala volume. We found that amygdala was activated in response to the photographs from about 70-80 ms. There was an initial peak of amygdala activity around 110 ms, followed by prominent and sustained activity from about 200 ms. Amygdala activity was modulated by person density in both time ranges. In a next step we will examine whether amygdala response is correlated with the affective evaluation of the pictures of varying person density, as well as with individual variables such as the anxiety level and the sensitivity to interpersonal distance influence. These data will shed new light in the involvement of amygdala in the emotional perception of our social environment.

J-04

A NOVEL PARADIGM FOR INVESTIGATING THE NEURAL AND COMPUTATIONAL MECHANISMS OF THEORY OF MIND *Damian A. Stanley, Cendri A.*

Hutcherson, Ghoncheh Ayazi, John P. O'Doherty, Ralph Adolphs; California Institute of Technology - A core process underlying day-to-day social functioning is the ability to think about the minds of others (Theory of Mind; ToM). Developing a detailed model of the neural computations and mechanisms underlying ToM is crucial to understanding both normal and impaired social development (e.g. Autism Spectrum Disorders - ASD). Recent work suggests that ToM processing is subserved by a distinct network of interconnected brain regions, but little is known about the specific computations performed by each region, and how they interact as a network. Here we present a novel Theory of Mind (ToM) paradigm that enables computational modeling of ToM learning processes while maintaining features of traditional ToM tasks from cognitive and developmental psychology (e.g. the representation of false beliefs). Participants (Mentalizers) learned about the beliefs and desires of real people (Agents) while observing them make a series of decisions about whether to donate an amount of money to one of three charities, or take an amount of money for themselves. Critically, the experiment had 2 modes. In 'Normal' mode, Agents' decisions were implemented 65% of the time, but were reversed 35% of the time. In 'Reversal' mode the opposite was true (35% implemented, 65% reversed). The program mode switched occasionally and unpredictably, and was presented explicitly to the Mentalizer on every trial, but had to be inferred by the Agent solely from outcomes, resulting in periods of false belief by the Agent. On each trial, Mentalizers had to give their best estimate of three attributes about the Agent: (1) the outcome the Agent desired (desire), (2) the mode the Agent believed was active on that trial (belief), and (3) the final action the agent would choose (choice). Mentalizers then saw what the Agent chose, whether that choice was reversed, and the outcome of the trial. Preliminary data were collected from healthy participants, as well as from high-functioning adults with autism spectrum disorder (ASD). Analysis of performance revealed two distinct groups of healthy participants, those who were able to learn about the Agents, and those who were not. Participants with ASD showed considerable variability in their estimates of belief and desire, but logically integrated those estimates to generate a choice prediction at above-chance levels. While preliminary, this finding suggests that those with ASD can form internal representations of other people, even though those representations may be inaccurate predictors of other people's behavior. More importantly, these data demonstrate that this novel ToM paradigm, in combination with model-based functional magnetic resonance imaging, has the potential to elucidate the specific computational and neural processes through which we learn about other people.

J-05

EARLY DAMAGE TO THE AMYGDALA BLUNTS AFFECTIVE REACTIVITY BUT NOT AFFECTIVE LEARNING *Eliza Bliss-Moreau, David G. Amaral; California National Primate Research Center, University of California Davis* - For the last twelve years, we have been following the affective development of a cohort of rhesus macaques

that sustained bilateral, complete damage to the amygdala as neonates in order to investigate whether the amygdala is critical for developing normal affective responding. Across their lifespans, animals with neonatal amygdala damage, compared to age-matched control animals, have demonstrated consistently reduced affective reactivity in the presence of novel objects and those thought to engender threat like responding (Bliss-Moreau et al., 2010; 2011). We recently demonstrated that these animals also have blunted affective responses to video stimuli depicting positive and negative social interactions and conspecifics' social signals (Bliss-Moreau, Bauman, & Amaral, 2011) suggesting that early amygdala damage permanently alters amygdala-lesioned animals' affective lives. To further test this hypothesis, our subjects completed an affective associative learning task (i.e., "fear potentiated startle") during which a light was associated with an aversive air puff to the face. When learning occurs, the light serves to increase the magnitude of startle to a 100 dB burst of white noise. Learning of this sort is amygdala-dependent in adult rhesus monkeys (Antoniadis, et al., 2007; 2009). Prior to the tasks' learning phase, we measured animals' startle responses to a series of loud white noise bursts (80 to 115 dB). Compared to control animals, amygdala-lesioned animals generated significantly smaller startle responses to the white noise bursts. Both control and amygdala lesioned animals generated larger startle responses to the loudest white noise burst (115 dB), as compared to the quietest (80 dB), indicating that amygdala-lesioned animals' still had the ability to modulate their responses based on stimulus intensity. Similarly, amygdala lesioned animals had significantly smaller startle responses to the aversive air puff to the cheek (100 psi, 1.2 seconds, via 4 6.35 mm nozzles ~10-12 cm from the face) used in the learning phase of the task. Strikingly, and despite their dramatically blunted affective reactivity, amygdala-lesioned animals were able to learn the association between the light and aversive air puff. Amygdala-lesioned and control animals startle responses' in the presence of the light were significantly greater after the light was paired with the aversive air-puff than before it was paired indicating that the light acquired fear value for both groups of animals. Taken together, these findings suggest that plasticity during neural development is able to account for some, but not all, of the functions normally attributable to the amygdala. Implications for understanding the amygdala's role in normal and pathological affective processing will be discussed.

J-06

MAPPING THE NEURAL CORRELATES OF CULTURAL IMITATIVE LEARNING *Elizabeth Reynolds Losin, UCLA, University of Colorado Boulder; Marco Iacoboni, Mirella Dapretto, UCLA* - Cultural learning through imitation is one of the core mechanisms of cultural acquisition. Although cultural neuroscience studies are beginning to reveal how cultural experience shapes the brain, little is known about the neural underpinnings of cultural acquisition itself. We previously proposed a model of the neural underpinnings of cultural learning

that included perceptual-motor regions involved in imitation, the reward system and the default mode network (DMN), thought to be important for metalizing about the self and others (Losin et al., 2009). Here, we tested this model in a series of three fMRI studies focused on imitative learning biases related self-similarity and social status that are thought to increase the efficiency of cultural learning. In the first two studies, we asked how gender and race, social categories that can suggest self-similarity and status, would modulate activity in the different nodes of our cultural learning model. In the third study, we asked how a more abstract type of social grouping, ideological similarity, influenced the neural mechanisms of imitation. Across the studies participants imitated and observed male and female models from three racial groups (European American (EA), African American (AA) and Chinese American (CA)) perform unfamiliar hand gestures. In study one, participants were 20 European American young adults. In this study we found that nodes of the reward system were modulated by gender similarity between model and imitator (Losin et al., 2012a), whereas perceptual-motor regions related to imitation were modulated by the model's race in a way more consistent with social status associations (Losin et al., 2012b). In study two, we tested whether these phenomena differed between the original sample of European American participants and an age- and SES-matched sample of African American participants (N=20). Surprisingly, we found that the race of the imitator modulated neural activity during imitation and imitation accuracy largely independently of the imitator's own race, suggesting that commonly held cultural stereotypes rather than differential cultural experience might drive neural mechanisms of imitative biases related to race in these groups (Losin et al., resubmitted). In the third study, we employed a new sample of 17 European American young adults. In this study we found that while shared ideology impacted feelings of interpersonal similarity in a comparable manner to gender and race, it was encoded by a different neural system during imitation (the DMN), the third system in our cultural learning model (Losin et al, in prep.). This body of work provides empirical support for our neural model of cultural imitative learning in the context of imitative biases and suggests that the nodes of this model may be differentially engaged depending on the level of abstraction of the social category. These findings also suggest that aspects of culture beyond ethnic background, such as social status, may shape neural mechanisms related to cultural acquisition.

J-07

IMAGINING OTHER PEOPLE'S EXPERIENCES IN DEVELOPMENTAL AMNESIA: AN FMRI STUDY *Jennifer S. Rabin, York University; Rosanna K. Olsen, Rotman Research Institute; Asaf Gilboa, Rotman Research Institute, University of Toronto, The Heart and Stroke Foundation Centre for Stroke Recovery; R. Shayna Rosenbaum, York University, Rotman Research Institute* - Findings from neuroimaging and patient lesion studies show that the hippocampus plays an integral role in episodic remembering, imagining of personal events, and in scene

construction. There are, however, several reports of cases who retain these abilities despite hippocampal damage. Among these cases are a person with hippocampal developmental amnesia who could recall some episodic memories (Maguire et al., 2001) and a person with intact scene construction despite adult-onset hippocampal amnesia (Mullally et al, 2012). fMRI findings suggest that the patients' intact performance was associated with residual function in the remaining hippocampal tissue. In the current study, we had the unique opportunity to measure activation of residual anterior and posterior hippocampal tissue in a developmental amnesic person (H.C.) as she engaged in episodic remembering and imagining the experiences of known and unknown others. Participants were scanned with fMRI as they recollected past experiences via episodic memory in response to personal photos ('EM' condition) and imagined other people's experiences in response to photos of personally familiar others ('pToM' condition) and unfamiliar others ('ToM' condition). Following the scan, participants were asked to describe the events as they had been recollected or imagined in the scanner. Narratives were scored using an adapted Autobiographical Interview scoring procedure. Due to the visually rich nature of the photos, internal details were further classified as either descriptive (i.e., details that describe the visual content of the photo) or elaborative (i.e., details that go beyond what is visually depicted in the photo). To examine activity within the hippocampus, we created four regions of interest (ROI) masks corresponding to the left and right anterior and posterior portions of the hippocampus. The average percent signal change for each ROI was calculated for the early (i.e., searching for the event) and late phase (i.e., expanding on event details) of EM, pToM, and ToM event generation. Behaviourally, H.C. was impaired compared to controls on elaborative details of episodic remembering and imagining of known others' experiences. She was intact, however, on imagining of unknown others' experiences. Despite her differential behavioural impairment, ROI analyses revealed the presence of bilateral anterior and posterior hippocampal activation in all three conditions in H.C. These results suggest that activation of residual hippocampal tissue does not necessarily reflect intact behavioural performance. Modulation of hippocampal activity and differences in connectivity between the hippocampus and other brain regions are explored as possible accounts for this discrepancy.

J-08

5-HTTLPR GENOTYPE MODERATES ASSOCIATIONS BETWEEN AVERSIVE PARENTING AND HIPPOCAMPAL AND AMYGDALA STRUCTURE DURING ADOLESCENCE *Keriann Little, University of Melbourne; Craig A. Olsson, Deakin University, Murdoch Childrens Research Institute; Nicholas B. Allen, University of Melbourne* - Background: A common variation within the promoter of the serotonin transporter gene (5-HTTLPR) has been repeatedly linked with increased risk for stress-associated disorders such as depression, particularly following stressful life events or adversity, including adverse family environments (Caspi,

Hariri, Holmes, Uher, & Moffitt, 2010). There is also evidence that, in psychiatrically healthy individuals, 5-HTTLPR genotype influences the volume of brain regions involved in emotion regulation and stress-responsivity, including the hippocampus and amygdala (Scharinger, Rabl, Sitte, & Pezawas, 2010). Aims: We investigated whether 5HTTLPR genotype moderated correlations between aversive parenting and hippocampal and amygdala volumes during adolescence. Methods: Participants were 175 adolescents (initially aged 12-13 years, 91 girls). When participants were 12-13 years old, mother-adolescent dyads engaged in 20-min pleasant event-planning (EPI) and problem-solving (PSI) conversations in the laboratory, which were designed to elicit positive and negative emotions respectively. Mothers' affective behaviour was coded in real time using the Living in Family Environments (LIFE) coding system (Hops et al., 1995). In this study, the construct of interest was the frequency of Aversive behaviors displayed by mothers on both the EPI and the PSI. Aversive behaviors included displays of contemptuous, angry, or belligerent affect, or disapproving, threatening or argumentative verbal content with neutral affect. Structural MRI data was also collected when participants were 12-13 years and volumetric assessment was via manual delineation of specific regions of interest (ROI). Saliva samples were obtained for genetic analysis and genotyping was performed by polymerase chain reaction (PCR) amplification and visualization by gel electrophoresis. Results: Path analysis indicated an overall significant correlation between more frequent displays of aversive parenting in the EPI and larger left hippocampal volume, and that this association was significantly moderated by 5HTTLPR genotype. Post hoc simple slope analyses suggested no relationship between aversive parenting and left hippocampal volume in S carriers, but a significant trend for more frequent displays of aversive parenting to be associated with larger volumes for L homozygous individuals. A similar pattern was observed between aversive parenting in the EPI and the right hippocampus at trend level. More frequent aversive parenting in the PSI was correlated with both larger left and right amygdala volumes overall, and again 5HTTLPR was found to be a significant moderator of these relationships. In L-homozygous individuals, higher levels of aversive parenting were associated with both larger left and right amygdala volumes. In contrast, in S-carriers, greater aversive parenting was associated with smaller left and right amygdala volumes. Significance: These findings suggest that both hippocampus and amygdala structure may be affected by aversive parenting environment. Hippocampal volumes were related to aversive parenting displayed during pleasant event-planning interactions between adolescents and their mothers, whilst amygdala volumes were associated with aversive parenting in more conflictual problem-solving interactions. Moreover, these brain-environment correlations were moderated by 5HTTLPR genotype; more aversive parenting was generally correlated with increased hippocampal and amygdala volumes in L homozygous adolescents whilst smaller amygdala volumes were observed for S-carriers.

J-09

**"YOU SAY SO, WHO KNOWS IF IT IS TRUE"
INFLUENCES OF SOCIAL HIERARCHY ON THE
SENTENCE COMPREHENSION AND CONFIDENCE**

Hernando Santamaría-García, Alba Ayneto, Nuria Sebastián-Gallés; Universitat Pompeu Fabra - Social hierarchies modulate some cognitive processes. Nevertheless, the study of the influence of social hierarchy on sentence comprehension is scarce. We presented sentences with different levels of plausibility uttered by speakers with different hierarchical status (as previously established through a hierarchical video game) and measured the modulations of the N400 component. Participants heard three subsets of sentences with different plausibility value, depending on the last word (high, intermediate and low-plausibility). Sentences could be spoken by a superior or by an inferior status player. When listening to the superior player, the modulation of the N400 component followed the expected pattern (inverse relationship between amplitudes and sentence plausibility). However, when participants heard the inferior speaker the amplitude of the N400 in high plausible sentences matched that of intermediate plausibility (increased). This result could be interpreted as an indicator electrophysiological of the trust process. Our findings are showing that participants' did not trust low rank speakers, even if sentences were high-plausible.

J-10 *SANS Poster Award Winner

**DISRUPTING THE LEFT PREFRONTAL CORTEX
DIMINISHES CHOICE-INDUCED PREFERENCE
CHANGE**

Flavia Mengarelli, Silvia Spoglianti, Alessio Avenanti, Giuseppe di Pellegrino; Università di Bologna, Centro Studi e Ricerche in Neuroscienze Cognitive - In everyday life, people often find themselves facing difficult decisions between options that are equally attractive. Cognitive dissonance theory states that after making a difficult choice between two equally preferred options, individuals no longer find the alternatives similarly desirable. Rather, they often change their existing preferences to align more closely with the choice they have just made. Despite the relevance of cognitive dissonance in modulating behavior little is known about the brain processes crucially involved in choice-induced preference change. In the present study, we applied cathodal transcranial Direct Current Stimulation (tDCS) to suppress neural activity in the left or the right dorsolateral prefrontal cortex (DLPFC) during a revised version of Brehm's (1956) free-choice paradigm. We found that suppression of the left, but not of right DLPFC activity caused a reduction of the typical behavior-induced preference change, relative to sham stimulation. Our findings highlight the role of prefrontal cortex in cognitive dissonance and provide causative evidence that left DLPFC plays a necessary role in the implementation of choice-induced preference change.

