

Social & Affective Neuroscience Society

Annual Meeting 2015

April 23-25, The Revere Hotel
Gallery - Sixth Floor
Boston, Massachusetts

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Conference Schedule

Thursday April 23

Start	End	Session
4:00 PM	7:30 PM	Registration
5:00 PM	6:00 PM	Welcome and Keynote Address by Dr. Michael Platt
6:00 PM	7:30 PM	Poster Session A & Welcome Reception

Friday April 24

Start	End	Session
8:00 AM	9:00 AM	Continental Breakfast and Registration
9:00 AM	10:30 AM	Symposium Session 1: Social Cognition Across Species
10:30 AM	10:45 AM	Coffee Break
10:45 AM	12:00 PM	Distinguished Scholar Address by James Gross
12:00 PM	1:30 PM	Lunch Break & Optional Funding Luncheon
1:30 PM	3:00 PM	Symposium Session 2: Affect & Altruism
3:00 PM	4:30 PM	Poster Session B & Coffee Break
4:30 PM	6:00 PM	Presidential Symposium: Neural Signals Supporting Social Communication
6:00 PM	7:00 PM	Presidential Reception

Saturday April 25

Start	End	Session
8:00 AM	9:00 AM	Continental Breakfast
9:00 AM	10:30 AM	Symposium 3: From Perception to Emotion
10:30 AM	10:50 AM	Coffee Break
10:50 AM	12:20 PM	Faculty Blitz Talks
12:20 PM	2:00 PM	Lunch Break
2:00 PM	3:00 PM	Graduate Students Present
3:00 PM	4:30 PM	Poster Session C & Coffee Break
4:30 PM	6:00 PM	Symposium 4: Groups & Affiliation
6:00 PM	6:15 PM	Closing Remarks

2015 Awards

Distinguished Scholar Award

James Gross, Stanford University

Innovation Award

Stephanie Preston, University of Michigan "*The origins of altruism in offspring care*"

Graduate Students Present¹

Robert Chavez
Taru Flagan
Jessica Koski
Sophie Payne
Tyler Santander
Elaine Shing
Mark Thornton
Wanting Zhong

DCN Travel Awards²

Ethan McCormick
Jennifer Silvers

SANS Poster Awards³

Ann Carroll
Brent Hughes
Eshin Jolly
John Ksander
Richard Lopez
Carolyn Parkinson
Katherine Powers
Isabelle Rosenthal
Jordan Theriault
Yuanbo Wang

¹ In recognition of the top 8 most highly rated abstracts submitted by graduate students who have not previously spoken at SANS. These students will present their work as brief talks on Saturday, April 25, 2015.

² The journal *Developmental Cognitive Neuroscience* has generously sponsored two travel awards for highly rated abstracts focused on the development of social, cognitive, and affective processes.

³ In recognition of the top 10 most highly rated abstracts that will be presented as posters.

Thursday, April 23 2015

Keynote

Keynote Address

The biology of strategic social behavior

5:00 – 6:00 PM

Speaker: Michael Platt

ABSTRACT

Most primates seem specialized for social life, yet how biology shapes complex social behaviors remains poorly understood. To address this gap, we study the biology and behavior of rhesus macaques in both the laboratory and the field. Recent work in the lab shows that monkeys favor giving rewards to another monkey, particularly if he is more familiar or subordinate, rather than give the rewards to no one. Oxytocin—a hormone implicated in social bonding—makes monkeys more giving. Finally, giving behavior selectively activates cells in medial frontal cortex, an area previously implicated in empathy in humans. In a separate study, we found inactivating this area impairs social learning. By contrast, when monkeys play a competitive game against each other, they rapidly develop unpredictable behaviors that serve to hide their intentions. Planning deceptive feints activates a population of neurons in the lateral frontal cortex, an area linked to deceptive planning in humans; inactivating these cells impairs deceptive planning. In the field, we find that intraspecific variation in social behavior and cognition has fitness consequences and emerges, in part, from genes that regulate neuromodulatory function. Together, our findings suggest deep homologies in the biological origins of complex social function in primates.

Posters

Keynote Reception and Poster Session A

6:00 – 7:30 PM

See page 28 for abstracts

Friday, April 24 2015

Symposium

Social Cognition Across Species

Friday, April 24, 2015

9:00 - 10:30 AM

Laurie Santos, Yale University	9:00-9:30
Inbal Bartal, University of California, Berkeley	9:30-9:45
Jan Haaker, Karolinska Institute	9:45-10:00
Joshua Greene, Harvard University	10:00-10:30

ABSTRACTS

A HUMAN UNIQUE MIND-MELD?: FROM BEHAVIOR-CONTAGION TO MIND-CONTAGION *Laurie Santos, Yale University* – What allows for our human unique ability to jump into the minds of others? Synthesizing recent work in primate social cognition, I'll argue that humans possess a species-unique capacity to mind-meld—an automatic mental state contagion that stems from our unique ability to represent the mental states of others. I'll first review work on emotional and behavioral contagion in non-human primates, suggesting that primates share our human capacity to automatically jump into other individuals' behavioral states. I'll then present recent work from primate theory of mind and social problem-solving to argue that other primates may lack the capacity to automatically represent others' mental states in the way humans do. However, I'll also argue that our human capacity to represent others' mental states comes with a representational cost—the act of representing others' beliefs, intentions, and preferences sometimes causes us to have less access to our own. I'll then discuss what this new empirical predictions this hypothesis provides for the field of social neuroscience.

EMPATHIC HELPING IN RATS AND ITS MODULATION BY SOCIAL PARAMETERS *Inbal Bartal, University of California, Berkeley* – Empathy, the recognition and sharing of affective states between individuals, is an adaptive response with ancient evolutionary roots. It has been clearly established that rodents show emotional contagion for the distress of conspecifics. The Empathic Helping paradigm we established shows that rats will intentionally release a cagemate trapped in a restrainer. When a second restrainer containing a highly palatable food (chocolate chips) was present, rats opened both restrainers and typically shared the chocolate. Yet, helping others is costly and resource depleting, and should thus be discriminately extended. In humans, the expression of empathically motivated pro-social behavior is dependent on social context, where people are more motivated to help in-group members than out-group members. Correspondingly, others have found that emotional contagion is modulated by familiarity in rodents. Studies using the helping behavior test demonstrate that pro-social motivation in rats is dependent on emotional contagion as well as the social context.

**OBSERVING OTHERS' FACE-TO-FACE CONFRONTATIONS SHAPES SOCIAL RANK
LEARNING AND THREAT RESPONSES**

Jan Haaker, Karolinska Institute – Social groups in both humans and other animals are organized along dominance hierarchies that regulate the access to valuable resources. The rank order in a hierarchy is often established through aggressive displays between conspecifics, and such displays might be visible to others in the group, providing a means to learn about the rank of others. We examined how observing dyadic confrontations between other individuals shaped the learning of social rank, and how these experiences affected subsequent conditioned fear learning about the observed individuals. In two behavioral and one fMRI experiment, we show that observing dyadic confrontations of others is sufficient for learning their positions in the social hierarchy. We found that observing the confrontations of others elicited defensive responses (potentiation of the eye-blink startle reflex) and amygdala reactivity. Both of these responses decreased as individual learning about the social hierarchy increased. The medial prefrontal cortex (mPFC) and the amygdala coded for the social rank during confrontation. Moreover, we observed that pairing an individual with high, as compared to low, social rank with an aversive outcome (electric shock) during fear conditioning, resulted in enhanced psychophysiological, and sustained amygdala, responses. Our results demonstrate that learning about social rank can emerge through observing others' confrontations, which enhances threat responses towards high dominant individuals. These findings enhance our understanding of the neurobiology underlying social dominance, which serves a key role in both normal social functioning and the development of neuropsychiatric conditions.