J-11 *SANS Poster Award Winner

**SOCIAL INFLUENCE: NEURAL CORRELATES
ASSOCIATED WITH RESISTANCE VERSUS
COMPLIANCE**

Christopher N. Cascio, Matthew O'Donnell,

Frank Tinney, Joe Bayer, Kristin Shumaker, Josh Carp, Emily B. Falk; University of Michigan - Throughout life social influences shape our decisions, attitudes, and behaviors. This is especially true during adolescence, a period when individuals are particularly susceptible to social influence. Social influence can come from direct contact with peers, or from mediated sources such as online reviews, ratings, or social network sites. While social influence in adolescence has been widely studied, relatively little is known about the neural mechanisms involved in responses to everyday social experiences, including social influence. The present study seeks to extend our understanding of social influence in adolescence by examining neural correlates associated with behavior change during a social influence task. Forty-six adolescent boys aged 16-17 completed two rounds of a social influence task examining preferences towards mobile game applications (e.g., Angry Birds). The first round was completed prior to an fMRI session, measuring baseline attitudes towards games that were previously unfamiliar to participants. The second round occurred during an fMRI session, where participants were exposed to their peers' game ratings (same, higher, lower, or not rated) then re-rated the games. In addition during the fMRI session participants also completed a social exclusion task (Cyberball). We hypothesized that individual differences in sensitivity to social and emotional cues during exclusion (compared to inclusion in Cyberball) would be associated with participants' decisions to conform (vs. maintaining their original preferences) during the app-rating task. To test this hypothesis, we identified neural regions of interest (ROIs) associated with the main effect of exclusion in Cyberball (DMPFC, subgenACC, anterior insula [AI]), and extracted parameter estimates of individual differences in activity within these regions. We then regressed these values onto overall rates of behavior change in response to peer feedback in the app-rating task, as well as the contrast of neural activity when participants conformed, versus failed to conform with peer ratings in the app-rating task. On average during the app-rating task, participants changed their preferences to be in line with the peer group 45.2% of the time, however participants were significantly more likely to change their rating when peers rated the game lower than the participant's rating ($M = 51.9\%$) versus when peers ostensibly rated the games higher ($M = 38.5\%$), $p < .001$. Individual differences in neural activity within the main Cyberball ROIs were not associated with frequency of behavior change during the app-rating task, but were associated with the underlying neural response to group opinions that differed from the participants. More specifically, individual differences in neural responses to exclusion during Cyberball within DMPFC and AI were associated with greater activity in neural regions associated with conflict detection (dACC) when participant's failed to conform with differing group opinions, and with increased activity in the brain's reward system (within OFC) when changing one's preference to align with the group. Thus, individuals who are more sensitive to social and emotional feedback may also experience stronger responses to situations when their opinions are out of line with the group, and may suggest that for these

individuals, conforming offers a means of reducing conflict and increasing reward.

J-12

VASOPRESSIN ALTERS FUNCTIONAL CONNECTIVITY OF THE MEDIAL PREFRONTAL CORTEX AND THE RIGHT AMYGDALA DURING THE PROCESSING OF SOCIALLY THREATENING STIMULI

Claudia Brunnlieb, University Magdeburg, University Lübeck; Bodo Vogt, University Magdeburg; Claus Tempelmann, University Magdeburg; Thomas F. Münte, University Lübeck; Marcus Heldmann, University Lübeck, University Magdeburg - The neuropeptide arginine vasopressin (AVP) is of crucial importance for the regulation of social behavior in diverse mammalian species. In animal studies, AVP has been linked to the formation of social bonds, social recognition, social communication and protective aggression, whereas in humans the mechanisms of AVP action are still poorly understood. Using fMRI in a double-blind, placebo controlled between-groups design, we investigated the influence of AVP on neural activations related to social cognition and emotional empathy in a group of healthy young men. Thirty-nine participants (AVP group: 21) viewed pictures depicting either one or two persons (social factor) in an emotionally neutral or negative scene (emotional factor). AVP modulated the activation of the right amygdala related to the emotional component of empathy. Moreover, AVP also increased the connectivity pattern of the right amygdala with the medial prefrontal cortex (mPFC) and the inferior parietal lobule during the processing of pictures illustrating a socially threatening scene. These findings suggest that AVP reduces suppressive effects of the mPFC on amygdala activity resulting in the observed enhanced neural activation pattern in the amygdala. Moreover, these findings corroborate the work by Zink et al. (2010) who previously argued that the negative feedback loop between the mPFC and the amygdala might be attenuated under AVP administration resulting in more sustained neural activity in the amygdala in response to threatening stimuli. From an evolutionary point of view, increased amygdala activity might be important for our survival, since it might trigger a faster reaction to socially threatening stimuli. At present it still remains unclear whether the increased amygdala activity reflects a direct impact of AVP on vasopressin V1 receptors in the amygdala or an indirect effect via vasopressin V1 receptors in the mPFC or other remote brain sites.

J-13

WE APPROVE THIS MESSAGE: PARTY ENDORSEMENTS AFFECT NEURAL RESPONSES TO POLITICAL INITIATIVES

Emile Bruneau, Massachusetts Institute of Technology; Jason Coronel, University of Illinois; Nicholas Dufour, Massachusetts Institute of Technology; Rebecca Saxe, Massachusetts Institute of Technology - In the months leading up to the 2012 elections, political parties and their advocates spent vast sums of money to communicate their arguments for, and endorsement of, policy positions. One particularly consequential context

for these arguments surrounds ballot initiatives, because voters directly influence policies. How do arguments and party endorsements affect individuals' responses to policy positions? Between September and November 2012 we examined the neural correlates of political reasoning in Democrats (n=20) and Republicans (n=11). During fMRI scanning, participants read 60 actual state initiatives from this and previous years, half of which were primarily supported by Democrats, and the other half by Republicans. The initiatives selected were relatively unfamiliar, avoiding especially hot-button issues. Each initiative was followed either by more information (Neutral), or an argument in favor of the initiative (Argument); the argument was either attributed to a non-partisan group ("Some people argue that...", Nonpartisan), or to whichever political party actually supported the proposition ("Democrats/Republicans argue that...", Partisan). Each initiative therefore had three versions: neutral, non-partisan argument, partisan argument. Participants saw only one version of each initiative, chosen at random. After the information/argument was presented, participants indicated how strongly they supported or opposed the initiative (from 1 strongly oppose to 4 strongly support). Consistent with previous studies in political science, we find that participants tended to support their own party's initiatives in the absence of arguments (Neutral: own-party =2.9, other-party 2.4). Adding arguments selectively increased support for one's own party's initiatives (own-party 3.1, other-party 2.5); adding party endorsements selectively decreased support for the other party's initiatives (own party 3.1, other party 2.2), an effect related to reactive devaluation. Overall, reading political Arguments (relative to Neutral information) led to reduced activity in brain regions associated with effortful, externally-directed thought (e.g. intraparietal sulcus, dorsolateral prefrontal cortex) and increased activity in brain regions associated with emotional and self-relevant stimuli (e.g. posterior cingulate, medial prefrontal cortex). These latter regions showed even greater activation when the argument was endorsed by a party. These data shed light on the mechanisms of by which party endorsements and arguments affect the political reasoning of individuals.

J-14

THE PROSOCIAL PUSH OF SOCIAL PAIN: DORSAL ANTERIOR CINGULATE CORTEX AND ANTERIOR INSULA ACTIVATION IN RESPONSE TO REJECTION PREDICTS RECONNECTION

David S. Chester, University of Kentucky; Naomi I. Eisenberger, UCLA; Richard S. Pond Jr., University of Kentucky; Stephanie B. Richman, University of Kentucky; C. Nathan DeWall, University of Kentucky - Social rejection is a threatening and aversive experience. Previous research has supported the social reconnection hypothesis, which states that the menacing nature of social isolation leads individuals to actively pursue the formation of new relationships (Maner, DeWall, Baumeister, & Schaller, 2007). However, the neural mechanisms through which post-rejection reconnection occurs remain unknown. Social rejection reliably elicits activation of the dorsal anterior cingulate

cortex (dACC) and the anterior insula, neural regions previously associated with the affective component of physical pain (Eisenberger, Lieberman, & Williams, 2003). Pain serves as an alarm through which we are motivated to avoid harm and repair damage. Given this motivational role of pain and rejection's ability to elicit it, we predicted that the pain of rejection, as evidenced by activation of the dACC and anterior insula would predict greater attempts at reconnection. To test this hypothesis, participants experienced social acceptance and rejection while undergoing functional magnetic resonance imaging (fMRI) and then were given a chance to behaviorally reconnect with one of their rejecters. Replicating previous research, rejection (as compared to social acceptance) was associated with activation of the dACC and anterior insula. Supporting our hypothesis, averaged activation across these neural regions was associated with greater attempts at behavioral reconnection. These findings support the social reconnection hypothesis and pain overlap theory and offer new insight as to the psychological processes that facilitate post-rejection reconnection.

J-15

FETAL PROGRAMMING EFFECTS OF TESTOSTERONE ON THE REWARD SYSTEM AND BEHAVIORAL APPROACH TENDENCIES IN HUMANS *Michael V. Lombardo, University of Cambridge; Emma Ashwin, University of Bath; Bonnie Auyeung, University of Cambridge; Bhismadev Chakrabarti, University of Reading; Meng-Chuan Lai, University of Cambridge; Kevin Taylor, Addenbrooke's Hospital; Gerald Hackett, Rosie Maternity Hospital; Edward T. Bullmore, University of Cambridge; Simon Baron-Cohen, University of Cambridge* - Sex differences are present in many neuropsychiatric conditions that affect emotion and approach-avoidance behavior. One potential mechanism underlying such observations is testosterone in early development. Although much is known about the effects of testosterone in adolescence and adulthood, little is known in humans about how testosterone in fetal development influences later neural sensitivity to valenced facial cues and approach-avoidance behavioral tendencies. With functional magnetic resonance imaging we scanned 25 8-11-year-old children while viewing happy, fear, neutral, or scrambled faces. Fetal testosterone (FT) was measured via amniotic fluid sampled between 13 and 20 weeks gestation. Behavioral approach-avoidance tendencies were measured via parental report on the Sensitivity to Punishment and Sensitivity to Rewards questionnaire. Increasing FT predicted enhanced selectivity for positive compared with negatively valenced facial cues in reward-related regions such as caudate, putamen, and nucleus accumbens but not the amygdala. Statistical mediation analyses showed that increasing FT predicts increased behavioral approach tendencies by biasing caudate, putamen, and nucleus accumbens but not amygdala to be more responsive to positive compared with negatively valenced cues. In contrast, FT was not predictive of behavioral avoidance tendencies, either through direct or neurally mediated paths. This work suggests that testosterone in humans acts as a fetal programming

mechanism on the reward system and influences behavioral approach tendencies later in life. As a mechanism influencing atypical development, FT might be important across a range of neuropsychiatric conditions that asymmetrically affect the sexes, the reward system, emotion processing, and approach behavior.

J-16

PAST BEHAVIOR AFFECTS FUTURE INVESTMENT DECISIONS AND MODULATES ACTIVITY IN PERSON PERCEPTION AND DECISION-MAKING BRAIN REGIONS *Victoria K. Lee, Elizabeth H. Thompson, Rachel E. Kranton, Lasana T. Harris; Duke University* - Social psychology demonstrates people infer traits about others from "thin slices" of behavior—brief single acts—as well as from faces and photographs (Ambady, 2010). These inferences activate a reliable person perception brain network and allow for generalizations about the person that may help guide behavior in future interactions (Brown & Brüne, 2012). Behavioral economics demonstrates brief descriptions of past behavior affect social decision-making and modulates brain activity in networks associated with decision-making processes including valuation and prediction error (Rilling & Sanfey, 2011). However, no study has examined the complete process of making inferences from behavior leading to generalization, then social decision-making across different domains. Here, we investigate the mechanisms underlying these generalizations for predicting behavior in person perception domains warmth and competence, and examine effects on future behavior in both domains. A database of participants completed a competence (time-estimation game) and a warmth task (charity donations). A separate group of participants then viewed accuracy and generosity information for database participants in the fMRI scanner before predicting and investing in the person's performance on an unrelated competence (guessing rocks in a jar) or warmth task (trust game). This allows us to test whether behavior in one game affects decision-making in a separate economic game, and whether this is mediated by the inferences made from the initial behavior. We show that inferences of trait warmth and competence are formed from prior behavior and affect investment decisions in both contexts, modulating activity in brain regions implicated in both decision-making and person perception.

J-17

IT'S WHAT IS INSIDE THAT COUNTS: EXPLORING THE EFFECTS OF MINDFULNESS ON NEUROAFFECTIVE REACTIONS TO INTERNAL VS. EXTERNAL FEEDBACK *Rimma Teper, Michael Inzlicht; University of Toronto* - Mindfulness is thought to comprise two facets - present moment awareness and the non-judgmental acceptance of thoughts and emotions. Though previous research has linked mindfulness to enhanced interoception and effective emotion regulation, the ways in which mindfulness and meditation practice may influence individuals' reactions to performance feedback

has not yet been studied. Specifically, we wondered: how might meditation and mindfulness effect individuals' neuroaffective reactions to internally-generated vs. externally-generated feedback? To explore this question, we conducted two studies in which we tested a) how meditation experience and mindfulness relate to individuals' neural responses to their own errors (Teper & Inzlicht, in press), and b) how trait mindfulness relates to individuals' neural responses to performance feedback (Teper & Inzlicht, under review). In these studies, we measured two different event-related potentials - the error-related negativity (ERN) and feedback-related negativity (FRN), as they are thought to be analogues of one another, indexing neural reactions to internal and external feedback, respectively. In Study 1, we recruited experienced meditators and control participants and recorded their brain activity using EEG while they completed a color-naming Stroop task. We measured the ERN, an internal index of conflict detection, which peaks within 100 ms of error commission and is localized to the anterior cingulate. Meditators exhibited better executive control (i.e. less Stroop errors), higher amplitude ERNs, and greater levels of mindfulness. Interestingly, mindful acceptance, the more emotive facet of mindfulness, significantly predicted ERN amplitude, such that individuals who were open to their affective experiences showed a stronger neuroaffective response to internal feedback. Mindful awareness, the more cognitive facet of mindfulness, did not predict ERN amplitude. These findings suggest that mindful emotional acceptance helps attune individuals to internal feedback (i.e. their own errors), and also facilitates control. In Study 2, we measured participants' levels of trait mindfulness and then recorded their neuroaffective reactions to external performance feedback (as indexed by the FRN) while they completed a time-estimation task. Also localized to the anterior cingulate, the FRN is a brain response that peaks approximately 250 ms after feedback presentation. Our findings suggest that mindful individuals were less aroused by negative and uncertain feedback, but that this was especially the case for individuals who ranked highly on the mindful acceptance facet of mindfulness. Mindful awareness, however, did not predict FRN amplitude. The results of this study suggest that adopting a non-judgmental acceptance of one's affective states may in turn help individuals regulate negative emotions. Taken together, the results of these studies suggest that mindfulness may have very different consequences for neuroaffective reactions to internal vs. external feedback. We discuss the intriguing role of mindful acceptance in these relationships and the implications that these findings have for current theory on mindfulness, executive control, and emotion regulation.

J-18

OXYTOCIN INCREASES DELAY OF GRATIFICATION *Alejandro de la Vega, University of Colorado Boulder; Christopher H. Chatham, Brown University; Grit Herzmann, University of Colorado Boulder; Yuko Munakata, University of Colorado Boulder* - The ability to delay gratification is essential for the pursuit of greater long-term goals. However, humans devalue future

rewards as a function of time. These aspects of behavior have been explained in terms of valuation systems that favor immediate rewards, and cognitive control systems that can override this preference. However, humans are extremely social creatures, and delaying gratification also relies upon an assumption of social cooperation, such that social factors may influence delay of gratification. We test this hypothesis by administering oxytocin, a hormone that influences social processing. We find that this manipulation increases choices of delayed rewards over smaller, immediate rewards, providing causal evidence for oxytocin in delaying gratification and highlighting the importance of social factors in the human ability to wait for rewards.

J-19

MOVING TOWARDS HAPPINESS: FULL BODY MOTION MODULATES THE INTERPRETATION OF AMBIGUOUS FACIAL EXPRESSIONS *Janek S. Lobmaier, Antje Stahlke, Fred W. Mast; University of Bern* - Human beings have a general tendency to avoid unpleasant stimuli and to approach pleasant stimuli. Various studies have demonstrated a link between affective evaluation of stimuli and approach-avoidance behavior. On the one hand, the evaluation of stimulus valence has been shown to facilitate affect-congruent approach and avoidance responses (i.e. faster approach towards positive and avoidance of negative stimuli). On the other hand the execution of various approach- and avoidance behaviors (e.g. pushing or pulling a lever to categorize stimuli with different valences) has been found to influence stimulus evaluation, resulting in more positive evaluations when executing an approach behavior and in more negative evaluations when executing an avoidance movement. In this study we investigated whether passive full body movement influenced whether a stimulus face was interpreted as showing a positive (happy) or negative (angry) expression. Specifically participants were briefly presented with faces with ambiguous expressions (i.e. morphs between happy and angry faces) while they were moved forward or backward on a 6-degrees-of-freedom motion platform (MOOG). For each face participants indicated whether it was expressing happiness or anger. We found that participants were more likely to categorize faces as being happy when they were being moved forwards compared to when being moved backwards. These results suggest that passive approach and avoidance movements bias our perception of emotional faces in such a way that when approaching an ambiguous facial expression we tend to interpret it as being positive, while the same face appears less positive when moving away from it. This finding is in line with a self-serving bias, stating that people seek a positive image of themselves and their environment. This is done with such vigor that reality is at times selectively interpreted.