JUDGING, FEELING, THINKING: WHAT MAKES US SPECIAL? *Joshua Greene, Harvard University* – Human brains closely resemble those of other primates, yet we do many nifty things that they do not. It's often said that we humans are distinguished by our "humanity", by our moral sensibilities. But research on moral cognition says that human morality is not the product of a distinctive moral faculty. Instead, moral judgment and behavior depend on the coordinated interaction of multiple neural systems, none of which appears to be specifically dedicated to moral cognition and all (or nearly all?) of which appear to be shared with other animals. What, then, makes us special? I propose that an essential ingredient—if not the essential ingredient—is our ability to rapidly and flexibly combine multi-modal concepts to form complex thoughts. I will discuss some new research on this remarkable human ability and consider its relation to other candidate answers to the "What makes us special?" question: language, "prospection", explicit reasoning, and the commitment to abstract ideals.

Award Address Distinguished Scholar Address

Emotion Regulation: Current Status and Future Prospects

Friday, April 24, 2015

10:45 – 12:00 PM

Speaker: James Gross

A B S T R A C T

The past decade has seen an extraordinary increase in research on emotion regulation. Work from dozens of laboratories around the world has converged to

establish that emotion regulation plays a crucial role in determining a wide range of affective, cognitive, and social outcomes. In this talk, I will do three things. In the first part of the talk, I will define emotion and emotion regulation, and describe a framework for understanding the role of emotion regulation in healthy adaptation. In the second part of the talk, I will review key research findings which suggest that specific forms of emotion regulation have different consequences for affective, cognitive, and social functioning. In the third part of the talk, I will discuss key questions that must be addressed by this field.

Lunch

Funding Luncheon

Open to pre-registered attendees

Brief presentations and panel Q&A with representatives from major SANS-area funding agencies

Friday, April 24, 2015

12:10 – 1:20 PM

Sally Dickerson, National Science Foundation

Nicholas Gibson, The John Templeton Foundation

Alumit Ishai, National Science Foundation

Adam Russell, IARPA

Janine Simmons, National Institute of Mental Health

Symposium

Affect and Altruism

Friday, April 24, 2015

1:30 – 3:00 PM

Mauricio Delgado, Rutgers University

1:30-2:00

Daniel Dillon, McLean Hospital, Harvard Medical School

2:00-2:15

Molly Crockett, Oxford University

2:15-2:30

Tali Sharot, University College London

2:30-3:00

A B S T R A C T S

SAVORING THE PAST: THE VALUE OF RECALLING POSITIVE MEMORIES *Mauricio Delgado, Rutgers University* – Maintaining positive feelings is associated with an increased ability for emotion regulation, which may benefit one's ability to cope with stressors in daily life. One way to elicit positive emotions is to reminisce about past positive life events. Autobiographical memories are vivid representations of the past that can serve various functions, such as bolstering self-identity. Such memories can also trigger the re-experience of emotions tied to the original event, eliciting positive feelings and enhancing an individual's well-being. In this talk, I will

discuss behavioral and neuroimaging data suggesting that the recall of positive memories is intrinsically valuable to an individual. Specifically, recalling the positive past can recruit neural circuits involved in reward processing, and can influence emotion and decision-making. The act of recalling positive memories can also help dampen the physiological effects of acute stress. Taken together, these results highlight how reminiscing about the positive past serves an important function in the maintenance of positive feelings and the promotion of successful adaptation to stress.

POSITIVE REINFORCEMENT ENHANCES ENCODING OF UPCOMING INFORMATION

Daniel Dillon, *McLean Hospital, Harvard Medical School* – Each day we form many short-term memories, most of which rapidly decay. However, some episodes stay with us for years, even decades. What triggers memory retention? We hypothesized that positive reinforcement is critical: by activating brain reward networks that communicate with medial temporal lobe memory regions, positive reinforcement may promote consolidation. To test this idea, in Experiment 1 38 adults viewed 240 natural and man-made images and decided to keep or reject each one. Decisions were reinforced by delivery of “rewards” (monetary feedback) or “zeros” (no monetary feedback), and the reinforcement rate for stimulus/response pairings varied throughout the task. Participants returned a day later for a surprise recognition memory test. Consistent with the hypothesis, memory was better for images that followed rewards versus zeros ($Z = 4.40$, $p < 0.001$). In Experiment 2, 22 adults completed the same task during functional magnetic resonance imaging. Memory accuracy was again higher for images preceded by rewards versus zeros ($Z = 4.04$, $p < 0.001$). A whole-brain “reward-zero” contrast revealed activation of bilateral hippocampus (left, $Z = 4.58$; right, $Z = 5.17$) and ventromedial prefrontal cortex ($Z = 4.94$), indicating coactivation of regions implicated in episodic encoding and reward valuation ($p < 0.05$, FWE-corrected). Because the memory tests were unexpected, these results cannot be attributed to strategic effects at encoding. Thus, positive reinforcement facilitates incidental encoding of upcoming information, leading to better retention. This mechanism may help explain the coincidence of anhedonia and memory deficits in certain psychiatric conditions, such as depression.

HYPERALTRUISM AND ITS NEUROMODULATION BY SEROTONIN AND DOPAMINE

Molly Crockett, *Oxford University* – How we evaluate the suffering of others is a central concern in moral decision-making, but its neural basis is not well understood. Here, we investigate how people evaluate others' pain relative to their own pain, and how serotonin and dopamine shape this evaluation process. To investigate these questions, we observed people trading off profits for themselves against pain for themselves or an anonymous other person, and used computational models to quantify how they valued others' pain relative to their own pain. In two behavioral studies, we show that most people are 'hyperaltruistic', sacrificing more money to prevent others' pain than their own pain. In two subsequent pharmacological studies, we examined the effects of the serotonin reuptake inhibitor citalopram and the dopamine precursor levodopa on the valuation of pain for self and others. Citalopram and levodopa had distinct and opposing effects on moral decision-making. Our findings have implications for understanding antisocial behavior in psychiatric disorders associated with abnormal serotonergic and dopaminergic function.

GOOD NEWS AND BAD NEWS: HOW HUMANS INCORPORATE INFORMATION

Tali Sharot, *University College London* – We are constantly flooded with information (e.g., via the Web, advertising, colleagues, and friends) that helps us form predictions about the future and make decisions. Classic theories in psychology, economics and machine learning all implicitly assume that beliefs are adjusted in a similar manner in response to desirable and undesirable information. In this talk I

will provide evidence challenging these assumptions. I will show that while people incorporate good news into their existing beliefs in a normative manner, they display an aversion to incorporating bad news, discounting the strength of the information leading to noisy posterior beliefs. This asymmetry in how we incorporate information can have important societal implications including the generation of financial market bubbles and ill preparedness in the face of natural disasters. However, we find that the asymmetry is not set in stone, but rather fluctuates in response to threats in the environment, in a way that may be adaptive. Using a combination of fMRI, TMS and DTI we characterise the neural system supporting this asymmetry and show that changes in this circuit are related to individual differences in behaviour and mental health, with more balanced coding of information observed in depression and middle age.