J-20

NEURAL CORRELATES OF NON-VERBAL SOCIAL INTERACTIONS: INSIGHTS FROM SINGLE & DUAL-EEG ANALYSES *Mathilde Ménoret, Institut des*

Sciences Cognitives; Léo Varnet, Lyon Neuroscience Research Centre; Raphaël Fargier, Institut des Sciences Cognitives; Anne Cheylus, Institut des Sciences Cognitives; Aurore Curie, Institut des Sciences Cognitives, Hospices Civils de Lyon; Vincent des Portes, Institut des Sciences Cognitives, Hospices Civils de Lyon; Tatjana A. Nazir, Institut des Sciences Cognitives; Yves Paulignan, Institut des Sciences Cognitives - Successful non-verbal communication between human beings requires dynamic and efficient encoding of others' gestures. Our study aimed at identifying neural markers of social interaction and context variations in a non-verbal task. For this, we recorded dual-EEG and arm/hand kinematics from two participants, an actor and an observer, in a real face-to-face paradigm. The observer watched "biological actions" performed by the human actor or "non-biological actions" performed by a robot. All these actions occurred within an interactive or a non-interactive context depending on whether the observer had to perform a complementary action or not (e.g. the actor presents a saucer and the observer either places the corresponding cup or does nothing). We assessed the motor system activation via motor related potentials (MRPs) and beta (~20Hz) oscillations of both participants. The differences between the two context conditions were statistically assessed using a cluster-based nonparametric permutation test. An advanced analysis of the inter-subject coherence was also performed to assess the relationship between the brains of the two partners. Movement kinematics did not differ in the two context conditions and for the actor the MRPs were similar in the two conditions. For the observer, however, an observation-related MRP was measured in all conditions but it was more negative in the interactive context over fronto-central electrodes and seemed specific to the human actor only. Concurrently, suppression of beta oscillations was observed rapidly after the onset of the actor's movement for movement execution (actor's EEG) and observation (observer's EEG). Critically, this suppression was stronger in the interactive than in the non-interactive context despite the fact that movement kinematics did not differ in the two context conditions. For the observer, this suppression was stronger in the interactive than the non-interactive context independently of whether the actor was a human or a robot. In addition, in the beta frequency band, the inter-brain analysis revealed that the inter-subject coherence increased during the interactive context compared to the non-interactive context specifically within centro-parietal electrodes. These results suggest that acting in a social context induced analogous modulations of motor and sensorimotor regions in observer and actor, therefore increasing the coherence between the two partners' brains. Sharing a common goal during an interaction seems thus to evoke a common representation of the global action through a centro-parietal network that develops over time.

J-21

HOW REAL-LIFE PRIOR EXPERIENCE INFLUENCES TRUST DECISIONS AND REWARD LEARNING MECHANISMS *Dominic S. Fareri, Rutgers University; Luke J. Chang, University of Colorado Boulder, University of*

Arizona; Mauricio R. Delgado, Rutgers University - Social relationships are predicated on trust—a social preference centered on the expectation that generosity will be reciprocated. Initial judgments of others as trustworthy can be made rapidly based solely on facial characteristics (Willis & Todorov, 2006); however, learning someone's reputation as trustworthy requires repeated interactions and relies on neural circuitry typically implicated in reward learning such as the striatum (e.g., King-Casas et al., 2005). Importantly, prior descriptive knowledge (Delgado et al., 2005) and social experience (Fareri et al., 2012) can instill social impressions that bias decisions to trust and the ability to update beliefs about others via reinforcement learning mechanisms. As many daily interactions occur with members of our social networks already deemed as trustworthy, however, it remains unclear how prior real-life experience with members of one's own social network may influence subsequent trust decisions and social learning mechanisms. We investigated whether participants (n=18) would differentially trust three partners in a repeated trust game—a close friend (in-network), a confederate (out-of-network), and a computer. Participants played as investors while undergoing fMRI and believed that trust game interactions would occur in real-time. In reality, all partners were programmed to reciprocate participants' investments 50% of the time. We expected highest rates of investment and enhanced reward-related neural responses when interacting with in-network partners. Accordingly, participants rated in-network partners as most trustworthy and invested most often with them. This effect of social network was observed in a ventral striatum ROI when processing trust game outcomes. Further, medial prefrontal cortex demonstrated enhanced neural responses when processing outcomes of trials with social compared to non-social partners. A reinforcement learning analysis revealed a tendency for participants to rely more strongly on positive trust game outcomes (e.g., partner reciprocation) to update beliefs about partner reputation when playing with in-network partners. These results suggest that real-life prior experience can bias not only behavior but also value related neural signals during social interactions.

J-22

BRAIN RESPONSES DURING EXTINCTION OF LEARNED FEAR TO RACIAL IN-GROUP AND OUT-GROUP FACES *Tanaz Molapour, Karolinska Institutet; Armita Golkar, Karolinska Institutet; Carlos Navarrete, Michigan State University; Olof Hjort, Karolinska Institutet; Andreas Olsson, Karolinska Institutet* - Previous research has shown that conditioned fear responses (CRs) to images of members of racial out-groups, as compared to in-groups, are more persistent and resist extinction. Much is known about the neural processes underlying the acquisition of CRs, involving a network of brain regions, such as the amygdala, anterior cingulate cortex (ACC), anterior insula (AI), and the extinction of CRs, involving the amygdala and prefrontal cortex (PFC). However, the neural mechanisms supporting the persistence of learned fear of racial out-group faces remain unexplored. The amygdala, AI and ACC have also been implicated during

viewing of members of out-groups and stigmatized groups, providing a link to the research on fear learning. We used functional magnetic resonance imaging (fMRI) to investigate the neural correlates of CRs to images of male Black and White faces in White participants. During fear acquisition, one face (the reinforced conditioned stimulus, CS+) from each category (Black and White) was paired with a mild electric shock. The other stimulus from each category (CS-) served as a control stimulus, and was never paired with a shock. Following acquisition, subjects watched unreinforced presentations of the faces (extinction). We found that during extinction, CRs to Black vs White faces showed greater activity in a neural network involved in fear learning, as well as the fusiform face area, which is known to be relatively enhanced during the perception of emotionally relevant faces. In addition, CRs to Black vs White faces were linked to increased activity in the medial and lateral PFC. Taken together, these results suggest that the persistence of CR to out-group vs. in-group faces might depend on an impaired down-regulation of the fear learning network and heightened perceptual processing in face specific regions. Our findings might help to explain the basic mechanisms underlying the acquisition and maintenance of aversions towards out-group individuals.

J-23

EXAMINING THE COMPONENT PROCESSES OF DECISION MAKING: THE INFLUENCE OF POSITIVE AND NEGATIVE CONCEPTUAL-KNOWLEDGE AND ASSOCIATIVE-LEARNING *Pareezad Zarolia, Kateri McRae; University of Denver* - Emotions are known to influence decision-making, but little is known about the effects of the way that emotional information is conveyed. Emotional information can be conveyed in the form of conceptual-knowledge (i.e., explicit, top-down knowledge of properties of alternatives) and associative-learning (i.e., pattern recognition based on experience that need not be conscious). While both types of information are known to influence decision-making independently, little is known about how these processes interact to influence decisions. In a series of three studies, we examined the effects of conceptual-knowledge and associative-learning on decision-making. Using an economic decision-making task, we examined the effects of positive and negative conceptual-knowledge and associative-learning on an individual's social decisions, impression formation and their physiological response to new information as measured by skin conductance level (SCL). We predicted that under some circumstances, these two sources of information would interact to inform decision-making. We observed an interaction such that when conceptual knowledge is provided first, it influenced positive but not negative associative-learning. Interestingly, conceptual-knowledge influenced both positive and negative associative-learning when it was a) refreshed along with associative-learning, and b) when the associative-learning had already been established. These interactions demonstrate that negative associative learning reduces the likelihood that conceptual information will influence decision-making, but only under certain circumstances. This important distinction brings us closer to

understanding not only how emotional information influences decision-making, but the relative effects of different types of emotional information on decision-making.

J-24

REGULATING FEAR IN THE FACE OF STRESS

Candace Raio, New York University; Temidayo Orederu, Hunter College; Laura Palazollo, New York University; Ashley A. Shurick, Stanford University; Elizabeth A. Phelps, New York University, Nathan Kline Institute for Psychiatric Research - The prefrontal cortex (PFC) is critical for recruiting the cognitive control necessary to regulate emotional responses to aversive stimuli. However, the regions of the PFC that are preferentially involved in the cognitive regulation of emotion are also those that are selectively impaired by stress, suggesting that stress may diminish our ability to employ these strategies precisely at the time when they are needed most. We examined this possibility using a fear-conditioning paradigm whereby participants were presented with one conditioned stimulus (CS+) that predicted a wrist-shock; the other predicted no shock (CS-). Skin conductance response (SCR) served as an index of fear arousal. After fear conditioning, participants reported the emotions they felt toward each CS and rated the intensity of these emotions. They then underwent a cognitive regulation session during which they learned to reappraise the CS+, and restructure the fear conditioning session, in a less threatening manner. After regulation training, all participants re-rated the emotions originally reported for the CS+. The next day, participants returned and were either exposed to acute stress (cold pressor task) or a matched control task before undergoing the same conditioning session from Day 1, except that they were instructed to utilize the cognitive regulation strategies from the previous session. Day 1 results revealed equivalent levels of differential fear learning (defined as greater arousal to the CS+ relative to the CS-) between groups. Both groups categorized the majority of emotions they felt toward the CS+ as fearful and rated these emotions with equal levels of intensity. After regulation training, participants showed a marked reduction in subjective fear that did not differ between groups. Day 2 results confirmed that our stress induction was successful—increases in cortisol relative to baseline were significantly greater for the stress group only. While fear arousal to the CS+ diminished significantly in the control group on Day 2, the stress group showed no such attenuation; instead, they demonstrated fear arousal that was comparable to that of the previous day. These data suggest that stress impairs the ability to deploy cognitive regulation strategies known to actively control emotional responding. These findings highlight important limitations of cognitive strategies for regulating emotional responses and offer insight into why such strategies may be challenging to recruit in everyday life where stress is ubiquitous.

J-25

ANGER BUT NOT HAPPINESS LEAVES INDIVIDUALS WITH AUTISM SPECTRUM DISORDER DYSREGULATED

Nakia S Gordon, Katherine Reiter, Noelle Fritz, Bridget Dolan, Amy V VanHecke; Marquette University - Emotional awareness and regulation are important for successful functioning. One proxy measure of emotional regulation is respiratory sinus arrhythmia (RSA) which provides an estimation of parasympathetic nervous system arousal. In the Polyvagal theory (Porges, 2007), higher RSA indicates a system that is well regulated and allows individuals to engage in social interactions. Yet, the literature remains mixed on whether there are state-induced changes of RSA in response to an emotional challenge. We investigated changes in RSA to high arousal positive and negative emotional challenges in both typically developing individuals (TYP) and those with Autism Spectrum disorder (ASD). Given that ASD is a pervasive social-developmental disorder that includes difficulties with both emotional experience (Ghazziuddin & Zafar, 2008) and physiological regulation (Rossignol & Frye, 2012), we also wanted to investigate whether there were differences physiologically and psychologically in individuals who do not readily express emotion. We recorded RSA, ERPs, and emotion in 13 individuals (7 ASD). RSA and subjective ratings of happiness, anger, and arousal were recorded before and after each of 3 (happiness, anger, neutral) autobiographical recall procedures. Subjectively, all participants reported more happiness after the happy induction, but also significantly less anger. They were significantly angrier after the anger induction, but had no change in reported happiness. At baseline, ASD participants were significantly less regulated as demonstrated by lower RSA scores. While reflecting on their emotional stories, ASD participants were less regulated in the Anger condition, but showed no differences in the Happy condition relative to TYP participants. Interestingly, ASD participants reported feeling significantly less aroused than TYPs throughout the experiment. These data suggest that while the inductions were successful at inducing the target emotions, anger is more malleable than happiness; there were greater changes to Anger in both induction procedures. And, only the Anger condition resulted in more dysregulation for ASD participants. These data also suggest that there may be a disconnection between physiology and emotional arousal in ASD participants given the low subjective arousal ratings. Analyses of ERP data in response to social and non-social emotional pictures are forthcoming.

J-26

EMOTIONAL ALTERATIONS IN BEHAVIORAL VARIANT FRONTOTEMPORAL DEMENTIA

Virginia E. Sturm, University of California, San Francisco; William W. Seeley, University of California, San Francisco; Howard J. Rosen, University of California, San Francisco; Bruce L. Miller, University of California, San Francisco; Robert Levenson, University of California, Berkeley - Socioemotional impairment is a hallmark feature of behavioral variant

frontotemporal dementia (bvFTD), a neurodegenerative disease that targets neural systems that are important for emotional appraisal, reactivity, and regulation. Early loss in frontoinsula, anterior cingulate cortex, and orbitofrontal cortex is often accompanied by profound behavioral changes including loss of empathy, disinhibition, and apathy. The ways by which emotional network degeneration gives rise to emotional symptoms, however, remain poorly understood. In our work, we have used laboratory-based methods from affective science to measure autonomic, behavioral, and experiential aspects of emotion in patients with bvFTD. This approach has proved to be a powerful tool that has advanced our understanding of how specific aspects of emotional functioning are preserved and others are disrupted in bvFTD. We have found that while certain emotional functions (e.g., startle reactivity, generation of happiness/amusement, and sadness) are generally intact in bvFTD, other functions (e.g., generation of disgust and embarrassment) are diminished. Loss in visceromotor emotion generation and emotion regulation systems influences behavioral and physiological emotional reactivity in patients with bvFTD. In addition to advancing our understanding of the emotional mechanisms that go awry in bvFTD, this work informs our knowledge of the neural basis of emotional and social deficits that are relevant for psychiatric disorders and contributes to our conceptualization of how the healthy brain supports emotional functioning.

J-27

PORTFOLIO CHOICE VS. SINGLE CHOICE - NEURAL DIFFERENCES IN COGNITIVE CONTROL

Ralf Morgenstern, University of Magdeburg; Marcus Heldmann, University of Lübeck; Bodo Vogt, University of Magdeburg - In experimental economics an important issue for obtaining reliable behavioral results is the design of payoff procedures for giving incentives to the subjects. One common payoff procedure in multiple lottery choice tasks is the random payoff mechanism. This mechanism provides incentives for a truthful response in every single choice task since every decision should be treated as independent from other decisions. A second, often used payoff procedure is to realize all decision. Since all decisions are determining the final reward, subjects are not incentivized to treat their decisions independently. The difference in risk behavior between both payoff procedures is known as the portfolio effect. In our study, we address the question how these two payoff mechanisms differ in their evaluation process since the portfolio effect is caused by a divergence in the independent valuation of a choice task. Evaluation processes occur before observable behavior takes place and can be assigned to cognitive control mechanisms. In order to reveal such processes, we performed an EEG paradigm comprising two sessions with equal choice tasks, but different payoff procedures. We focus on the stimulus locked N200 component, an event related potential closely related to cognitive control processes. Our behavioral data show differences between both payoff mechanisms which can be assigned to a portfolio effect. The analysis of the stimulus-locked event related

potentials reveals a characteristic pattern of the N200 amplitude between indifferent and sure choices. Indifferent choices evoke higher N200 amplitudes than sure choices which can be attributed to a higher action control conflict when subjects are indecisive. Furthermore, a higher N200 amplitude is also present for sure lottery choices when all decision are paid out. This is contrary to the random payoff mechanism in which an increased N200 is absent for these choices. This implies that more resources are allocated in a portfolio choice task when lotteries are chosen. Risky portfolio choices seem to involve additional choice criteria such as the relevance of previous decisions. As a consequence, a potential portfolio effect has to be related to a non-independent choice task evaluation solely in risky portfolio choices.