Posters

Poster Presentations: Session B

Friday, April 24, 2015

3:00-4:30 PM

See page 57 for abstracts

Symposium

Presidential Symposium

Neural Signals Supporting Social Communication

Friday, April 24, 2015

4:30 – 6:00 PM

Speakers: Winrich Freiwald and Uri Hasson

Introduction: Alexander Todorov, SANS President

Winrich Freiwald, Rockefeller University

4:40-5:20

On the Neural Circuits for Face Recognition: a Vision Science
Perspective on the Social Brain

A B S T R A C T

Faces provide powerful inroads into the social brain: they evoke emotions, activate memories, draw and direct attention, and elicit communicative responses. Thus faces have provided the social neurosciences with powerful tools to map the neural circuits and unravel the neural mechanisms of the social brain. Faces, as it turns out, similarly provide the visual neurosciences with a unique opportunity to decipher the neural mechanisms of object recognition. This is for two reasons. Faces are a well-defined stimulus class, and primates have evolved a beautiful dedicated face-processing system that is particularly amenable to neuroscientific analysis. The temporal and frontal lobes of macaque monkeys contain neural machinery to support face recognition, consisting of a fixed number of discrete patches of face-selective cortex. The four main organizing

features of this system, concentration of cells encoding the same complex object category into modules, functional specializations of modules, spatial separation of modules, and integration of modules into a network, make it possible to break down the process of face recognition into its components. In my talk I will describe this network and a close companion we recently discovered, both from a vision and a social cognition perspective. I will describe how the system is embedded into the rest of the brain in ways that are suggestive for how the network may support the powerful emotive and cognitive functions faces elicit. I will indicate how these investigations of the macaque social brain may aid our understanding of human social cognition.

Uri Hasson, Princeton University

5:20-6:00

Face to face, Brain to brain: Exploring the mechanisms of dyadic social interactions

A B S T R A C T

Neuroimaging studies of language have typically focused on either production or comprehension of single speech utterances such as syllables, words, or sentences. In this talk I will introduce novel methodological and analytical tools we developed for characterizing the neural responses during production and comprehension of complex real-life speech. First, using a time-warp based intra-subject correlation method, we identified all areas that are reliably activated in the brains of speakers telling a fifteen minute long narrative. Next, we identified areas that are reliably activated in the brains of listeners as they comprehended that same narrative. This allowed us to identify networks of brain regions specific to production and comprehension, as well as those that are shared between the two processes. The results indicate that production of a real-life narrative is not localized to the left hemisphere but recruits an extensive bilateral network, which overlaps extensively with the comprehension system. Moreover, by directly comparing the neural activity timecourses during production and comprehension of the same narrative, we were able to identify not only the spatial overlap of activity but also areas in which the neural activity is correlated (coupled) across the speaker's and listener's brains during production and comprehension of the same narrative. We demonstrate widespread bilateral coupling between production- and comprehension-related processing within both linguistic and non-linguistic areas, exposing the extent of shared processes across the two systems. The ability to communicate thoughts to other brains is a hallmark feature of human cognition. The robust production-comprehension coupling observed here underlines the importance of studying comprehension and production within a unified framework. Just as one cannot study the processes by which information is transmitted at the synaptic level by focusing solely on the pre-synaptic or post-synaptic compartments, one cannot fully characterize the communication system by focusing on the processes within the border of a single isolated brain.

Reception

Presidential Reception

6:00 – 7:00 PM

Saturday, April 25 2015

Symposium

From Perception to Emotion

Saturday, April 25, 2015

9:00 - 10:30 AM

Philippe Schyns, University of Glasgow	9:00-9:30
Megan Willis, Australian Catholic University	9:30-9:45
Marc Pell, McGill University	9:45-10:00
Adam Anderson, Cornell University	10:00-10:30

ABSTRACTS

THE FACE, A TRANSMITTER OF DYNAMIC SOCIAL SIGNALS *Philippe Schyns, University of Glasgow* – One of the most powerful tools in social communication is the face, from which observers can quickly and easily extract rich information for various social judgments (e.g., identity, gender/sex, age, race/ethnicity, sexual orientation, physical health, attractiveness, emotional state, personality traits, states of pain or physical pleasure, deception and even social status). Yet, since the face comprises a high dimensional information space, identifying precisely which information subtends the dynamic perception of social categories remains challenging. Understanding this relationship - i.e., between information transmitted in the external environment and its interpretation by an observer - is a central goal of psychophysics. Here, I will demonstrate a key selection of data-driven methods - each based on the psychophysical method of reverse correlation - which aims to isolate, in the high dimensional information space of the face, the precise information that elicits the perception of a given social category.

ENHANCEMENT OF FACIAL EXPRESSION RECOGNITION BY ANODAL TRANSCRANIAL DIRECT CURRENT STIMULATION *Megan Willis, Australian Catholic University* – The ability to recognise facial expressions is fundamental to effective social communication and deficits in this capacity can have devastating social consequences. The orbitofrontal cortex (OFC) is one neural structure that has been implicated in the capacity to accurately recognise facial expressions. The current study used a mild brain stimulation technique called transcranial direct current stimulation (tDCS) to excite the neural activity of the right OFC in healthy adults. It was anticipated that anodal tDCS administered to the right OFC would enhance facial expression recognition when compared to the sham condition. Across two counterbalanced sessions of tDCS (i.e., anodal and sham), 20 undergraduate participants (16 female) completed a forced choice facial expression labelling task comprising angry, disgusted, fearful, happy, sad and neutral expressions. Responses were scored for accuracy, median reaction time, and overall efficiency (i.e., combined accuracy and reaction time). The results indicated that anodal tDCS to the right OFC enhanced facial expression recognition, as reflected in greater efficiency and speed of recognition across all emotions, compared to participants' performance in the sham condition. This

finding is the first to demonstrate that anodal tDCS to the right OFC can boost facial expression recognition. These findings provide a solid foundation for further research to examine the potential efficacy of this technique as a means to treat facial expression recognition deficits, particularly in those with OFC damage or dysfunction.

NEUROPHYSIOLOGICAL RESPONSES TO VOCAL EMOTION CUES IN AND OUT OF

SPEECH *Marc Pell, McGill University* – In this study we used ERPs to compare the time course for processing vocal emotions expressed through non-linguistic vocalizations and in speech prosody, to test whether emotional vocalizations are treated preferentially by the neurocognitive system. Young adults passively listened to angry, sad, or happy pseudo-utterances and corresponding vocalizations (i.e., grunts, sobs, laughter) while focusing on a subsequent visual target (a face). ERPs time-locked to voice onset looked at the effects of vocal expression type and emotion type on ERP components related to acoustic structure building (N100), emotional salience detection (P200), and cognitive elaboration of vocal emotional meanings (Late Positive Component, LPC). Results suggest that non-linguistic vocalizations are preferentially processed over speech-embedded emotions at early processing stages (N1-P2 complex), affecting both the amplitude and latency of these components. At the stage where the motivational significance of vocal stimuli is registered (P200), vocalizations elicited stronger, earlier, and more differentiated responses than speech; vocalizations (especially anger) also evoked a stronger late positivity (LPC) effect than emotional prosody in the 450-700ms time window. Secondary analyses suggested that individuals with high trait anxiety exhibited early, heightened sensitivity to vocal emotion cues (particularly vocalizations) as well as later differences in how attention may have been deployed to emotional speech. Our findings show that while neuronal responses to emotional speech and vocalizations follow a similar electrophysiological pattern, as evolutionarily primitive signals of human emotion in the auditory modality, vocalizations are accorded precedence over speech.