J-28

THE TIME-COURSE OF DEALING WITH MORALLY OBJECTIONABLE LANGUAGE: WHAT HAPPENS WHEN WE READ ABOUT BAD STUFF? *Marijn E. Struikma, Myrto Pantazi, Hannah N.M. De Mulder, Jos. J.A. van Berkum; UiL OTS, Utrecht University* - Language is the primary mode of expressing our moral opinions - after all, people talk about what they think is good and bad all the time: at home, work, in class, church, congress, on the web, etc. Understanding how value-dependent moral judgment interacts with the processing of language is thus important. There is a growing body of evidence regarding which brain areas respond to moral transgressions, but little is known about the time-course and nature of the various sub-processes involved. In previous EEG work, Van Berkum et al. (2009) compared strict Christian to non-Christian elderly men and reported an early positivity, a small N400-effect and a late positive potential (LPP) specific to the reading of attitude-survey statements that clashed with participants' moral values. When dealing with morally loaded language, such as "abortion is acceptable", our value system has a direct impact on how we process the linguistic input. While processing such statements word-by-word, readers already experience an affective reaction to the morally loaded initial noun (e.g. abortion), and consequently build up strong expectations with respect to plausible upcoming words, expecting the noun to be modified in line with their personal moral beliefs (e.g. 'abortion is unacceptable' for a pro-lifer, but 'abortion is acceptable' for pro-choice individuals). To determine whether the previously reported N400-effect in response to morally objectionable statements was similar to a typical N400-effect and to see whether the tri-phasic response would generalize from elderly men to students, we recorded EEG from students while reading morally loaded attitude-survey statements, as well as factually correct or incorrect general statements (e.g., "every year computers get slower", a world-knowledge violation). The world-knowledge violation task elicited a typical N400-effect; the attitude-survey task, in contrast, did not, suggesting that there was no strong word anticipation effect in reading morally objectionable statements in our current group of participants. In line with the previous study we did observe an early positivity and an LPP (an effect that is typically elicited by emotionally engaging stimuli). More specifically, the statements that clashed

with the participant's moral values were found to elicit a stronger positivity than the statements that were consistent with their moral values. The observation of an LPP effect in the current experiment is thus consistent with extremely rapid engagement of affective systems during the processing of language. Additionally, how we deal with language that opposes our moral values may well be influenced by personality traits. To examine such individual differences we correlated the abovementioned ERP effects with how our participants scored on several relevant personality questionnaires. A significant correlation was found with scores on perspective-taking (PT) as measured by the Interpersonal Reactivity Index self-report scale. Participants scoring high on PT showed a greater positivity towards morally objectionable statements than participants scoring low on PT, suggesting that the more people are inclined to take other people's perspective, the stronger they react to statements that clash with their values. These results indicate the importance of considering individual differences when disentangling how value-dependent moral judgment and language processing interact.

J-29

IMPAIRED COGNITIVE REAPPRAISAL SUCCESS AMONG ADULTS WITH A HISTORY OF DELIBERATE SELF-HARM: EVIDENCE FROM AN FMRI STUDY *Tchiki S. Davis, University of California, Berkeley; Daniel Lumian, UCLA; Iris B. Mauss, University of California, Berkeley; Páree Zarolia, University of Denver; Brett Q. Ford, University of California, Berkeley; Kateri McRae, University of Denver* - The practice of intentionally hurting one's own body without suicidal intent (deliberate self-harm; DSH) is a common, yet poorly understood behavior. Theories suggest that heightened negative emotional reactivity and poor emotion regulation are characteristics of those who engage in DSH. The present study aimed to build on this research by assessing negative emotional reactivity and cognitive reappraisal success (i.e., ability to reframe a situation to reduce its negative impact) in an fMRI laboratory experiment. Negative emotional reactivity was assessed by measuring amygdala activation in response to negative images. Reappraisal success was assessed by measuring amygdala and prefrontal activation in response to negative images for which participants were instructed to use cognitive reappraisal. Compared to a carefully matched control group (non-DSH participants who were matched to the DSH group on demographics, depression, and anxiety symptoms; n=27), the DSH group (participants with a history of DSH; n=21) did not exhibit differences in negative emotional reactivity. However, the DSH group exhibited less successful down-regulation of amygdala activation and greater activation in cortical control regions (e.g., dorsomedial prefrontal cortex and posterior cingulate) during attempted reappraisal. These results suggest that DSH is characterized by deficits in cognitive reappraisal but not heightened negative emotional reactivity.

DISTRIBUTION ANALYSIS OF fMRI CONTRASTS IN SOCIAL AND AFFECTIVE TASKS

R. McKell Carter, Jeff J. MacInnes, Amy Winecoff, R. Alison Adcock, Scott A. Huettel; Duke University - In order to isolate a specific aspect of brain function, fMRI researchers compare data from a complex task with data from a carefully controlled baseline that differs only in the cognitive process of interest. For example, to identify neural processes responsible for emotion regulation, activation during passive viewing of emotional images may be subtracted from activation during emotion regulation of similar images. Nowhere are these comparisons more carefully constructed than in social and affective neuroscience. In spite of this effort, social, affective, and motivation paradigms are designed to study cognitive processes that are very engaging, meaning, arousal and engagement often differ substantially between the condition of interest and its baseline. As a result, large overlapping brain networks are identified with little specificity to the cognitive process of interest. We have previously shown that regression of whole brain data (distributional analyses) - based on combinatoric methods for identifying independent information carried in each brain region -- can effectively discriminate social and non-social processes in game-theoretic decision making. Here, we used distribution analysis of fMRI to identify factors that drive the overlapping networks identified in two common affect and motivation tasks. Using fMRI data from a previously published monetary incentive delay (MID) task, we found that an average increase in activation for the task condition can explain the majority of normally identified task activations. Using fMRI data from a previously published emotion regulation task, we find that the network of brain regions normally associated with emotional regulation (ER) is also engaged (to a lesser extent) during passive viewing. We conclude that, for the MID and ER tasks described here, most activations can be explained by cognitive processes that are also active during the baseline condition. Models incorporating these common effects can be used to isolate brain function related to the desired process.

J-31**THE INFLUENCE OF VALENCE AND DECISION DIFFICULTY ON SELF-REFERENTIAL PROCESSING**

Harma Meffert, National Institutes of Health; Laura Blanken, Sophia Children's Hospital; Karina S. Blair, National Institute of Mental Health, National Institutes of Health; Stuart F. White, National Institutes of Health; James R. Blair, National Institutes of Health - Self-referential processing is defined as the process by which a person becomes aware that specific contents are related to his or her own self. Cortical midline structures, such as dorsal and medial prefrontal cortex, and regions such as inferior frontal cortex, insula and temporal pole have been implicated in self-referential processing. However, the specific contribution of each of these areas is still largely unknown. More particularly, not many studies have examined the influence of valence and decision making difficulty on regions involved in self-referential processing. In this study, participants

evaluated how well personality traits, differing in valence and decision difficulty, described them or president Obama. In line with predictions, ventral, rostral and dorsal parts of medial prefrontal cortex showed greater activity when participants judged traits about themselves relative to judging traits about President Obama. However, none of these regions showed significant modulation by trait valence. Increasing trait decision difficulty was associated with increased activity within dorsal medial prefrontal cortex and bilateral anterior insula. However, there was very minimal overlap (6/119 voxels, i.e. 5%) of the regions of dorsal medial prefrontal cortex implicated in self-referential processing and those implicated in trait decision difficulty. The results are interpreted within current accounts of self-referential processing.

J-32**MEASURING AFFECTIVE SHARING: INTERPERSONAL COUPLING OF PHYSIOLOGICAL SIGNALS IN MINIMAL SOCIAL CONDITIONS**

Yulia Golland, Yossi Arzouan, Nava Levit-binnun, IDC Herzliya - Extensive research demonstrates that during social interactions people become coupled to each other in their behavior and emotions. For example, two people engaged in conversation were found to synchronize expressions, vocalizations, postures, and movements and, consequently, to become similar in their emotional states. Moreover, evidence for physiological coupling during social interaction is also emerging demonstrating that people enter a state of biologically maintained interpersonal resonance in which their cerebral activity shows synchronized dynamical changes (e.g. Hasson et al., 2011). Here, we investigated if synchronization of ongoing physiological responses of two co-present individuals can occur in minimal social conditions, when there is no direct, face-to-face interaction between them. For that aim we recorded continuous autonomic activity (cardiovascular and electrodermal measures) from participants while they watched emotional movie clips either alone or in groups of three. This paradigm allowed us to study physiological responses to identical emotional stimulation in different social conditions. We expected that social presence will enhance attunement to the movie, resulting in more reliable movie driven responses. Moreover, we hypothesized that participants who shared both the input (a movie) and the physical presence with each other (two participants from the same group) will be more similar in their response dynamics than those who only shared the input (two participants from different groups). In accordance with our hypothesis, participants who watched the movie in groups showed higher across-groups synchrony of physiological activity than those who watched the movie alone. These results suggest that the presence of other people leads to more robust and consistent responses to external emotional stimulation. Remarkably, the physiological coupling of ongoing autonomic signals was significantly higher between participants who watched the movie together than between those who watched the movie with a different partner, on a different occasion. This difference was evident for both the cardiovascular and the electrodermal

coupling, which were highly interrelated. We suggest that the group-specific coupling of dynamic physiological changes is associated with emotional entrainment of the co-present individuals, in which minimal facial and postural cues of others are automatically mimicked, leading to shared moment-to-moment emotional experiences. Supporting this suggestion, the level of physiological coupling between the co-present participants was associated with the feeling of collective experience, reported after the experiment. The results of the current study demonstrate that co-present individuals distinctively affect each other's biological responses to external stimuli, even without direct, face-to-face exchanges of verbal and affective information. Moreover, they suggest that physiological coupling between co-present individuals is one of the biological processes underlying this phenomenon.

J-33

THE IMPACT OF EARLY ADVERSE CARE AND A PREVENTIVE INTERVENTION ON PATTERNS OF NEURAL ACTIVATION DURING A RESPONSE INHIBITION TASK *Kathryn F. Jankowski, University of Oregon; Kathryn S. Gilliam, University of Oregon; Leslie E. Roos, University of Oregon; Jennifer H. Pfeifer, University of Oregon; Phillip A. Fisher, University of Oregon, Oregon Social Learning Center; Jacqueline Bruce, Oregon Social Learning Center* - Maltreated children in foster care commonly experience a range of early adverse experiences, including neglectful and/or abusive care and caregiver instability. These events are commonly linked with negative behavioral and neurological outcomes, including increased externalizing and internalizing behaviors, cognitive and emotional deficits, and impaired neurological and neurobiological development. Importantly, recent studies suggest that early interventions may ameliorate these negative effects. The current study investigated the impact of early adverse care and a family-based preventive intervention, Multidimensional Treatment Foster Care for Preschoolers (MTFC-P), on neural patterns associated with a response inhibition task during late childhood/early adolescence. Participants included 36 children, ages 9-14 years old: 11 foster care children who received MTFC-P (MTFC-P; 4 males; M = 12.02 years), 11 foster care children who received treatment services as usual (RFC; 5 males; M = 12.22 years), and 14 low-income, non-maltreated community comparisons (CC; 7 males; M = 11.81 years). Groups did not differ significantly on age or gender. Participants completed an event-related fMRI Go/NoGo task that measured the ability to respond to frequent target Go stimuli and inhibit prepotent responses to infrequent NoGo stimuli. The task consisted of two runs with 260 events per run. Imaging data were acquired using a Siemens Allegra 3T, head-only MRI scanner and preprocessed and analyzed using SPM8. At the fixed effects level, planned linear contrasts were created for each participant for three trial types (correct Go trials, correct NoGo trials, and incorrect NoGo trials) compared to an implicit baseline. Regressors of no interest included incorrect Go trials, six rigid body realignment parameters, and trials characterized by major motion artefacts.

Repeated measures ANOVAs were calculated at the random effects level, where trial type was the within-subjects factor and group was the between-subjects factor. For this presentation, we examined group differences associated with successful response inhibition (correct NoGo trials) relative to successful responding (correct Go trials). While task accuracy was similar across groups, there were significant group differences on neural patterns of activity in frontal, temporal, parietal, and subcortical regions. MTFC-P recruited greater frontal regions (medial and superior frontal gyrus and claustrum) and reduced periamygdala compared to CC, while RFC recruited reduced middle temporal gyrus, precuneus, thalamus, and hippocampus compared to CC. In addition, MTFC-P recruited greater lingual gyrus/occipital cortex compared to RFC. While frontal regions are primarily recruited during response inhibition and error processing, research also supports the role of temporal and posterior parietal (including precuneus) recruitment in error processing and inhibitory control preparation, as well as subcortical (e.g., amygdala, thalamus) recruitment in salience detection and impulse control. From these results, two important conclusions should be considered (1) Experiencing adverse care during early childhood is associated with atypical neural patterns underlying response inhibition, error monitoring, and salience detection in late childhood/early adolescence; (2) Preventive intervention may be associated with distinct neural patterns supporting successful response inhibition. Additional research is necessary to further characterize these distinct neural profiles, as well as examine their association with executive functioning more broadly, as well as externalizing and internalizing behaviors.

J-34

NEURAL BASES UNDERLYING COGNITIVE REGULATION OF FOOD CRAVING IN CHILDHOOD AND ADOLESCENCE *Insel C, Columbia University; Silvers JA, Columbia University; Powers A, Weill Cornell Medical College; Casey BJ, Weill Cornell Medical College; Mischel W, Columbia University; Ochsner KN, Columbia University* - With childhood obesity on the rise, it is crucial to understand how children and adolescents respond to food cues, as these responses guide health-related decision making on a daily basis. Behavioral and neuroimaging experiments have shown that children and adolescents show more neural and behavioral reactivity to appetitive cues than adults. However no prior work has examined the neural processes underlying cognitive regulation of craving across development. In the present study children and adolescents age 6-18 completed a task designed to examine cognitive regulation of craving for food while whole-brain functional magnetic resonance imaging (fMRI) data were collected. The task involved looking at pictures of appetizing foods on two types of trials. On "Close" trials, participants imagined that the pictured food was directly in front of them and focused on its appetitive features (e.g., taste, smell). On "Far" trials, participants down-regulated their appetitive desire by imagining that the food was further away and focusing on its basic visual features (e.g., color, shape). After

viewing each stimulus in the instructed manner, participants used a 1-5 scale to indicate how much they wanted to eat the food that they had just viewed. Behavioral results showed that, overall, participants reported less craving on Far than on Close trials and could thus successfully regulate craving. Neuroimaging results demonstrated that on Far trials relative to Close trials, participants showed attenuated recruitment of reward-related circuitry, including the ventral striatum and ventromedial prefrontal cortex. Across development, age was associated with decreased self-reported craving, such that adolescents reported wanting the food less during Close and Far conditions. Moreover, for both Close and Far conditions, age was associated with attenuated activation in the ventral striatum, suggesting that adolescents show less reward-related reactivity to food cues than children. Together, these findings suggest that behavioral and neural responses to food craving and regulation change across development.