NEURAL REPRESENTATIONS OF EXTERNAL EVENTS AND THEIR INTERNAL AFFECT *Adam*

Anderson, Cornell University – Over a century ago W. Wundt proposed the construct of affect—the way sensory events “affect” us—as a unique dimension of perceptual experience. It remains unclear how the brain represents external objective sensory events alongside our internal subjective impressions of them. We employed representational mapping of multivoxel activity patterns evoked by complex scenes and basic tastes and uncovered neural codes supporting a continuous axis of pleasant-to-unpleasant valence. Valence information was encoded both within modality specific primary and secondary gustatory and visual cortices. This visual valence code was distinct from low-level physical and high-level object property representations. The gustatory valence code was largely distinct from representations of basic taste qualities. In contrast to the ventral temporal and anterior insular cortices that supported valence codes specific to vision and taste, the medial and lateral orbitofrontal cortices maintained a valence code independent of sensory origin. Only the OFC code could classify experienced affect across participants. These results demonstrate the entire valence spectrum is represented as a collective pattern of regional neural activity as sensory-specific and abstract codes. While the former may provide support for Wundt’s thesis of affect as a primary perceptual dimension, the latter affords a reference frame in which the subjective quality of affect can be objectively quantified across stimuli, modalities, and people.

Faculty Blitz Presentations

Saturday, April 25, 2015

10:50 AM - 12:20 PM

Lauren Atlas, National Center for Complementary and Integrative Health, NIH

R. McKell Carter, University of Colorado

Mina Cikara, Harvard University

Catherine Hartley, Weill Cornell Medical College

Hackjin Kim, Korea University

Jennifer Kubota, University of Chicago

Kristen Lindquist, University of North Carolina

Dean Mobbs, Columbia University

Kyle Ratner, University of California, Santa Barbara

Alexander Shackman, University of Maryland

Lucina Uddin, University of Miami

Dylan Wagner, The Ohio State University

ABSTRACTS

HOW EXPECTATIONS SHAPE AVERSIVE LEARNING *Lauren Atlas, National Center for Complementary and Integrative Health, NIH* – Decades of work in human neuroscience indicate that cognitive factors such as verbal instructions can shape emotion, affect, and decisions. Recent work in human neuroscience suggests that instructions also shape dynamic value-based learning in both appetitive and aversive domains. We know less about whether our own cognitive beliefs also shape how we learn about our environment. We tested whether explicit, cognitive factors that are self-generated, rather than external, also shape aversive learning. We examined whether the strength, speed, and mechanisms of aversive learning are modulated when individuals explicitly report expectations during aversive learning, relative to participants who do not make any judgments. We performed two experiments: A behavioral study (Study 1; N = 80) and an fMRI study (Study 2; N = 40). In both studies, participants were randomly assigned to either an Expectancy Rating Group or a Passive Group. Both groups performed a Pavlovian fear conditioning task with a single reversal. The Expectancy Rating Group recorded shock expectancy on a continuous visual analogue scale on every trial, whereas the Passive Group viewed stimuli and received shocks without making any responses. We found that making expectancy ratings actually slowed learning, as measured by smaller differential skin conductance responses following the reversal, as well as significantly lower learning rates across the entire task. FMRI analyses revealed that the Passive Group showed larger differential responses across the entire task, and also showed larger differential responses post-reversal in bilateral ventral striatum and left amygdala. These results indicate that attending to expectations actually slows simple associative learning. Expectancies are likely

to be sensitive to higher order rules rather than simple associations, which reduces purely feedback-driven associative learning.

THE NEXUS MODEL OF THE TPJ AND CO-OPTED SOCIAL FUNCTION

R. McKell Carter, University of Colorado – We have identified the temporal parietal junction (TPJ) as a region of the brain that uniquely predicts social decisions. We describe here the nexus model for TPJ function, in which the neural organizing principles of hierarchy and proximity are used to reconcile the role of TPJ in social cognition with its hypothesized role in attention and memory. The nexus model proposes that novel functions (e.g., mentalizing) arise in the brain where previously unassociated computational streams are brought into close proximity. I will discuss the implications of the nexus model in both the contexts of healthy social processing and the autism spectrum disorders, in which social processing could be co-opted in favor of objects of circumscribed interest.

REDUCED SELF-REFERENTIAL NEURAL RESPONSE DURING INTERGROUP COMPETITION PREDICTS COMPETITOR HARM

Mina Cikara, Harvard University -- Why do interactions become more hostile when social relations shift from “me versus you” to “us versus them”? We tested whether acting with a group reduces spontaneous self-referential processing in the moral domain and facilitates competitor harm. In an fMRI experiment: participants (n=21) performed a competitive task once alone and once with a group; we indexed spontaneous self-referential processing during competition using activation in an independently localized region of the medial prefrontal cortex (mPFC/pgACC) associated with self-reference; and we assessed participants' willingness to harm competitors versus teammates. Participants performed a go/no-go task—once with their teammates (ostensibly one room over) and once alone. The cover story for the experiment was related to social communication. Half of the items were in first-person and true of participants (assessed via pre-test); half were written in third-person and untrue. Go items were related to communication, e.g., “She has a twitter account.” No-go items were related to good and bad moral behavior, e.g., “I have stolen food from a shared refrigerator” (“distractors” were never labeled as moral). In the group (but not the alone) condition, a significant correlation was observed: robust mPFC response to first-person (vs. third-person) moral items was associated with benign treatment of competitors, whereas reduced (or reversed) mPFC response to these items was associated with selecting less flattering photos of competitors relative to teammates. In other words, attenuated mPFC response to self-relevant moral information during intergroup competition, but not during individual competition, was associated with later willingness to harm a competitor.

THE DEVELOPMENTAL EMERGENCE OF GOAL-DIRECTED BEHAVIOR

Catherine Hartley, Weill Cornell Medical College -- Psychological theories and experimental data distinguish “goal-directed” behaviors, performed to obtain specific desired future outcomes, from “habits”, actions rendered stimulus-bound and automatic through previous reinforcement. Goal-directed behavior is proposed to rely upon a “model-based” learning process, which recruits a cognitive model of potential actions and outcomes to flexibly pursue a goal. In contrast, habits are thought to stem from a more efficient “model-free” learning process that enables previously rewarded behaviors to be repeated without forethought or attention. Model-based learning is proposed to recruit prefrontal-subcortical circuitry, which undergoes substantial structural and functional change as individuals mature from childhood into adulthood. This suggests that the reliance on goal-directed versus habitual action might also change markedly with age. In this study, we examined the developmental trajectories of these two forms of action selection. Children, adolescents, and adults performed a two-stage reinforcement-learning task through which we can assess whether participants rely upon a cognitive model of the task to make choices, or whether they simply repeat previously rewarded actions. Our data suggest that whereas model-free learning is recruited from

childhood onwards, model-based influences on choice are not evident until adolescence, and continue to strengthen into adulthood. This protracted maturation of goal-directed behavior may contribute to the shortsighted decision-making in affective contexts that is commonly observed during adolescence.

NEURAL BASIS OF VALUATION AND DECISION-MAKING FOR SELF AND OTHERS

Hackjin Kim, Korea University -- Why and how do we make decisions for others? What distinguishes prosocial decision from selfish one? The ability to accurately estimate other people's preferences and make prosocial choices for others, albeit not immediately related to one's own profit, can be critical for establishing and maintaining successful social life in human society. Recent studies from my lab demonstrated that the dorsomedial prefrontal cortex (DMPFC), possibly through its communication with the temporo-parietal junction (TPJ), can be preferentially engaged in computing values of risky decisions for others, and that its activity predicted accuracy in the estimation of other people's preferences on various items based on brief exposures to their appearances. Contrary to a large body of literatures supporting the role of DMPFC in mentalization, however, we suggest that DMPFC activity is not necessarily associated with altruistic/prosocial decisions. In support of this argument, we recently observed that, when people learn to maximize benefits of themselves or others, activity in the ventromedial prefrontal cortex (VMPFC) encoded more self- than other-regarding values, while the opposite was true for DMPFC. Interestingly, such a spatially segregated functional dissociation within the medial prefrontal cortex was more prominent among selfish than prosocial participants. Finally, one of the latest studies from my lab showed that others' observation facilitated ethical consumer decisions via increase in the intuitive valuation system involving the ventral cortico-thalamo-striatal loop, which was then accompanied by decreased DMPFC activity. In summary, these findings provide further supports to the dual-process model of prosocial decision. More specifically, the ventral cortico-thalamo-striatal loop, serving as an intuitive valuation system primarily for self-regarding decisions, can be also recruited to elicit socially desirable other-regarding decisions among prosocial individuals particularly under social pressure. On the contrary, the dorsal counterpart working in conjunction with TPJ may override/suppress the intuitive valuation process to promote a more deliberative analysis of goal-relevant information, leading to a more strategic other-regarding choice.

THE NEURAL UNDERPINNINGS OF IMPLICIT PREJUDICE INTERVENTION

Jennifer Kubota, University of Chicago -- Implicit racial prejudice is ubiquitous in the United States and predictive of many discriminatory behaviors, but ultimately malleable. Scholars are uncovering the neural mechanisms that underlie implicit prejudice intervention. In this talk, I will present functional neuroimaging and brain lesion research, exploring the neural regions that support successful implicit prejudice reduction. Data presented will focus on a network of regions involved in emotion and emotion regulation (including the amygdala, DLPFC, and ACC) to highlight how exposure to counterstereotypes decreases implicit bias by altering evaluative and regulatory processing.

THE BRAIN BASIS OF POSITIVE AND NEGATIVE AFFECT: EVIDENCE FROM A META-ANALYSIS OF THE HUMAN NEUROIMAGING LITERATURE

Kristen Lindquist, University of North Carolina -- The ability to experience pleasant or unpleasant feelings, or to represent objects as "positive" or "negative" is known as representing hedonic "valence." Although scientists overwhelmingly agree that valence is a basic psychological phenomenon, debate continues about how to best conceptualize it scientifically. We used a meta-analysis of 397 functional magnetic resonance imaging (fMRI) and positron emission tomography (PET) studies (containing 914 experimental contrasts and 6827 participants) to test three competing hypotheses about the brain basis of valence: the bipolarity hypothesis that positive and

negative affect are supported by a brain system that monotonically increases and/or decreases along the valence dimension, the bivalent hypothesis that positive and negative affect are supported by independent brain systems, and the affective workspace hypothesis that positive and negative affect are supported by a flexible set of valence general regions. We found little evidence for the bipolar or bivalent hypotheses. Findings instead supported the hypothesis that, at the level of brain activity measurable by fMRI, valence is flexibly implemented across instances by a set of valence general limbic and paralimbic brain regions.

SOCIAL INFLUENCES ON FEAR *Dean Mobbs, Columbia University* -- My talk will focus on the neural basis of fear and anxiety and how the social environment influences these emotions. I will present data showing that our perceptions of fear alter when we are alone vs in a group and that these differences also rely on how we rate our group members abilities to protect us. These studies support the theory that there are two key survival advantages of group living - protection and stress reduction.

ACETAMINOPHEN BLUNTS INTERGROUP BIASES IN MENTAL REPRESENTATIONS OF FACES *Kyle Ratner, University of California, Santa Barbara* -- Acetaminophen, the active drug in Tylenol, is generally used to relieve pain. However, a growing body of research suggests that the drug has broader psychological effects (Dewall et al., 2010; Randles et al., 2013). Our lab has recently shown that acetaminophen blunts positive and negative reactivity to emotional images (Durso, Luttrell, & Way, under review). Building on this research, the current work examined whether acetaminophen also dampens intergroup positivity and negativity. We tested this hypothesis across two studies, which used a double blind, placebo-controlled design. In the first study, we gave participants acetaminophen or placebo and then created novel groups with a classic minimal group paradigm. Next, we used a reverse correlation procedure to visualize biases in mental representations of ingroup and outgroup faces. The images generated from this procedure were subsequently rated by an independent sample. The ratings indicated significantly less ingroup positivity and outgroup negativity for participants given acetaminophen compared to placebo. In a second study, we used a reverse correlation procedure to examine effects of acetaminophen on mental representations of African American faces. The resulting African American images were then rated by an independent sample. Participants given acetaminophen produced a less negative image of African Americans. This work suggests that acetaminophen can blunt positivity and negativity in mental representations of group members. More broadly, this work raises the possibility that commonly used medications that modulate neurochemistry can influence how people respond in intergroup situations.

THE INTEGRATION OF EMOTION AND COGNITION IN THE BRAIN *Alexander Shackman, University of Maryland* -- Humans tend to experience cognition and emotion as fundamentally different. Emotion is saturated with feelings of pleasure or pain and manifests in readily discerned changes in the body. In contrast, cognition often seems devoid of substantial hedonic, motivational, or somatic features. These apparent differences in phenomenological experience and peripheral physiology have led many to treat emotion and cognition as distinct mental faculties. But newly available neurobiological data compel a fundamentally different view. First, imaging studies demonstrate that negative affect, pain, and cognitive control recruit overlapping regions of the mid-cingulate cortex (MCC). Second, anatomical studies reveal that the MCC constitutes a hub where information about pain, threat, and other more abstract kinds of potential punishment reinforcers can be synthesized and used to regulate regions involved in expressing fear and anxiety, executing goal-directed behaviors, and biasing the focus of attention. Finally, electrophysiological studies indicate that emotion and cognition are functionally integrated in the MCC. Errors,

punishments, and other prompts for enhanced cognitive control are associated with exaggerated MCC control signals in individuals prone to heightened negative affect and the magnitude of these signals is, in turn, strongly predictive of elevated behavioral inhibition and avoidance in future encounters. Collectively, these observations suggest that a circuit centered on the MCC adaptively controls thoughts, feelings, and behavior when there is uncertainty about actions and their potentially aversive outcomes. More broadly, these findings provide compelling evidence that emotion and cognition are deeply interwoven in the fabric of the brain and provide a novel framework for understanding the nature of temperament and the origins of psychopathology.

SALIENCE PROCESSING AND INSULAR CORTICAL FUNCTION AND DYSFUNCTION

Lucina Uddin, University of Miami -- The brain is constantly bombarded with multiple sources of stimuli competing for attention. The relative salience of these inputs determines which are selected for more in depth processing. The 'salience network', with key nodes in the insular cortices, has a central role in the detection of behaviorally relevant stimuli and the coordination of neural resources. Emerging evidence suggests that atypical engagement of specific subdivisions of the insula within the salience network is a feature of many neuropsychiatric disorders. I will summarize recent findings from our lab using network analyses and dynamic functional connectivity to examine the salience network in typical development and neurodevelopmental disorders of social cognition including autism spectrum disorder.

GETTING LOST IN A STORY AND ITS CONSEQUENCES FOR SOCIAL COGNITION AND

SHARED EXPERIENCE *Dylan Wagner, The Ohio State University* --When people experience films and novels they almost invariably adopt the perspective of the characters in the story. However, individuals differ in the degree to which they are "transported" by the narrative of a particular story. In the present study, participants (n=34) viewed the first thirty minutes of a popular Hollywood film while undergoing functional magnetic resonance imaging. Individual differences in narrative transportation were positively correlated with activity in the dorsal medial prefrontal cortex during scenes depicting social interactions. In addition, analysis of the time series of cortical responses in the dorsal medial prefrontal cortex demonstrated that individuals high in narrative transportation showed a greater inter-subject correlation of time series compared to those low in narrative transportation. These results suggest that transported subjects not only show increased mentalizing during fictional social interactions but may also experience the film's narrative in a similar fashion.