J-35

BENEFITS OF EXPRESSIVE WRITING THROUGH INCIDENTAL EMOTION REGULATION *Jared B. Torre, UCLA; Tristen K. Inagaki, UCLA; Catherine M. Mulvanna, Yale; Kate E.B. Haltom, UCLA; Andrea Niles, UCLA; Annette L. Stanton, UCLA; Matthew D. Lieberman, UCLA* - When individuals experience chronic or acute distress, the act of seeing a therapist, talking with supportive others, or writing in a journal can each have substantial psychological benefits. Two decades of social and clinical psychological research on expressive writing have empirically documented that a small number of brief expressive writing sessions, focused on the source of one's distress can produce demonstrable mental and physical health benefits over the course of several months. Although a number of mechanisms have been proposed over the years, none have garnered widespread support. We have previously proposed that the simple act of putting feelings into words (or "affect labeling") is itself a form of unintentional emotion regulation that serves to diminish distress by dampening limbic responses and the physiological correlates that typically parallel limbic activity. Affect labeling is associated with increased activity in ventrolateral prefrontal cortex (VLPFC), diminished amygdala activity, and diminished self-reported distress, similar to the pattern of effects observed during intentional emotion regulation strategies such as reappraisal. In the present research, we tested the relationship between expressive writing and two emotion regulation strategies, affect labeling and reappraisal, through the use of fMRI and an expressive writing intervention. Reappraisal has previously been suggested as one of the major mechanisms through which expressive writing is able to confer its health benefits, though we propose that the incidental form of emotion regulation of affect labeling may be a more substantial component of this mechanism. During an initial session, subjects performed both affect labeling and reappraisal via established task paradigms in the MRI scanner and answered questionnaires assessing clinically-relevant individual difference variables (such as a physical health symptomatology checklist). Subjects then engaged in four

expressive writing sessions (or four control task writing sessions) over the following four weeks and were given a 3 month follow-up to observe mental and physical health benefits. A whole-brain conjunction analysis of the neuroimaging data acquired at the baseline time point demonstrated significant overlapping activations for the two emotion regulation tasks, affect labeling and reappraisal ($p < .001$, $k = 20$), particularly in the ventromedial prefrontal cortex. However, we were also able to run a within-subject correlation of ROI parameter estimates taken from the VLPFC which showed a strong relationship ($r = .35$; $p < .001$) across the emotion regulation tasks. Finally, an additional whole-brain analysis was run to observe the relationship between the neural responses on these tasks with the clinically-relevant individual difference variables assessed at both pre- and post-intervention. Modeling the interaction term between group membership (intervention vs. control) and a physical health symptomatology checklist improvement (calculated as post- minus pre-intervention score) showed bilateral VLPFC activations as significant in the affect labeling task ($p < .005$, $k = 43$; $r = .34$ for intervention; $r = -.31$ for controls). No significant activations were revealed in the reappraisal task. These findings suggest that despite the amount of neural overlap between affect labeling and reappraisal, affect labeling in particular predicts better health improvements via an expressive writing intervention and is likely a major component of the mechanism that confers these benefits.

J-36

UNDERSTANDING MOTIVATION-RELATED CHANGES IN ATTENTIONAL FLEXIBILITY: A NEURAL NETWORKS APPROACH *Rebecca D. Calcott, Elliot T. Berkman; University of Oregon* - Motivational states play an important role in tuning our attention to facilitate goal pursuit. Importantly, the most beneficial type of attention can vary depending on the context. Although several studies have examined how motivation affects attentional breadth (i.e., the broadness vs. narrowness of one's attentional focus), less is known about how approach and avoidance motivation affect one's ability to flexibly shift his/her attention to match situational demands. The current studies examined how approach and avoidance motivation affect the flexibility of attentional breadth, using both behavioral and fMRI measures. In these studies, participants completed a modified version of Navon composite letter task in which the ratio of global to local targets was varied by block. Thus, on some blocks, it was beneficial to adopt a global attentional focus (mostly global blocks), on others a local attentional focus was most adaptive (mostly local blocks), and in the control condition, both types of attention were equally beneficial (even blocks). Approach, avoidance, and neutral motivational states were manipulated within-subjects using pictures and embodied arm positions. Two indices were used to operationalize attentional flexibility: context sensitivity, which is the degree to which participants shifted their attentional bias to be consistent with the block (long timescale), and switch costs, which reflect the speed with which participants can shift their attentional focus on a trial-by-trial basis (short timescale).

Behavioral results (N=101) showed that motivational states have complex effects on attentional flexibility. Avoidance motivation led to increased context sensitivity on mostly global blocks, whereas approach led to reduced switch costs on mostly global blocks. Thus, avoidance motivation led people to adapt their attention to the level that is most beneficial in the context, at the cost of increased switch costs when less expected stimuli occur. Approach motivation, on the other hand, led to attention that does not adapt as much to the context, but is more open to unexpected stimuli. In order to investigate the neural mechanisms underlying these findings, another group of participants completed the same task while their brains were scanned using fMRI. Preliminary block-level analyses (N=10) suggest that across different block types, avoidance motivation led to greater activation in medial prefrontal (mPFC) regions compared to approach. This finding may suggest that mPFC activation is one route by which avoidance states enhance sensitivity to contextual information. Subsequent event-related analyses will examine the degree to which approach and avoidance motivation engage neural default and task-related networks while responding to global and local targets across different contexts. These findings will help clarify the mechanisms that underlie motivation-related changes in attentional flexibility.

J-37

CROSS-CONTEXT INFLUENCES: GAINS AND LOSSES IN SOCIAL STATUS AFFECT FINANCIAL RISK TAKING Vincent C. Schoots, Erasmus University Rotterdam, Radboud University Nijmegen; Maarten A.S. Boksem, Erasmus University Rotterdam, Radboud University Nijmegen; Alan G. Sanfey, Radboud University Nijmegen; Ale Smidts, Erasmus University Rotterdam - Different rewards (i.e. money, food, sex, social inclusion) are encoded similarly by the brain, which can potentially lead to spill-over effects. Here, we find that gains and losses in a social status context can directly impact subsequent financial risk-taking. In a behavioral experiment, participants competed with two others on a simple task. On each round of the game they could either win or lose, thus impacting their competitive rank. This game alternated with a financial choice, always between a sure gain and a risky gamble. The subjective expected utility of the gamble was matched to the sure option for each individual, such that we expected participants to gamble on 50% of the trials; however, participants gambled on only 38%. Players in the top rank (high social status) gambled more after wins, while players in bottom rank (low social status) gambled more after losses (interaction [status*win/loss]). Thus, subjects gambled more (i.e. behaved in the expected direction) when the status-quo was maintained in the social status game. Subsequently, we tested 29 males in an fMRI experiment, using the same paradigm. We observed activity in midline visual cortex, cingulate cortex, and bilateral insula when decisions followed the status-quo, suggesting a role for attention and conflict monitoring. We propose that attention is shifted from the status game to the gambling task during these status-quo trials. While people might base their decision on gut-feeling during low attention, higher

attention to the choice options allows for choices more in line with individuals' reasoned risk preferences.

J-38

THREAT, PAIN, AND BRAIN - THE EFFECTS OF FEAR AND ANXIETY ON THE PERCEPTION OF PAIN Matthias J. Wieser, University of Würzburg; Philipp Reicherts, University of Würzburg; Antje B.M. Gerdes, University of Mannheim; Andreas Mühlberger, University of Regensburg; Stefan M. Schulz, University of Würzburg; Paul Pauli, University of Würzburg - It has demonstrated that pain processing is influenced by emotions such that negative emotions increase pain perception. With regard to anxiety, it has been proposed that fear (phasic) and anxiety (tonic) are probably different aversive affective states. In this distinction, fear is characterized by an aversive reaction to the perception of a specific threat stimulus, whereas anxiety is defined by prolonged vigilance to a diffuse, unspecific threat. Moreover, the predictability of upcoming aversive events during fearful anticipation is a key feature for the distinction between transient phasic and sustained tonic fear. It has been proposed that fear versus anxiety might also lead to distinct processing of sensory threatening events. For example, fear and anxiety might have different effects on pain perception with higher pain sensitivity under anxiety, but lower pain sensitivity under fear. These potential differences were investigated by comparing conditioned fear (CF/fear), where the threat is predictable, and instructed fear (IF/anxiety), where the imminent threat is unpredictable. Forty-five participants (CF n=23; IF n=22) received thermal pain stimuli while watching cues indicating threat or safety. Before this test phase, the CF group underwent classical fear conditioning with visual cues either predicting threat (aversive electric stimulus) or safety, whereas the IF group was only verbally instructed about these contingencies but actually never received a shock. Pain and cue ratings, skin conductance level (SCL) and BOLD responses (fMRI) to the cues and the thermal pain stimuli were obtained in the test phase. Cue ratings showed successful threat induction and the SCL was higher in response to threat compared to safety cues in both groups. In addition, affective pain ratings in later threat compared to safety trials were increased in the instructed fear group, only. BOLD analysis for IF revealed that threat compared to safety cues elicited higher activation in visual and fear-related areas. For CF, the activity pattern was similar but less pronounced. An interaction of pain and threat revealed higher sensory and threat-related activity in IF, whereas in CF activity increase was restricted to fear-related areas. Results demonstrate increased subjective and neurophysiological pain processing during instructed fear, in line with theories proposing heightened attention and sensory sensitivity during anxiety. However, fear-related analgesia was not found in the fear conditioning group. The latter finding might indicate that fear conditioning did not elicit elevated levels of arousal probably necessary for analgesic effects.

J-39

DISTINCT EFFECTS OF VISUAL AND AURAL INPUT ON NEURAL SUBSTRATES OF SELF-REFLECTION OF SOCIAL ATTRIBUTES

Yina Ma, Peking University, Dartmouth College; Shihui Han, Peking University - The medial prefrontal cortex (mPFC) activity related to self-reflection on personality traits is modality specific, being involved when reflecting on visually but not aurally presented trait adjectives in sighted people. As our recent research found that self-reflection on social attributes induced greater activity in the mPFC, precuneus and bilateral temporoparietal junction (TPJ), the current work tested whether all these brain regions involved in self-referential processing are similarly affected by sensory input. Using functional magnetic resonance imaging, we scanned 23 sighted young adults during judgments of social attributes of oneself and a familiar other. The items for judgments were presented on a screen or through a headset. We found that self- vs. other-judgments significantly activated the mPFC, precuneus and bilateral TPJ when stimuli were visually presented. When stimuli were presented aurally, however, self- vs. other-judgments only activated the bilateral TPJ. Direct comparison between the neural activities in response to visually and aurally presented stimuli showed that the mPFC activity was stronger in response to self- vs. other-judgments on visually compared to aurally presented stimuli, whereas the TPJ activation did not differ between the visual and aural modalities. Together with our previous findings, we demonstrate that self-representation of both mental and social attributes in the mPFC is specific to visual modality. In contrast, the TPJ activity that is engaged in representation of one's own social attributes and others' mental states is not sensitive to sensory input in sighted adults. Thus different brain regions involved in self-referential processing are not affected by sensory experiences in a similar vein.

J-40

SPECIFICITY TO EMOTION AND ANIMACY: NEURAL RESPONSE TO THREATENING AND ANIMATE STIMULI

Stuart F. White, National Institute of Mental Health, NIH; Christopher J. Adalio, University of California, Berkeley; R. James Blair, National Institute of Mental Health, NIH - Background: There is considerable apparent overlap in the regions that process emotional stimuli and those involved in social cognition, specifically those processing animate stimuli, including amygdala, ventromedial prefrontal cortex (vmPFC) and temporal cortices. It could be argued that this overlap at least partially represents a bias for processing animate stimuli because animate stimuli are more likely to become associated with threat than non-animate stimuli (c.f. Yang et al., under revision); however, emotional and animate stimuli have rarely been directly contrasted. Based on previous work, it was predicted that vmPFC (Gobbini et al, 2011) and amygdala (Yang et al, under review; Zald, 2003) would show responses to both emotional and animate stimuli, medial fusiform cortex would preferentially respond to inanimate stimuli (Gobbini et al 2011; Mahon et al, 2007) and superior temporal gyrus

would preferentially respond to animate stimuli (Beauchamp et al, 2002; Gobbini et al, 2011). Methods: Twenty-two right-handed, healthy adults (12 female) viewed threatening or neutral images that could be either animate (facial expressions) or inanimate (objects) in the context of a dot probe task while undergoing fMRI. Results: A 2 (Emotion: Negative, Neutral) x 2 (Animacy: Animate, Inanimate) x 2 (Congruence: Congruent, Incongruent) ANOVA was conducted on the subjects' BOLD responses within the amygdala, fusiform, STG and vmPFC ROIs. Main effects of emotion and animacy indicated increased response to animate and threatening stimuli within the amygdala. Main effects of emotion and animacy were also seen in fusiform cortex, though in non-overlapping regions. The regions of fusiform cortex showing significant main effects for emotion were slightly anterior and lateral to those showing significant main effects for animacy. Notably within the regions of fusiform cortex showing significant main effects of animacy, there was significant modulation by emotion but only for objects, not faces [left: objects: $t(21)=3.802$, $p=0.001$; faces: $t(21)=.758$, $p=.46$; right: objects: $t(21)=2.663$, $p=0.015$; faces: $t(21)=.831$, $p=.42$]. Only the inanimate independent t test (threatening objects vs. neutral objects) revealed significantly greater BOLD responses to threatening objects relative to neutral objects within medial fusiform gyrus ($p<0.02$). There was a main effect of animacy within bilateral STG, but no significant main effect of emotion. However, there was a significant emotion-by-animacy interaction in a slightly more superior region of STG. Within this region, the response to neutral objects was significantly less than the response to both neutral faces and negative objects [$t(21)=3.99$ & 3.73 , $p=.001$ & $.002$ respectively]. There was a main effect of animacy within vmPFC. However, there was no significant main effect of emotion or any interaction with emotion within this region. Conclusions: The current data suggest the amygdala is responsive to both emotional and animate stimuli. Furthermore, there appears to be category specific enhancement of responsivity by threat information in temporal cortex. Finally, while the absence of vmPFC response to emotional information may be type II error, it may indicate that previously reported vmPFC activity to emotional stimuli is a result of differences in stimulus differences in animacy and/or task instructions encouraging greater self-relevant processing of emotional stimuli.

J-41

FACE THE HIERARCHY: EVENT-RELATED POTENTIALS AND ALPHA SUPPRESSION ELICITED BY FACES EMBEDDED IN A HIERARCHICAL CONTEXT

Audrey Breton, Cerveau et Cognition; Karim Jerbi, Lyon Neuroscience Research Center (LNRC); Marie-Anne Henaff, LNRC; Anne Cheylus, Cerveau et Cognition; Jean-Yves Baudouin, Université de Bourgogne; Christina Schmitz, LNRC, Pierre Krolak-Salmon, LNRC; Jean-Baptiste Van der Henst, Cerveau et Cognition - Living in a sophisticated social environment is cognitively more demanding than living alone. A growing body of neuroscience studies argues that a major evolutionary force that shapes the

brain of primates is the complexity of the social environment. In this framework, hierarchy stands out as a key feature that contributes to such complexity. A large proportion of primates' social relationships are indeed asymmetrical and humans are no exception. In order to navigate their social world, individuals need to recognize hierarchical relationships. Although recent neuroimaging studies have identified some of the brain structures involved in the processing of hierarchical stimuli, the temporal dynamics of the neural response associated with such processing remains unknown. The present study explores this issue by investigating both the event-related potentials and the alpha oscillatory activity elicited by facial stimuli embedded in a hierarchical context. Hierarchy was manipulated by presenting neutral-expression faces in a game setting, where participants were confronted to other players represented by their photographs. They had to rank their performance with respect to other players. The EEG signal was then recorded while participants were presented with high-rank, middle-rank and low-rank faces and had to answer a question concerning the hierarchical position of each face compared to their own position. The purpose of the present study is twofold. First, we sought to determine whether the hierarchical context modulates the early structural processing of faces, indexed by the N170 event-related and/or whether context influences a higher-order cognitive processing stage, indexed by later potentials, such as the late positive potentials (LPPs) reported in social categorization and in motivational/attentional commitment. Second, we also investigated the putative involvement of alpha (9-12 Hz) oscillations to better characterize the cortical processes related to hierarchical faces. Three main findings emerge from the study. First, the experimental manipulation had no effect on the early N170 component, which suggests that hierarchy did not influence the structural encoding of neutral-expression faces. Second, hierarchy significantly modulated the amplitude of the late positive potentials (LPPs) within a 400-700 ms time-window; with high-rank faces elicited the largest LPP amplitude compared to middle or low-rank faces. A higher status is socially and evolutionarily more desirable than a lower status and cognitive resources are thus likely to be allocated to high-status information. The higher LPP amplitude observed for highest-rank faces may thus reflect an attentional and motivational commitment. Third, high-rank faces were associated with the highest reduction of alpha power. It has been proposed that alpha synchronization is a way to neutralize task-irrelevant regions, while alpha desynchronization indicates a greater engagement of the regions affected by this suppression. According to this view, greater alpha suppression observed for the highest-rank faces would reflect a greater allocation of cognitive resources to these stimuli. Taken together these findings provide novel electrophysiological evidence for enhanced allocation of attentional resource in the presence of high-rank faces. At a broader level, this study brings new insights into the neural processing underlying social categorization.