Student Talks

Graduate Students Present

Saturday, April 25, 2015

2:00 - 3:00 PM

Robert Chavez, Dartmouth College

Taru Flagan, University of Texas at Austin

Jessica Koski, Temple University

Sophie Payne, Royal Holloway, University of London

Tyler Santander, University of Virginia

Elaine Shing, Wake Forest University

Mark Thornton, Harvard University

Wanting Zhong, Rehabilitation Institute of Chicago & Northwestern University

A B S T R A C T S

SELF-ESTEEM MODULATES FRONTOSTRIATAL NETWORK INTERACTIONS SUPPORTING SELF-EVALUATION AND SOCIAL COGNITION: STRUCTURAL, FUNCTIONAL, AND LONGITUDINAL EVIDENCE

Robert Chavez, Dartmouth College – Comprised of a mixture of emotional, social, and self-referential components, the study of self-esteem occupies a unique intersection in the social and affective neurosciences. Brain regions that support social and self-referential processing include areas within medial prefrontal cortex (MPFC) whereas valenced affective responses are often reflected in subcortical activity in areas such as the ventral striatum. By definition, the processes that give rise to self-esteem must incorporate evaluative processing with information about the self. Here, we will present a line of evidence indicating that the connectivity of these regions supports individual differences in self-esteem. Using fMRI, functional connectivity between the MPFC and the ventral striatum during positive self-evaluation was correlated with measures of state self-esteem reflecting transient feelings positive self-regard. Using diffusion tensor imaging, we found that white matter integrity in tracts connecting the same frontostriatal regions was correlated with individual differences in trait measures of self-esteem reflecting self-esteem maintenance. Furthermore, we found that these white matter connections predicted longitudinal polarization of self-esteem seven months after initial scanning. Finally, in a dynamic emotion perception paradigm we found that participants high in self-esteem showed greater MPFC activity to positive facial expressions directed towards the self than directed away from the self in areas with strong anatomical connectivity to the ventral striatum. Similar connectivity results in other regions were not related to self-esteem in any of these studies. Taken together, these results provide multimodal evidence that self-esteem is supported by frontostriatal circuits integrating positive affective with self-referential processing.

DO YOU LIKE ME? DO YOU LIKE ME NOT?: THE NEURAL BASIS OF DECODING AMBIGUOUS INTENT

Taru Flagan, University of Texas at Austin – When the intent of another person could be positive or negative, how do we decode that ambiguity? Much attention has been paid to neural systems of making mental (versus non-mental) inferences about others, yet little is known about how the content of a mental inference is decided. A model-based approach examines the precise functions of regions involved in decoding ambiguous intent. Subjects (n=27) underwent fMRI while decoding ambiguous (compared to positive or negative) intentions of others. A Drift Diffusion Model estimated two processes involved in ambiguity resolution: the extent to which the decision process begins with an expectation that favors a positive or negative interpretation (i.e., starting point) and the preferential accumulation of evidence in favor of one interpretation (i.e., drift rate). The extent to which ambiguous intentions were decoded using relatively positive starting points was associated with increased VMPFC and amygdala activation and both regions showed decreased functional connectivity with striatum. Relatively negative starting points were associated with increased dACC activation which showed increased functional connectivity with DLPFC. Preferential accumulation of negative evidence was associated with inferior parietal lobule activity, whereas no regions showed a significant relationship with preferential accumulation of positive evidence. These findings

suggest that decoding of ambiguous intent may be more strongly driven by one's expectations than accumulation of information in the moment. Amygdala-striatum and VMPFC-striatum connectivity may govern the influence of positive expectations when decoding ambiguous social cues; dACC-DLPFC connectivity may govern the influence of negative expectations.

THE EMBEDDING OF SOCIAL STATUS IN PERSON KNOWLEDGE: AN MVPA STUDY

Jessica Koski, Temple University -- Humans rapidly assign status information to others based on a host of variables including career title, income, and reputation. Status is so salient that it shapes our attention, judgment, and memory for other people. Given the prominence of this variable in person processing, it seems plausible that status information would be embedded within neural representations of specific individuals. Here we asked whether person-specific representations in ventral face-processing regions (occipital face area (OFA), fusiform face area (FFA)) as well as more anterior regions (ventral anterior lobe (vATL) and orbitofrontal cortex (OFC)) contain information about a person's status. The later regions were examined because prior work has shown that the ventral ATLs are particularly sensitive to abstract person knowledge while patches in the OFC are sensitive to the rewarding aspects of other people (see poster by Troiani and Olson). Participants learned to associate names and status information (high versus low ratings) with objects and faces over a two-day training regimen. These stimuli were then presented in an fMRI experiment. We functionally localized face and object sensitive regions using a separate localizer task. Multi-voxel pattern analysis (MVPA) revealed that face and object sensitive regions in the ATLs and lateral OFC decoded face and object status, respectively, whereas perceptual regions like the FFA were not sensitive to social status. Our data suggest that regions sensitive to abstract person knowledge and valuation interact during the perception of social status, potentially contributing to the effects of status on social perception.

FACING THE SELF OR FACING THE OTHER? INVESTIGATING ROLE OF RTPJ IN SELF-OTHER DISTINCTION WITH TDCS

Sophie Payne, Royal Holloway, University of London -- Self-other discrimination is vital for self-awareness. Neuroimaging studies suggest that both higher-level conceptual self-other discrimination tasks such as perspective taking, as well as low-level face discrimination, recruit right temporoparietal junction (rTPJ). There is an apparent contradiction in the literature regarding the role of rTPJ in social cognition. Does rTPJ represent the self as distinct from others, as face-recognition studies would suggest, or does it facilitate the self "to become" another, as suggested by research on perspective taking? To answer this question, participants performed a video morphing task in which their own face morphed into, or out of, a familiar face, before and after stimulation of rTPJ with transcranial direct current stimulation (tDCS) in a double-blind, sham-controlled between groups design. Participants made a response when they judged that the face started to look more like the person it was morphing into. Depending on the direction of morphing, our task measured the assimilation of other into the self representation, or the projection of the self onto other. Following anodal stimulation, participants displayed a greater projection of self onto other. This unidirectional effect may reflect a low-level mechanism of putting oneself into someone else's shoes, a mechanism that is essential for social cognition.

THE SOCIAL (NEURAL) NETWORK: A DATA-DRIVEN, MULTIVARIATE APPROACH TO DECODING EPIGENETIC VARIABILITY IN THE OXYTOCIN RECEPTOR GENE

Tyler Santander, University of Virginia -- The human brain is a complex, hierarchical dynamical system whose micro- and macroscale components interact to produce myriad mental states. In a large sample (N>100) of healthy young adults, we probed the macroscale neural network architecture underlying three aspects of social perception: perception of animacy, biological motion, and emotional faces. For each task, low-frequency regional BOLD timeseries were extracted from

90 anatomically-defined ROIs (via wavelet decomposition), and interregional coherence was computed using the minimum variance distortionless response method. We then applied graph and information theoretic measures to quantify both network topology (e.g. nodal degree, clustering, and efficiency) and nonlinear dynamics (e.g. approximate entropy). Finally, using a sparse Bayesian learning technique for multivariate pattern recognition (relevance vector regression), we attempted to decode inter-individual variability in DNA methylation—a continuous molecular variable—on the oxytocin receptor gene (OXTR) from these spatiotemporal network characteristics. On the microscale, OXTR methylation mediates endogenous OXT action and thus pro-social behavioral outcomes. Results show that several aspects of “social network” topology and nonlinear dynamics significantly predict OXTR methylation. These findings suggest that factors at the molecular level (i.e. DNA methylation) fine-tune the action of the system by shaping overall network topology, which constrains information flow between macroscale network components and therefore determines the eventual “quality” of behavioral/mental states. This novel approach to investigating the complex, hierarchical nature of the human brain may ultimately offer critical insights into how abnormalities at the micro- and macroscales of a system interact to produce disordered conditions such as autism.

PERFUSION CHANGES IN THE VENTROMEDIAL PREFRONTAL CORTEX CURING AN AFFECTIVE MEANING PROCESSING TASK PREDICT DECREASED UNPLEASANTNESS IN DAILY LIFE EVENTS

Elaine Shing, Wake Forest University -- In the brain-as-predictor approach, neural activity is used to predict experiences in daily life, such as self-control, relationship satisfaction, and mood disorder symptoms. We augment this body of literature with a study investigating the relationship between the ventromedial prefrontal cortex (vmPFC), a region that has been consistently linked to the experience of positive emotions and the downregulation of negative emotions, and the temporal dynamics of affective processing in daily life events. We hypothesized that state-related changes in vmPFC blood flow after an emotional task would positively predict daily event pleasantness and negatively predict unpleasantness. We assessed participants' resting blood flow via an arterial spin labeling perfusion scan before and after an emotional task (rating positive and negative self-related statements). Participants then used the Day Reconstruction Method to record daily events and rated the pleasantness and unpleasantness throughout each event (i.e. beginning, middle, end, 15 minutes after, 30 minutes after) for up to one week following the initial scan. We found that pre-post blood flow changes in the vmPFC negatively predicted individuals' subjective experiences of unpleasantness, particularly 15 and 30 minutes after the end of each event, possibly reflecting their ability to recover from negative responses to life events. Blood flow changes were unrelated to participants' ratings of event pleasantness. These results provide ecological validity for the involvement of the vmPFC in affective modulation and bolster the brain-as-predictor approach as a useful method to link neuroscience findings with real-world psychological outcomes.

VENTRAL MEDIAL PREFRONTAL CORTEX SUPPORTS A MULTIDIMENSIONAL CODE FOR SIMILARITY TO SELF

Mark Thornton, Harvard University -- One person can differ from another in an almost infinite variety of ways. However, people make holistic judgments of interpersonal similarity easily and naturally, and use similarity as a basis for how to interact with others. How do perceivers integrate the vast array of potential differences between self and other into a single representation of similarity? One way their brains might accomplish this is through a multidimensional code: within a single brain region, neural subpopulations would modulate activity in response to different dimensions of similarity. The pattern of activity across the region would thus represent overall similarity, despite the heterogeneous responses of its subpopulations. To test this hypothesis, in the present study participants

underwent functional magnetic resonance imaging while they imagined personally familiar others in a number of scenarios. Using representational similarity analysis, we decoded the perceived similarity to self of these targets from patterns of neural activity within ventral medial prefrontal cortex (vmPFC). This result is highly consistent with earlier research implicating vmPFC in the representation of similarity, making social inferences, and integrating information. Moreover, we observed similarity-encoding patterns within a portion of vmPFC previously demonstrated to be involved in self-reference. The effect remains robust even when controlling for a wide range of other social variables. The presence of a multidimensional code was further supported by the absence of parallel univariate effects and the results of cross-validated factor analysis. These findings support the hypothesis that similarity is represented in a deeply multidimensional, rather than monolithic, way.

DISENTANGLING THE INNER WORKINGS OF EMOTIONAL EMPATHY IN TRAUMATIC BRAIN INJURY PATIENTS Wanting Zhong, Rehabilitation Institute of Chicago & Northwestern University --

Emotional empathy refers to the ability to share, understand, and infer the emotional states of other people. It is crucial to social interactions and prosocial behavior, but can be impaired in patients with brain injury, affecting their daily social functions. Here, we investigated different subcomponents of emotional empathy in a unique sample of 185 patients with penetrating traumatic brain injury (pTBI), using the Balanced Emotional Empathy Scale (BEES) as an emotional empathy measure. Exploratory factor analysis on the scale items revealed two principal factors, one contributing to emotional contagion and empathic concern (i.e. "It upsets me to see someone being mistreated."), and one contributing to affective perspective taking (i.e. "I cannot relate to the crying and sniffing at weddings."). Each factor score correlated with a different aspect of Emotional Intelligence (EI), assessed with the Mayer-Salovey-Caruso Emotional Intelligence Test (MSCEIT). While the Emotional Contagion/Empathic Concern factor was correlated with Experiential EI (perceiving and using emotions), the Affective Perspective Taking factor was correlated with Strategic EI (understanding and managing emotions). Stepwise multiple regression analysis showed that Experiential EI and right insula damage predicted the Emotional Contagion/Empathic Concern factor, while Strategic EI and right vmPFC lesion predicted the Affective Perspective Taking factor, after adjusting for pre-injury intelligence, depression, and total volume loss. These results identified two different components of emotional empathy, showing that distinct processes in perception and understanding of emotions may underlie these components, and that each component was uniquely associated with a distinct region within the empathy-related brain network.

Posters

Poster Presentations: Session C

Saturday, April 25, 2015

3:00-4:30 PM

See page 87 for abstracts

Symposium

Groups & Affiliation

Saturday, April 24, 2015

4:30 – 6:00 PM

Eric Nelson, National Institute of Mental Health	4:30-5:00
Dylan Gee, Weill Cornell Medical College	5:00-5:15
Amy Krosch, New York University	5:15-5:30
Jennifer Bartz, McGill University	5:30-6:00

ABSTRACTS

NEUROBIOLOGICAL PROFILES OF SOCIALLY ANXIOUS ADOLESCENTS AS THEY ANTICIPATE AND RECEIVE JUDGMENTS FROM THEIR PEERS

Eric Nelson, National Institute of Mental Health – Adolescence is time of great changes in social behavior which include a dramatic increase in salience of peers. Adolescence is also a developmental period that is associated with a marked increase in social anxiety. To get a better understanding of some of the neurobiological processes that mediate adolescent social anxiety ... my we developed a peer interaction paradigm – the chatroom task – in which social decisions, assessments and feedback in relation to peers is simulated in a neuroimaging environment. In several implementations of this task we have uncovered a number of consistent differences between socially anxious and non-anxious adolescents. These include anxiety related bias to expect more negative judgments and deficits in memory for positive social experiences. Neuroimaging findings included greater activation in amygdala and striatum when contemplating and anticipating rejection related decisions relative to acceptance related decisions. Finally, in a prediction error based model we found a robust interaction in the striatum between anxiety, approach decision, and feedback in the striatum – but only for socially anxious adolescents. The PE related striatal activity related to subsequent memory performance. Together these results represent a neurobiologically-based model for how anxiety related cognitive biases may be manifest in neural circuits of the adolescent brain.

MATERNAL BUFFERING OF HUMAN AMYGDALA-PREFRONTAL CIRCUITRY DURING CHILDHOOD BUT NOT ADOLESCENCE

Dylan Gee, Weill Cornell Medical College – Mature amygdala-medial prefrontal cortex (mPFC) circuitry provides regulation of affect in adulthood; however, this circuitry is late to develop. Caregivers provide potent regulation of affect in the absence of mature regulatory circuitry. The present investigation examined a potential mechanism through which caregivers provide regulatory influences in childhood. Children (n=23; ages: 4-10) showed greater suppression of right amygdala reactivity in the presence of maternal stimuli, which had no effect in adolescents (n=30; ages: 11-17; p=.049). In the absence of maternal stimuli, children exhibited an immature connectivity pattern. However, in the presence of maternal stimuli, connectivity exhibited a mature pattern (i.e., negative connectivity) resembling the adolescent pattern (mother/stranger x age interaction: p=.034). This finding suggests that children are able to recruit more mature patterns of connectivity when in the presence of maternal stimuli. Maternal effects on amygdala-mPFC circuitry were associated with maternal buffering effects on behavior, such that affect-related regulation during an emotional face go/nogo was improved when children were in the presence of their mother (p=.015). Individual differences emerged such that greater maternal influence on amygdala-mPFC circuitry was associated with lower separation anxiety, more secure attachment, and more modulation of behavioral regulation by the mother in daily life. Taken together, the present findings suggest a neural mechanism through which caregivers modulate children's regulatory behavior by inducing a mature pattern of amygdala-prefrontal connectivity and buffering against heightened amygdala reactivity.