ENTORHINAL AND PARAHIPPOCAMPAL INTEGRITY DETERMINE THE SUBJECTIVE TIME HORIZON FOR NOVELTY EXPLORATION IN OLD AGE

Sandra Duezel, Max-Planck Institute for Human Development; Ulman Lindenberger, Max-Planck Institute for Human Development; Emrah Duezel, German Centre of Neurodegenerative Diseases

There is growing consensus that lifestyle factors such as physical exercise, cognitive and social enrichment and nutrition influence cognitive abilities and brain structure in old age. However it is largely unknown which mechanisms drive the motivation to engage in an active lifestyle, that involves physical activity and exploring novelty changes, in old age. We developed a new questionnaire, the "subjective health horizon" (SHH), which captures the time horizon within which individuals can imagine being able and motivated to lead an active and exploratory lifestyle. We propose that the SHH is an important source of motivation towards an active and exploratory life. The SHH-questionnaire contains 30 questions assessing individual estimates of future health-expectation and physical performance within an age-adjusted time dimension. The items focus on physical time perspectives, performance-related perspectives, future-planning perspectives and novelty and exploratory perspectives. We collected the SHH-questionnaire from 74 healthy older participants originating from two different studies (mean age=70,1 years; 44 female) together with other measures of health and wellbeing, motivation as well as other time perspectives. For all participants a structural brain imaging data set was available. We first determined how the time perspectives to different questions cluster. A factor analysis revealed three main factors accounting for 37,5%; 14,8% and 7,9% (sum 60,2 %) of the total variance respectively. The first component included items accessing physical time perspectives. Items assessing novelty and exploratory perspectives loaded on the second component and the third component comprised items measuring performance-related perspectives. We observed that time perspectives were shortest scored for the novelty-driven component (2). In a second step we determined whether the main time perspectives for the components were correlated with the cortical thickness a priori defined brain regions. We focused on the frontal poles, precuneus and hippocampus, entorhinal cortex and parahippocampal regions. These regions are components of the episodic memory network, which is functionally associated with future thinking. Gray matter volumes were automatically extracted from native space using FreeSurfer (<http://surfer.nmr.mgh.harvard.edu/>). We found a highly significant relationship between left entorhinal ($p < 0.02$) and parahippocampal volume ($p < 0.00$) and for the time perspective related to novelty and exploratory (component 2) only. This relationship is still existent when controlling for age and body-mass-index. Interestingly the novelty and exploratory time perspectives (component 2) were not associated with novelty seeking. None of the other relationships were significant. These findings suggest that the integrity of entorhinal and parahippocampal regions is associated with the subjective future perspective to engage in

novelty-related behaviors. Thus, the integrity of these regions may determine how much exposure to novelty older individuals may experience. Furthermore these aspects the SHH questionnaire appear to be sensitive to the integrity of regions that are affected early in the course of Alzheimer's disease.

J-43

NEURAL CORRELATES OF EMPATHY DEVELOPMENT DURING EARLY ADOLESCENCE

John C. Flourney, William E. Moore III, Sanjay Srivastava, John C. Mazziotta, Marco Iacoboni, Mirella Dapretto, Jennifer H. Pfeifer During early adolescence, there is considerable development and refinement of social cognitive abilities, and specifically empathy, that is crucial for successful social functioning. Adolescents also make gains in two areas that may support this increase in empathy: the ability to regulate emotions and to take the perspective of others. Theoretical models suggest that the ability to empathize begins with affective resonance, defined as a vicarious emotional response that mirrors that of another person. Affective resonance, however, can lead to either a concerned, sympathetic response called empathic concern (EC), or to a self-focused, distressed response called personal distress (PD). Previous research shows that during adolescence, emotion regulation improves, EC increases, and PD decreases. While increased emotion regulation is associated with decreases in PD, there appears to be no effect of increased emotion regulation on EC. Additionally, perspective taking is positively correlated with EC and negatively correlated with PD. Prior research clearly identifies key regions of interest that are likely to play a role in each of these processes. Certain brain regions are active during both the observation and imitation of emotions, and have therefore been interpreted as an affective resonance system, including the mirror neuron system, anterior insula, and amygdala. In prior research, the degree of activation in this network during an imitation/observation task has been correlated with measures of both PD and EC, which suggests that both make use of this system. Additionally, regions that support emotion regulation and perspective taking may modulate this network to elicit changes in EC and PD. We hypothesized that during adolescence, increases in EC and PD would be associated with increased activations in regions implicated in affective resonance during observation of emotional faces. Moreover, decreases in personal distress would be associated with activity increases in regions implicated in perspective taking and/or in emotion regulation. 38 participants, at two timepoints (age 10 and 13), observed affective facial expressions during fMRI. Stimuli were full-color, whole-face images comprising 16 diverse individuals (8 male, 8 female) making 5 different emotional expressions (angry, fearful, happy, neutral, or sad). Participants also completed the Interpersonal Reactivity Index (IRI), which includes subscales measuring EC and PD. Regions of interest were determined a priori from topical meta-analyses that use a multi-level kernel density approach. Results from growth curve and cross-lagged models will be discussed.

J-44

NEURAL ACTIVITY PREDICTS BOX OFFICE PERFORMANCE OF MAINSTREAM FILMS

Benjamin C. Gunter, Locke Welborn, Stephanie Vezich, Matthew D. Lieberman; UCLA - Neural response to persuasive stimuli has been previously shown to predict future change in population-level behavior more accurately than self-report alone. We scanned participants while they viewed full-length trailers advertising unreleased films from several genres. Preliminary analyses reveal that measures of population-level behavior including box-office performance and critical reception are indexed linearly by activity in several regions of the brain, including medial prefrontal cortex (mPFC) and posterior cingulate cortex (PCC), measured in a subject group months before the release of the films. Results will contribute to a framework for neural models predicting a variety of real-world events beyond the capacity of self-report by laymen and even experts.

J-45

THE EFFECT OF INFLAMMATION ON THE AMYGDALA'S RESPONSE TO SOCIALLY THREATENING IMAGES

*Tristen K. Inagaki, UCLA, *SANS Graduate Student Travel Award Winner; Keely A. Muscatell, UCLA; Michael R. Irwin, Semel Institute for Neuroscience and Human Behavior, Cousins Center for Psychoneuroimmunology, UCLA; Steve W. Cole, Semel Institute for Neuroscience and Human Behavior, Cousins Center for Psychoneuroimmunology, University of California Los Angeles School of Medicine, Los Angeles AIDS Institute, The Jonsson Comprehensive Cancer Center, UCLA; Naomi I. Eisenberger, UCLA* - Everyone has had the unpleasant experience of being sick. In addition to physical symptoms such as headache and fever, a major symptom of sickness is social withdrawal. However, the mechanisms associated with this behavioral change remain unclear. In animals, the amygdala is a key neural region involved in sickness-induced social withdrawal. Consistent with this, in humans, heightened amygdala activity to negative social cues is associated with social avoidance tendencies. Based on these findings, the current investigation explored the effect of an experimentally induced inflammatory challenge (endotoxin) on amygdala activity to socially threatening and nonthreatening images. To the extent that inflammatory activity increases social withdrawal by heightening amygdala activity, we hypothesized that endotoxin vs. placebo would lead to increased amygdala activity to socially threatening images vs. other types of images. We also explored how amygdala activity was related to feelings of social disconnection in participants made to feel sick. In a between-subject design, thirty-nine participants were randomly assigned to receive either placebo or endotoxin, which safely increases inflammatory activity. Self-reported feelings of social disconnection and physical sickness symptoms were assessed at 7 hourly time points as well as pro-inflammatory cytokines via blood draws. Two hours post-injection when inflammatory activity is at its peak, participants underwent an fMRI scan to assess the

amygdala's response to socially threatening images (fear faces), non-socially threatening images (guns), socially non-threatening images (happy faces), and non-social, non-threatening images (household objects). As hypothesized, endotoxin led to greater amygdala activity in response to socially threatening vs. all other types of images. No such differences were found for placebo participants. Additionally, increased amygdala activity in endotoxin participants during the viewing of socially vs. non-socially threatening images was associated with increased feelings of social disconnection (from baseline to 2 hours post-injection) even after controlling for self-reported physical sickness symptoms. These findings highlight the amygdala as a neural region that may be important for sickness-induced social withdrawal.

J-46

FEEDBACK-RELATED NEGATIVITY AND REWARD SENSITIVITY PREDICT SPONTANEOUS CHEATING BEHAVIOR *Xiaoqing Hu, Northwestern University; Narun Pornpattananankul, Northwestern University; Ellen Reynolds, Columbia University; Robin Nusslock, Northwestern University* - Previous studies that examined the neural correlates of deception usually omitted two important factors: the voluntary intention to deceive and the individual differences regarding reward sensitivity in deception. Here, we recorded event-related potentials (ERPs) in 18 participants to examine the neurophysiological processes underlying spontaneous cheating in a coin-guess task in which participants may win monetary incentive by misreporting their prediction of the coin-flips. Moreover, we measured participants' Behavioral Inhibition System and Behavioral Activation System using BIS/BAS questionnaires to assess the influence of participants' motivational systems on spontaneous cheating behavior. Results showed participants were generally honest: no significant differences between the opportunity to cheat and no opportunity to cheat condition regarding cumulative monetary outcome and accuracy. Nonetheless, the feedback-related negativity (FRN) following the coin-flip outcomes were more negative during the opportunity to cheat than the no-opportunity to cheat condition ($F(1, 17)=7.56, p<.02$). Moreover, the larger FRNs in the opportunity condition than the no-opportunity condition, the more likely participants were going to cheat ($r=-.51, p<.05$). This enlarged FRN during the opportunity to cheat condition suggested that participants were more motivated to evaluate the outcome of the coin-flip when they have a chance to gain incentives by cheating. This signal may guide participants' actual behavior toward cheating so as to increase their gains. Regarding one's self-report of BIS/BAS, we found that only the BAS Reward subscale (but not Drive, Fun Seeking or BIS) was positively correlated with one's potential cheating behavior ($r=.65, p<.01$). Specifically, the higher the BAS Reward scores, the more participants would claim to win during the opportunity to cheat condition than during the no opportunity to cheat condition. This demonstrated that participants with higher level of reward sensitivity may be more likely to cheat when incentives were present. Finally, the FRN and the BAS Reward subscale were not

correlated with each other ($r=-.169, p>.2$), suggesting these two indicators may represent unique psychological processes during the spontaneous cheating behavior. A regression model including both the FRN and BAS Reward accounted for 58.2% of variance in predicting participants' possible cheating behavior, and both FRN and BAS Reward scores were independent predictors of cheating. This study provides the first electrophysiological evidence in predicting one's spontaneous cheating behavior when confronting incentives and has important implications for understanding between FRN and reward sensitivity in predicting cheating behavior.

J-47

SELF-CONSTRUAL PRIMING MODULATES NEURAL RESPONSE TO OWN VS. FRIENDS' REWARDS *Zhenhao Shi, Michael E. W. Varnum, Xi Liu, Shihui Han; Peking University* - The neural circuitry of reward, primarily the ventral striatum, has been shown to encode both one's own rewards and others' rewards (Mobbs et al., 2009; Tabibnia et al., 2008). However, culture has been shown to affect people' motivation when their performance is linked to rewards for the self or close others, and this effect appears to be linked to differences in how the self is construed (Kitayama & Park, 2012). In the present study we sought to test whether manipulating self-construal would shift neural representations of monetary reward for the self versus a close friend. Fifteen subjects (age = 19-24, 10 female, after excluding 4 subjects with excessive head motion) participated in the present study. The study involved playing a card-guessing game in which correct guesses led to monetary rewards and incorrect guesses led to losses. A square or a rhombus indicated on each trial that the subject had won or lost either for herself or her friend (SELF/FRND). There was also a neutral condition where the letter "N" was on the cards and no win or loss followed the guesses. Subjects were scanned using functional magnetic resonance imaging (fMRI) while they played the game in two sessions. In one session, each run was immediately preceded by independent self-construal priming (IND); in the other session, each run was preceded by interdependent self-construal priming (INT). Each priming procedure consisted of 16 sentences. For IND priming, subjects judged whether an independent pronoun (e.g., 'I', 'mine') was present in each sentence; for INT priming, they judged the presence of interdependent pronouns (e.g., 'we', 'ours'). Another sample of 16 subjects (age = 18-25, 9 female) participated in a localizer study to pre-localize the loci of bilateral ventral striatum that encode monetary reward in Chinese. Subjects were scanned while playing the same game used in the main study, except that they played only for themselves and no priming was administered. The left and right ventral striatum (lVStr and rVStr) were activated by win versus loss in the localizer study ($x/y/z = -12/5/-8$ & $12/8/-8$). The regions were defined as regions of interests for the main study and their contrast values of win versus loss were subjected to a 2x2 MANOVA involving IND/INT and SELF/FRND. We found a reliable interaction of the two factors (Pillai's Trace = 0.49, $p < 0.02$). Univariate tests

showed that the interaction was significant for rVStr ($F(1,14) = 12.01, p < 0.005$). Pairwise comparisons confirmed the stronger activity of rVStr for SELF than for FRND after IND priming ($t(14) = 2.29, p < 0.05$), and weaker for SELF than for FRND after INT priming ($t(14) = -1.91, p = 0.077$). The IVStr also displayed a similar interaction ($F(1,14) = 7.02, p < 0.02$) despite the fact that pairwise differences were significant ($t(14) = 1.44$ & $-1.29, ps > 0.1$). These results demonstrate that the neural representation of vicarious reward is dynamic and sensitive to cultural values. Whereas interdependent self-construal priming heightens vicarious reward, independent self-construal priming decreases it.

J-48

EXAMINING THE ROLE OF BELIEF IN AUTOMATIC IMITATION Elizabeth Evans; Emma Gowen; Ellen Poliakoff; University of Manchester - The passive perception of the actions of others can have an effect on the execution on one's own actions, known as 'automatic imitation', which is typically stronger for biological as opposed to non-biological stimuli. For example, when pressing a button, reaction times are faster when performed whilst observing a finger depression (compatible action) and slower whilst observing a finger lift (incompatible action). Automatic imitation is thought to represent a controlled laboratory model of the well-known spontaneous motor mimicry of actions, observed in naturalistic social situations. Imitation is typically reduced or absent whilst observing an object movement as opposed to a human movement. However, the strength of this "human bias" appears to be modulated by top-down factors, such as belief (Stanley et al., 2007, *Journal of Experimental Psychology: Human Perception and Performance*, 33, 915-926). For example, if a participant believes that an object movement was generated by a human movement, stronger automatic imitation effects may be generated than if a participant has no human belief about the origin of the stimulus. In Experiment 1, participants were presented with pure blocks of stimuli in the following sequence: object, hand, object, and finally object (after being told that the object movement was generated by the human hand movement). However, the belief manipulation had the opposite effect to that expected; imitation was initially present for the object but completely absent after the belief manipulation. It is possible that there was initial anthropomorphism of the object due to the oblong finger-like shape of the object which had been designed to closely match the hand. Conversely, seeing a real biological hand stimulus led to a subsequent reduction in imitation for the object as it appeared less biological following observation of the hand. In Experiment 2, participants were presented with the object followed by the object with manipulated belief. No automatic imitation was observed initially for the object, however after the belief manipulation automatic imitation was present. Taken together, these experiments suggest that belief can both increase and reduce automatic imitation. The initial automatic imitation for the object in Experiment 1 is difficult to explain, but may be due to individual differences in participants' initial beliefs about the origin of the object stimulus. Future research is

planned to investigate the effects of belief in autism, as some research suggests there may be a fault in top-down modulation of automatic imitation in autism.

J-49 *SANS Poster Award Winner

THE STRUCTURE AND USAGE PATTERNS OF ONLINE SOCIAL NETWORKS MODERATE ADOLESCENT NEURAL RESPONSES TO SOCIAL INFLUENCE Matthew Brook O'Donnell, Joe Bayer, Chris Cascio, Emily B. Falk; University of Michigan - Social network analysis (SNA) provides a rich set of measures and techniques to quantify the size, structure and scope of an individual's social environment as well as operationalizations of sociological concepts such as social capital, influence, support, connectedness and brokerage. Online social networks, such as Facebook (FB), play an increasingly dominant role in the development of social identity during adolescence. One question is the extent to which responses (and specifically neural responses) to peer feedback in social influence situations are related to the size, structure and usage patterns of an individual's online social network. Such networks provide access to egocentric data that can be analyzed using the tools of SNA. In this study, a group of male teens ($n=35$, ages 16-17) rated mobile game applications twice: once prior to fMRI scanning, and then a second time during fMRI scanning, after receiving feedback about how a group of their peers rated the same apps. The peer group ratings were manipulated to include an equal number of ratings that were HIGHER, LOWER, the SAME or NOT RATED in comparison to the subject's initial ratings made before the imaging session. Participants also, subsequently, played a game (Cyberball) in which we identified neural regions associated with the experience of social exclusion (compared to inclusion). Finally, in a second, separate, lab session participants completed a survey regarding their use of social media and added a FB app to their account that requested permissions to gather information about their FB network and usage. We hypothesized that neural and behavioral responses to feedback that peers' opinions diverged from participant ratings would be moderated by their social network characteristics. We were particularly interested in regions associated with mentalizing and social threat (identified functionally during Cyberball). Thus, we first computed SNA measures on the Facebook network data, including ego-degree (number of FB friends), density (FOF interlinkage), betweenness centrality (role of ego in linking friends). The size of participants' Facebook networks was positively correlated with their susceptibility to social influence within the app-rating task. We next examined the SNA measures in relation to neural responses to social feedback in the game-app rating task within a priori defined regions of interested (ROIs) identified in the exclusion > inclusion contrast from Cyberball. These regions included regions previously associated with social pain (anterior insula, subgenual cingulate) and mentalizing (dorsomedial prefrontal cortex, temporal pole). Number of FB friends and the density of FB network—derived from static (all friends in network) and active (friends with whom interaction is recorded in wall posts during previous six months) networks—moderates the relationship between

participants' decisions to change their behavior in response to peer feedback, and activity within social pain (AI) and mentalizing (DMPFC) regions identified using the exclusion localizer. These data suggest that social connection in the new media environment may affect and/or be affected by the ways that teens respond to social feedback. In addition, these data contribute to our understanding of the role of the brain's socio-emotional systems during every day social interactions in adolescents.

J-50

NEURAL CORRELATES OF EMOTION REAPPRAISAL IN INDIVIDUALS WITH EXTERNALIZING PSYCHOPATHOLOGY AND NEGATIVE AFFECT

Allison J. Lake, Thomas W. James, Peter R. Finn; Indiana University - Externalizing psychopathology (EXT) comprises a range of disinhibitory disorders, including substance use disorders and behavioral problems such as conduct disorder and antisocial personality disorder. In addition to various cognitive deficits related to reduced activation in areas associated with cognitive control, high EXT individuals also display high levels of emotion dysregulation and negative affect (NA; e.g. depression, anxiety). Previous research with healthy controls suggests that reappraisal is an effective emotion regulatory strategy that draws heavily on areas of the prefrontal cortex to down-regulate emotion-related areas including the amygdala during affective events. Limited reports using reappraisal paradigms in high NA-only groups implicate amygdala hyper-reactivity as a source of general emotion dysregulation in these groups. General models of EXT, however, suggest dysregulation of cognitive control regions during reappraisal, which may also lead to emotion dysregulation among these individuals. In order to specify the breakdowns associated with reappraisal and thereby gain insight into the unique emotion regulatory deficits associated with EXT and NA, we utilized a group design that fully crossed EXT and NA (low vs. high) in a traditional negative emotion reappraisal task. As predicted, group differences were largely independent. However, these differences were found outside the hypothesized areas, specifically visual perception and supplementary motor areas for EXT and NA, respectively. These results suggest unique mechanisms of emotion dysregulation between individuals with high levels of EXT and NA.

J-51

NATIVE LANGUAGE TRIGGERS GREATER POSTERIOR CINGULATE CORTEX ACTIVITY IN IMPLICIT SELF-REFERENTIAL EVALUATION

Pin-Hao A. Chen, Dartmouth College; Dylan D. Wagner, Dartmouth College; Joseph M. Moran, Harvard University; William W. Kelley, Dartmouth College; Todd F. Heatherton, Dartmouth College - A robust finding in social neuroscience is the activation of cortical midline structures such as medial prefrontal cortex (MPFC) and posterior cingulate cortex (PCC) in explicit self-referential processing tasks (Kelley et al., 2002; Heatherton et al.,

2006; Mitchell et al., 2006). These regions are also activated when participants process self-relevant information implicitly (Moran et al., 2009). In a recent study of bilingual Chinese subjects, we found enhanced PCC activation for explicit self-judgments when the trait words were presented in Chinese, but not in English (Chen et al., 2012). The current study builds on this work by examining PCC activation when Chinese participants implicitly process self-relevant facts presented in the participants' first (Chinese), and second languages (English). Sixteen native Chinese-speaking students, who were also fluent in English, were recruited. Prior to scanning, participants provided autobiographical information on 27 categories, (e.g., their hometown, mother's name, etc.) in both Chinese and English. In an event-related fMRI paradigm, participants viewed 200 Chinese words and their corresponding English words. These words reflected SELF (self-relevant facts in white font, n=40), NEUTRAL (self-irrelevant words in white font, n=120), or were ODDBALL (self-irrelevant facts in green font, n=40). Participants were instructed to press a button only when words appeared in green font (ODDBALL). Whole brain analysis revealed greater activation in MPFC, PCC, bilateral temporo-parietal junction, and right para-hippocampus for SELF relative to NEUTRAL words. A PCC region of interest (ROI: -3, -33, 27) was defined by the peak activation coordinate in the SELF vs. NEUTRAL contrast. Activation in this PCC ROI was significantly greater in the orthogonal contrast of viewing self-relevant Chinese words versus English words ($t(15) = 2.46, P < 0.05$). This was consistent with our previous findings that PCC engagement was greater when participants performed explicit self-judgments in their first language (Chinese) than in their second language (English). Given previous research suggesting the involvement of PCC in autobiographical memory, it is possible that such memories are encoded in and more easily retrieved by the participants' first language than the second language. Future studies are needed to test this possibility.

J-52 *SANS Poster Award Winner

THE AMYGDALOSTRIATAL AND CORTICOSTRIATAL EFFECTIVE CONNECTIVITY IN ANTICIPATION AND EVALUATION OF FACIAL ATTRACTIVENESS

Hongbo Yu, Xiaolin Zhou, Peking University - Decision-making consists of an anticipation stage and an outcome evaluation stage (Platt, 2002). The ventral striatum (VS) is pivotal to both stages (Haber and Knutson, 2010), bridging motivation and action. The ventral medial prefrontal cortex (vmPFC) and the amygdala play important roles decision-making and goal-directed behaviors and are found to work in concert with the VS (Li et al., 2011; Mobbs et al., 2009). However, it is less clear concerning how the vmPFC and the amygdala work together with the VS in functioning human brain. Here we combined fMRI with dynamic causal modeling (DCM) to investigate the information flow along amygdalostriatal and corticostriatal pathways in a beauty guessing task. Specifically, we asked the participant to guess whether a blurred photo of female face was attractive (anticipation stage) and then presented them

with an unblurred photo of either an attractive or an unattractive face (evaluation stage). We found that at the anticipation stage, the bilateral amygdala and VS showed higher activation for the “attractive” guess than for the “unattractive” guess. At the evaluation stage, the vmPFC and the bilateral VS were more activated by the feedback faces whose attractiveness level was congruent with the participants’ initial guess than by the incongruent ones. The evaluation-related activities in the vmPFC and the VS were further modulated by the attractiveness of the feedback face: the effect of congruency was only significant for attractive feedback faces but not for unattractive ones. DCM analyses showed that at the anticipation stage, the choice-related information entered the amygdalostratial pathway through the amygdala and was projected to the VS. Only the unidirectional intrinsic connectivity from amygdala to the VS was significant, which was enhanced by the action of guessing (attractive and unattractive). At the evaluation stage, the outcome-related information entered the corticostratial pathway through the vmPFC. Bidirectional connectivities existed between the vmPFC and the VS, with the VS-to-vmPFC connectivity weakened by unattractive faces. These findings advanced our understanding of the reward circuitry by demonstrating the pattern of information flow along the amygdalostratial and corticostratial pathways at discrete stages of decision-making.

J-53 *SANS Poster Award Winner

HIGH-RESOLUTION FUNCTIONAL NEUROIMAGING AT 7 TESLA SHOWS DEFINITIVE ACTIVATION IN PERIAQUEDUCTAL GREY (PAG) COLUMNS TO AFFECTIVE IMAGES *Ajay B. Satpute, Northeastern University; Tor Wager, University of Colorado, Boulder; Julien Cohen-Adad, Polytechnique Montreal; Marta Bianciardi, Massachusetts General Hospital; Ji-Kyung Choi, Massachusetts General Hospital; Jason Buhle, University of Colorado, Boulder; Larry Wald, Massachusetts General Hospital; Lisa Feldman Barrett, Northeastern University, Massachusetts General Hospital, Harvard Medical School* - The periaqueductal grey (PAG) is a nucleus in the brain stem that is related to a variety of functions including sexual reproduction, social and emotional stress, pain, and arousal. In non-human animals, these functions are organized into columns with different columns and portions of columns being associated with specific physiological and motor response patterns. Little is known about how the PAG operates in humans however. Non-invasive studies of PAG function in humans must rely on functional neuroimaging, but it has been difficult to pinpoint activity in this area because the PAG surrounds an aqueduct that produces large fluctuations in bold signal and because examining the columnar arrangement requires sub millimeter resolution. Using high resolution functional neuroimaging at 7 Tesla and a customized analysis procedure, we provide the first definitive neuroimaging evidence for functional activation in the PAG to affective inducing images. We show distinct activations in the vicinity of the lateral and ventrolateral columns. This technological advance opens new directions for examining the role of the PAG in affect and emotion in humans as well as across a variety of

other domains.

J-54

SYSTEM JUSTIFICATION AND RESPONSES TO FEEDBACK: AN EVENT RELATED POTENTIALS STUDY *Shona M. Tritt, Jordan B. Peterson, Michael Inzlicht; University of Toronto* - System Justification (SJ), the endorsement/ rationalization of the current, social, economic, or political system (e.g., Jost et al., 2008), has been argued to serve anxiety buffering psychological functions. SJ has been found to protect against some of the negative psychological consequences that seem to accompany societal inequality (Napier & Jost, 2008). Presumably, this is because it allows individuals, whatever their class or societal status, to feel that they live in a meaningful, just, and predictable world. We assessed the possibility that SJ is associated with more general biases in information processing. If system-justifying beliefs are adopted as a means of self-regulation, then they might be associated with biased processing of information that promotes positive affect and reduces negative affect. We use event-related potentials (ERPs) to explore the association between system justifying beliefs and attentional bias to expected and unexpected positive and negative feedback. If SJ is associated with the tendency to focus more on positive and less on negative information then this type of belief should be correlated with enhanced ERPs in response to positive compared to negative self-referential information (feedback). Furthermore, if system justifiers have a tendency to ignore information that is inconsistent with their expectations (uncertainty threat), then they should exhibit reduced ERPs in response to unexpected compared to expected feedback. Method Participants (N=28) completed an 8-item questionnaire assessment of SJ and a time estimation task on a computer in which they received expected and unexpected positive and negative feedback while electroencephalography was recorded. We specifically looked at the feedback related negativity (FRN), quantified as the difference in voltage between the most negative peak 200-300 ms after response onset and the preceding positive peak 100-200 ms after response onset, at the Fz electrode site. To isolate the effects of valance and expectation, we created difference scores representing the FRN in response to 1) expected negative minus expected positive feedback, 2) unexpected negative minus unexpected positive feedback, 3) unexpected negative feedback minus expected negative feedback, and 4) unexpected positive minus expected positive feedback. Results SJ was related to significantly reduced FRN in response to unexpected versus expected negative feedback ($r=.40, p=.037$) and a trend was noted whereby SJ was related to greater FRN in response to expected positive compared to expected negative feedback ($r=.32, p=.099$). Discussion The results of our study suggest that system justifiers respond more to positive than to negative feedback and respond less to unexpected compared to expected negative feedback. Taken together, it seems that system justifiers responded less to anxiety-provoking information and more to positive information. These findings are consistent with Napier & Jost’s (2010)

notion that system justification serves a palliative function. However, our results may additionally suggest that SJ is associated with self-regulatory tendencies that are more general than previously considered, extending to the realm of attentional biases to self-referential information. This research may provide understanding of the broader self-regulatory motivational systems associated with system justifying beliefs and may help to inform which individuals and situations are most conducive to SJ.

J-55

NEURAL MEDIATORS OF COMPETITIVE BEHAVIOR, DEPENDENT ON HIERARCHICAL RANKING AND COMPETITION OUTCOME *Erik L Knight, Pranjal Mehta, Junaid S Merchant; University of Oregon* - Social hierarchies are ubiquitous in humans' lives, influencing physiology, immune functioning, and behavior dependent on one's position within a hierarchy. Recent work has begun to determine the underlying neural networks associated with representations of these social phenomena. But what role these and other neural networks play in mediating competitive behavior - an important aspect of gaining or losing status within a hierarchy - against higher and lower ranked opponents is unknown. This study sublingually administered suprapharmacological doses of testosterone to women prior to exposing them to a fixed contest against higher and lower ranked opponents. Participants then chose whether they would like to compete again with the same opponent or a different one. Behavioral analyses demonstrate that status (high vs. low) and competition outcome (win vs. lose) interact to significantly affect decisions to compete again. This study will examine neural mediators of competitive behavior that respond to the interaction of hierarchical context and competition outcome. The role of testosterone - a steroid hormone known to influence and respond to hierarchical interactions like competitions - in modulating these neural networks will also be explored. The results will help point to potential means for hierarchies - as narrow as workplace rankings and as broad as socioeconomic status - to influence social behavior, health, and well-being.

J-56

MOTIVATION MODULATES TASK PERFORMANCE AND STRIATAL ACTIVATION DURING A FEEDBACK-BASED LEARNING TASK *Samantha Swanson, Elizabeth Tricomi; Rutgers University* - The striatum is reliably activated by outcomes that influence learning, such as rewards and punishments, including performance-related feedback. Because striatal responses to rewards and punishments are modulated by the subjective value of such stimuli, we hypothesized that striatal responses to performance-related feedback would be affected by the individual's motivation to perform well on the task. To investigate this hypothesis, we administered two sessions of a feedback-based paired associate learning task, before and after an intervention that was designed to increase motivation to perform well

on the task. The trials in the two sessions were unrelated, with 80 distinct trials in each. During the break between sessions, participants first rated on a scale of 0 to 10 how important their performance on the task was to them. Following their rating, they were encouraged to provide two reasons that their rating was as high as it was, rather than a lower number. The intervention was inspired by techniques used in motivational interviewing, and behavioral piloting revealed the intervention to be effective at increasing both motivation and performance on our learning task. Moreover, the extent to which motivation increased was correlated with the degree of improvement in task performance. We found using fMRI that the caudate nucleus is more strongly engaged in processing positive feedback after the intervention than it is before the intervention. The caudate nucleus has been previously implicated in feedback processing during this same paired-associate learning task. Therefore, our results suggest that a motivational intervention that encourages participants to reflect on reasons to want to perform well can sensitize the striatum to positive feedback and facilitate enhanced performance during learning.

J-57

AGE-DIFFERENCES IN BRAIN AND BEHAVIOR DURING RECOGNITION OF HAPPY AND ANGRY FACIAL EXPRESSIONS AT LONGER AND SHORTER DURATIONS *Lennart Högman, Stockholm University; Joakim Svärd, Karolinska Institute; William Högman, Stockholm University; Natalie Ebner, University of Florida; Irena Makover, Stockholm University; Håkan Fischer, Stockholm University* - Current research denotes that some aspects of emotion recognition decline with age. This seems to be true especially for the recognition of facial expressions of anger, sadness and fear and to a lesser extent for positive and disgust expressions. It is however not clear whether this age-effect exists also in rapid detection of facial expressions, i.e., microexpressions. In the present study we assessed age differences in the recognition of facial expressions and microexpressions. In a first experiment, $n = 27$ young ($M_{age} = 25.3$) and $n = 30$ older ($M_{age} = 68.4$) participants identified happy, angry, and neutral facial expressions presented for 3500 ms during an fMRI session using a 3T Siemens Magnetom Trio Tim scanner. In a second behavioral experiment some month later the same young and older participants were presented with seven different basic facial microexpressions (angry, disgusted, fearful, happy, neutral, sad, surprised) displayed for only 200 ms and had to indicate which facial expression was shown. Behavioral results from the first experiment showed no significant differences between the age groups in their ability to recognize facial expressions: Both younger and older participants were better at recognizing happy faces than angry faces. Here older compared to younger participants showed greater medial prefrontal (MFG) activation for happy faces compared to the younger subjects. These age-differences were not present for angry faces. Results from the second experiment showed that older participants had more difficulties recognizing microexpressions of fear and sadness than younger participants. Interestingly, the difference in MFG

activation between happy and angry faces in Experiment 1 was positively related to the contrast in hit rate for happy relative to angry microexpressions in Experiment 2 in older but not younger adults. These results are in line with a "positivity bias" in older adults discussed in the literature.

J-58 *SANS Poster Award Winner

THE EFFECT OF MUSICAL EXPERIENCES AND MUSICAL TRAINING ON NEURAL RESPONSES TO EMOTIONALLY EVOCATIVE MUSIC AND NON-MUSICAL SOUNDS

Rebecca J. Lepping, University of Kansas, University of Kansas Medical Center; Ruth Ann Atchley, University of Kansas; Laura E. Martin, University of Kansas Medical Center; Trisha M. Patrician, University of Kansas, University of Kansas Medical Center; Rick Ingram, University of Kansas; Alicia Ann Clair, University of Kansas; William M. Brooks, University of Kansas Medical Center; Cary R. Savage, University of Kansas Medical Center

Background: Musical training has previously been associated with differences in neural processing of musical syntax, congruency, and other aspects of music cognition. Other research suggests that emotional responses to music are learned, not through musical training, but through the process of enculturation. The current ongoing study used functional MRI to investigate neural processing of emotional everyday sounds and emotional music. Specifically, we assessed the impact of musical training and self-reported affective responsiveness to music on fMRI activation in this auditory emotion-processing paradigm. Methods: Fourteen participants underwent fMRI scanning (5 males; MeanAGE=24.8; MeanED=16.1 years). fMRI data were collected while participants listened to short segments of emotionally evocative, unmanipulated instrumental music; nonmusical sounds selected from the International Affective Digital Sound set (IADS); and emotionally neutral tones. An earlier rating study verified the music and sounds were equally arousing and equally valenced. Stimuli were presented in thirty second blocks, alternating between positive, negative, and neutral stimuli. Participants rated each block as positive or negative via button press. Duration of musical training in years was collected in a short demographic questionnaire. Self-reported affective responsiveness to music was assessed with the Brief Music Experience Questionnaire (MEQ). The Brief MEQ is a 53 item self-report measure of music centrality in the respondent's life, his or her musical aptitude, and his or her experience with and reaction to music; affective responsiveness is a subscale of this measure (MEQ-AR). GLM analysis was conducted for the fMRI data, and a whole-brain map of the contrast (Music > Sounds) was generated. Musical training and MEQ-AR scores were then correlated with each voxel in the fMRI contrast map. Results: The emotionally matched Music and Sounds activated different brain networks, with music activating areas involved in emotional decision-making and conflict resolution (anterior cingulate cortex [ACC], precuneus, bilateral occipital cortex) more than sounds, and sounds activating areas involved in problem solving and semantic processing more than music, including dorsolateral prefrontal cortex

(DLPFC) and primary auditory cortex. Musical training was not significantly correlated with brain response in any region across the whole brain. MEQ-AR scores, however, were significantly positively correlated with fMRI activity in several regions, corrected for multiple comparisons, including bilateral DLPFC, posterior insula, parietal cortex, posterior cingulate cortex, lingual gyrus, occipital cortex, and cerebellum. Bilateral DLPFC showed significant activation in the basic contrast: sounds evoked a greater response than music overall; however, greater responsiveness to music in this region was associated with greater MEQ-AR scores. Discussion: In this paradigm, musical and non-musical sounds, carefully matched for emotional quality and level of arousal, evoked different patterns of brain activity. Additionally, this activity was modulated by individual variation in affective responsiveness to music, but not by years of musical training. The present study, therefore, supports the hypothesis that emotional responses to music are likely learned through experiences with music in social settings, and are not dependent on formal training in music.

J-59

SOCIAL DOMINANCE CUES INTERFERE WITH NEURO-COGNITIVE COMPONENT AND BEHAVIORAL PERFORMANCE DURING ACTION MONITORING

*Narun Pornpattananangkul, Northwestern University, *ICNC Travel Award Winner; Vivian X. Wang, Northwestern University; Natalie Blahunka, Boston College; Joan Y. Chiao, Northwestern University*

Social dominance cues have a powerful effect across many animal species and human societies (Chiao, 2010). The present study was designed to examine the extent to which social dominance cues influences performance and event-related brain potential (ERP) during an action-monitoring task. A novel social dominance Go/NoGo (GNG) paradigm was used while ERP was measured. In this paradigm, facial cues varying in social dominance (i.e., raised, bowed and neutral faces for dominant, submissive and neutral cues, respectively) were employed as Go/NoGo stimuli. In each of nine blocks, participants were instructed to ignore one type of social dominance cues (i.e., NoGo stimuli) and respond to the other two types (i.e., Go stimuli). The sensitivity index, or d' , was used to analyze accuracy in behavioral performance such that higher value indicated higher hit rate and/or lower false alarm. Results showed that d' was significantly lower in dominant-NoGo blocks ($M = 2.92$, $SD = .67$) than in submissive-NoGo blocks ($M = 3.23$, $SD = .56$; $F(2,34) = 3.640$, $p = .037$, partial $\eta^2 = .18$). This worse performance in dominant-NoGo blocks occurred despite the fact that participants responded significantly quicker in submissive-NoGo blocks ($M = 449.83$ ms, $SD = 57.38$) than in dominance-NoGo ($M = 467.04$ ms, $SD = 57.03$) and neutral-NoGo ($M = 478.03$ ms, $SD = 54.37$) blocks ($F(2,34) = 9.37$, $p = .001$, partial $\eta^2 = .36$). As for ERP, the N2 component at FCz that has been viewed as reflecting response-conflict monitoring processes (Nieuwenhuis, Yeung, van den Wildenberg, & Ridderinkhof, 2003) was analyzed. We found that Nogo N2 amplitudes for dominant faces ($M = -2.46$, $SD = 3.42$) were significantly less negative than that for neutral ($M =$

-4.06, SD = 3.12) and submissive faces ($M = -4.28$, $SD = 3.46$; $F(2,34) = 9.51$, $p = .001$, partial $\eta^2 = .36$). Similarly, across blocks, Go N2 amplitudes for dominant faces ($M = -2.51$, $SD = 2.62$) were significantly less negative than that for neutral ($M = -3.77$, $SD = 2.72$) and submissive faces ($M = -3.78$, $SD = 2.80$; $F(2,34) = 7.06$, $p = .003$, partial $\eta^2 = .29$). Finally, there was a significant interaction of N2 between Go/NoGo stimuli and social dominance cues ($F(1.62,27.58) = 7.61$, $p = .004$, partial $\eta^2 = .31$) such that although NoGo N2 was more negative than Go N2 in submissive-NoGo and neutral-NoGo blocks, NoGo N2 was less negative than Go N2 in dominant-NoGo blocks. Altogether, results suggest that perceiving high social dominance cues impairs response-conflict monitoring processes at both neural-cognitive and behavioral levels. Our findings have implications for understanding the role of social dominance perception as a social-situational factor when monitoring actions.

J-60

PARENTING AND NEURAL PLASTICITY IN HUMAN FATHERS' BRAINS *Pilyoung Kim, University of Denver; Paola Rigo, University of Trento, University of Denver; James F. Leckman, Yale University School of Medicine; Linda C. Mayes, Yale University School of Medicine; Ruth Feldman, Bar-Ilan University; James E. Swain, University of Michigan* - Previous studies demonstrated brain regions that are important for parenting behaviors in human mothers; however, little is known about the neural basis of parenting in fathers. In mothers, increased activations in the striatum, thalamocingulate circuits and prefrontal cortex (PFC) in responses to infant pictures or cry sounds are associated with sensitive parenting behaviors (Barrett & Fleming, 2010; Swain, Lorberbaum, Kose, & Strathearn, 2007). We previously reported that increased gray matter volumes in the striatum during the first few months postpartum was associated with mothers' more positive thoughts and feelings about their own baby (Kim et al., 2010). Rodent and primate studies suggest that similar neural regions may also be important for sensitive parenting and parent-child emotional bonding in fathers. For example, parenting experience was associated with the greater density of the PFC in male marmosets (Kozorovitskiy, Hughes, Lee, & Gould, 2006). Thus, in the current longitudinal study, we investigated structural changes in brain areas responsible for parental behaviors over time during the early postpartum period. Biological fathers ($n=17$) with full-term, healthy infants have been recruited in postpartum hospital rooms. All the fathers were mostly college educated and middle-to-upper class. High-resolution structural images were collected when fathers visited to the research center at 2-4 weeks postpartum (Time 1) and at 12-16 weeks postpartum (Time 2). The longitudinal VBM analysis was performed with VBM8 toolbox for Statistical Parametric Mapping 2 (SPM8) (Wellcome Department of Neurology, London, UK). The processed structural images were analyzed with a repeated-measure ANOVA to test changes between Time 1 and Time 2 in gray matter volumes, controlling for fathers' age, parenting experience, and scan intervals between two time points. An initial, voxel-wise threshold of $p < 0.005$ and a minimum cluster size of 260 voxels gave

a corrected p value of 0.05, using Monte-Carlo simulations. The longitudinal VBM analysis revealed that fathers had significant increase in gray matter volume from Time 1 to Time 2 in several brain regions, $p < 0.05$ (corrected). The brain regions included left striatum, subgenual cingulate cortex, and right lateral PFC (BA 45,46,47) (Figure 1). Grey matter volumes in these regions were also negatively correlated with depression and state anxiety at Time 2, based on the BDI and STAI measures, $ps < .05$. On the other hand, fathers showed significant decrease in gray matter volume in right orbitofrontal cortex and right fusiform gyrus from Time 1 to Time 2, $p < 0.05$ (corrected). The findings suggest that parenting experience in early postpartum period may be associated with structural increase in neural regions for parental motivation and mood regulation in human fathers. The structural increase in these regions may be related to better mood regulation, which can also facilitate paternal sensitivity toward a baby. The efficiency in processing infant-related information may explain the structural decrease in neural regions for emotional and social information processing over the first three months postpartum. The findings may shed light on what brain regions may be linked to a human father's ability to develop appropriate parental behaviors and parent-infant attachment.

J-61

YOU ARE WHAT YOU SENSE: BASELINE FUNCTIONAL PROPERTIES IN SOMATOSENSORY BRAIN REGIONS PREDICT INDIVIDUAL DIFFERENCES IN EXTRAVERSION *Tong Sheng, Katherine Fu, Lisa Aziz-Zadeh; University of Southern California* - The "sensory hypothesis of personality" posits that extroverted individuals tend to be more stimulus seeking as compared to introverts due to lower baseline levels of arousal in sensory cortices. However, while evidence from behavioral and functional neuroimaging studies offer some support for this hypothesis, a direct relationship linking baseline hemodynamic activity in sensory cortices to extraversion has not been clearly established. In the current study, we used fMRI to scan participants during resting state and found that resting-state hemodynamic signals in primary and secondary somatosensory cortices showed an inverse linear relationship to trait scores in extraversion. A similar relationship was also observed in the thalamus. Together, these results suggest a relationship between the baseline properties in cortical and subcortical sensory networks and personality traits. These findings support the sensory hypothesis of personality and, more generally, highlight the important relationship between functional properties of fundamental neural networks and disposition.

J-62

THE VALUE OF PSYCHOPATHY: ABERRANT COMPUTATION OF SUBJECTIVE VALUE DURING INTERTEMPORAL CHOICE IN INCARCERATED PSYCHOPATHS *Joshua W. Buckholtz, Harvard University, Massachusetts General Hospital; Erik Kastman, Harvard University; Hayley Dorfman, Harvard University; Joseph P.*

Newman, University of Wisconsin-Madison; Kent. K Kiehl, MIND Research Network, University of New Mexico - Psychopaths are notorious for their callousness and lack of remorse - their "cold-bloodedness" - highlighting the dramatic emotional and interpersonal deficits that characterize these individuals. Prior work suggests that abnormal connectivity and function within a corticolimbic circuit comprised chiefly of amygdala and medial prefrontal cortex, and implicated in emotional arousal, emotion regulation, and mentalizing, may underpin such socio-affective deficiencies. However, as much as psychopaths are known for a lack of reactivity in certain affective and social contexts, their inability to delay gratification - reflected in high levels of impulsive antisocial behavior, sensation seeking, and substance abuse - suggest an exaggerated response to rewards. Previously, Buckholz and colleagues (2010) have found evidence of heightened activity and dopamine transmission in the ventral striatum following monetary and drug rewards (respectively) in community volunteers with impulsive-antisocial traits. This is consistent with morphometric data showing structural abnormalities within the striatum in incarcerated psychopaths (Glenn et al 2010, Schiffer et al 2011). While together these data raise the possibility that striatal hyper-responsiveness may impair the ability to delay gratification and drive impulsive-antisocial behavior in psychopathy, several questions remain. First, while functional abnormalities within the striatum have been shown in community volunteers with impulsive-antisocial traits, clear evidence for striatal hyper-reactivity in "true" psychopaths (i.e. those meeting clinical diagnostic criteria) is lacking. Moreover, the cognitive mechanisms through by which striatal hypersensitivity might contribute to poor decision-making in psychopathic individuals remains unclear. Given the known role of this region in calculating subjective value, we hypothesized that exaggerated striatal reactivity could lead to an aberrant assignment of value to more immediate options during decision-making, inducing a maladaptive bias in choice behavior. To test this hypothesis, we scanned clinically assessed incarcerated offenders with fMRI during an intertemporal choice task. We recruited 49 male inmates (age 20-45; mean = 31) at two medium security state prisons in Wisconsin. A mobile MRI facility enabled local scanning at each correctional facility. Participants were clinically evaluated for DSM-IV disorders and psychopathy using the Structured Clinical Interview for the DSM (SCID) and the Psychopathy Checklist-Revised (PCL-R), respectively. During fMRI at 1.5T, participants performed an intertemporal choice task in which they were asked, on each of 126 trials, to choose between two monetary rewards. One reward was smaller in magnitude but available sooner (between 0 and 45 days), while the other was larger in magnitude (by between 1 and 50%) but only available after a delay (between 15 to 30 days after the "sooner" reward on that trial). Participants were instructed that two trials would be selected at random for veridical payout at the end of the experiment. Each individual's hyperbolic discounting factor k was calculated; this was then used to compute trial-wise estimates of subjective value for each option. A subjective value difference measure (SVDiff = $SV_{\text{sooner}} - SV_{\text{later}}$)

was calculated for each trial and used as a parametric modulator of trial onset regressors in a random-effects general linear model analysis within SPM8. For each subject, we calculated correlations between their PCL-R score and SVDiff fMRI beta-weights (extracted from anatomically defined regions of interest). Age and substance abuse history were included as covariates. Across participants, neural signals encoding subjective value were observed in ventral striatum and medial prefrontal cortex (pFDR < 0.05). Consistent with our hypothesis, PCL-R total scores were positively correlated with subjective value signals originating within the striatum ($r = 0.44$, $p < 0.005$). This relationship was not factor-specific, as significant correlations were observed for both factor 1 (emotional-interpersonal) and factor 2 (impulsive-antisocial) scores. Importantly, despite the fact that substance abuse history is independently associated with striatal SV signals, the relationship between psychopathy and striatal SV-related activity is still significant when controlling for individual substance abuse history ($p < 0.01$).

J-63

SYSTEM JUSTIFICATION IS ASSOCIATED WITH BRAIN STRUCTURE H. Hannah Nam, New York University; John T. Jost, New York University; Jay J. Van Bavel, New York University; Daniel Campbell-Meiklejohn, New York University, Aarhus University - System justification theory holds that people are motivated to defend and bolster the way things are, rationalizing the social, economic, and political status quo (Jost, Banaji, & Nosek, 2004). People who endorse ideologies that serve to justify the status quo in society tend to exhibit higher needs to reduce threat and uncertainty (Jost & Hunyady, 2005). We tested the hypothesis that greater system justifying tendencies associate with differences in neuroanatomical structure. In a sample of 48 American participants, we related self-reported system justification motivation to grey matter volume using structural MRI, adjusting for variability in brain volume due to age, gender, and overall size differences. We found that higher system justification was associated with increased grey matter volume of the bilateral amygdala and orbitofrontal cortex region. Our results extend previous findings that system-justifying ideologies (i.e., political conservatism) can be reflected in human brain structure (Kanai, Feilden, Firth, & Rees, 2011), and suggest that greater sensitivity to cues for threat and uncertainty associated with system justification is reflected in brain structure.