Maternal buffering in childhood, but not adolescence, suggests that childhood may be a sensitive period for amygdala-prefrontal development.

SCARCITY ALTERS THE NEURAL ENCODING OF BLACK FACES: EVIDENCE FOR A DEHUMANIZATION ACCOUNT OF RACIAL BIAS UNDER ECONOMIC STRESS

Amy Krosch, New York University – When the economy declines, racial discrimination typically increases. Previously, we found that scarcity promotes discriminatory resource allocation through altered perception of Black Americans as darker and more “stereotypically Black.” Given historical and empirical links between blackness and dehumanization, we asked whether perceivers dehumanize Black Americans in order to justify giving them fewer scarce resources. Although dehumanization is a complex construct, its visual component is literally the degree to which a face is perceived as a face. We tested whether scarcity impedes visual processing of Black faces using the N170 component of the event-related potential, a neural index of face encoding that occurs approximately 170 ms after face presentation. Indeed, when resources were framed as scarce, as opposed to neutral, participants’ N170 response was delayed to Black relative to White faces, with longer delays associated with greater anti-Black allocation bias in behavior. These findings indicate that resource scarcity may motivate perceivers to see Black faces as less face-like, suggesting a visual “dehumanization” account for scarcity effects on behavioral discrimination, and a new mechanism through which economic stress might exacerbate racial inequality.

THE PHARMACOLOGICAL DISSECTION OF AFFILIATION

Jennifer Bartz, McGill University – It is widely accepted that humans have a fundamental “need to belong” and that thwarted belonging needs can result in both mental and physical ill-being. Moreover, to be health promoting, at least some of our relationships need to be close and enduring. Although the biological mechanisms that support the various components of human affiliation are not well understood, work in non-human animals highlights the oxytocin and opioid systems. One way in which oxytocin is thought to facilitate bonding is by increasing the rewarding and reinforcing properties of conspecifics and social interactions (via interactions with the mesolimbic dopamine system). Alternately, endogenous opioids—which are associated with the experience of liking, pleasure, gratification and well-being—are thought to facilitate affiliation by modulating the pleasure we experience when socially connected and pain we experience when socially disconnected (which, should prompt socially motivated behavior to restore well-being). In this talk, I will discuss recent work using pharmacological probes including Syntocinon (synthetic oxytocin), and Naltrexone (an opiate antagonist) to “dissect” the neurochemical pathways that mediate key dimensions of affiliation in humans, highlighting the distinct contributions of the oxytocin and opioid systems. The notion that oxytocin may be important for the initiation and opioids may be important for the maintenance of close bonds will be discussed.

Farewell

Closing Remarks

6:00 – 6:15 PM



SEE YOU NEXT YEAR!

**SOCIAL & AFFECTIVE NEUROSCIENCE SOCIETY
2016 ANNUAL MEETING**

★ APRIL 28-30, 2016 ★ NEW YORK CITY ★

Poster Session A

Thursday, April 24, 6:00-7:30PM

A-1

PHASE-LOCKING AND COHERENCE DURING PERSPECTIVE TAKING PREDICT ENHANCED PREDICTION ACCURACY FOR COUNTER-STEREOTYPIC CHOICES IN OUT-GROUP MEMBERS

Kelly A. Duran-Jordan - University of Delaware; Adam B. Magerman - University of Delaware; Chad E. Forbes - University of Delaware – Extant research suggests our brains are designed for one primary function: prediction. 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. 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. 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. The present study examined this question directly by investigating whether perspective taking enhanced one's ability to accurately predict out-group behaviors. 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. Continuous EEG activity was recorded while white participants completed a prediction task. Participants viewed the information from either the perspective of out-group members or objectively. Time frequency analysis, revealed interesting interactions occurring during the perspective taking condition that is unique to viewing Latino Republicans. Posterior Cingulate Cortex

(PCC) -Medial Prefrontal Cortex (MPFC) phase-locking and coherence was associated with greater accuracy for counter-stereotypical predictions only.

A-2

NEUROBIOLOGY OF SOCIAL COGNITION IN CHILDREN: A FUNCTIONAL IMAGING STUDY OF THEORY OF MIND

Natalie Kleeman - Harvard University; Sarah Hope Lincoln - Harvard University; Audrey Torricelli - Harvard University; Theresa Cheng - Harvard University; Christine I. Hooker - Harvard University – Theory of mind (ToM) is the ability to attribute mental states and beliefs to others. Previous research suggests that children can perform traditional ToM tasks, e.g. false belief tasks, between 4 and 5 years of age, across cultures. We modified Saxe & Kanwisher's (2003) short story tasks to investigate the neural mechanisms of ToM using false-belief and false photographs conditions in typically developing children ages 8 through 13 (Dodell-Feder et al 2011). The stories in this modified task were at a grade 3 reading level as determined by the Flesch-Kincaid readability index. In this group of children, we saw recruitment of social cognitive areas during the ToM task, specifically the superior temporal gyrus, superior temporal sulcus, and somatomotor cortices. These findings confirm our hypothesis that the downward extension of this task is a valid measure of ToM in this age group. Additionally, we found that ToM activation relates to the behavioral measures of social cognition and social functioning in this group, suggesting that differences in the recruitment of the ToM network may be mediating social cognition and social functioning differences in children.

A-3

THE NEURAL CORRELATES OF INFANTS FALSE BELIEF PROCESSING: AN ERP STUDY

Maria Crespo - Lancaster University; Vincent Reid - Lancaster University; Elena Geangu - Lancaster University – It is widely accepted that children develop false belief reasoning around the age of 4, when they pass verbal false belief tasks (e.g. Perner et al., 2005). However, more recent studies using behavioural non-verbal false belief tasks have suggested that infants can pass them (e.g. Onishi et al., 2005). However, it is yet unknown whether infant's performance in these tasks relies on similar processes as those

needed for the classic false belief test. Our study aims to address this gap by investigating the neural correlates of infant belief processing. Interestingly, in adults and children, explicit and implicit false belief tasks elicit similar event-related potential (ERP) responses, characterized by a frontal-parietal distributed late slow wave –LSW– (e.g. Bowman et al., 2011; Liu et al., 2009; Sabbagh et al., 2000), suggesting that they tap into the same cognitive construct (Geangu et al., 2013; Kuhn-Popp et al., 2013). Using the same task as Geangu et al. (2013), we presented 15-month-old infants (N=15) with image sequences depicting a character according to her true (TB) or false (FB) beliefs about reality, while EEG was continuously recorded. ERPs time-locked to the onset of the last image were analysed with respect to the effect of belief (true/false) and laterality (right/midline/left). The results revealed that parietally (700-1000ms), FB evoke a more positive LSW ($M = 2.150\mu V$) compared to TB ($M = -2.746\mu V$), ($F(1,14) = 9.981$, $p = .007$). No significant effects were found at frontal locations. Results will be further discussed in terms of their implications for understanding infant belief processing development.

A-4

SANS Poster Award winner

IMPAIRED THEORY OF MIND IN AUTISM MAY STEM FROM DISRUPTED COMPUTATION OF OTHERS' INTENTIONS

Isabelle Rosenthal - Wellesley College; Cendri A. Hutcherson - California Institute of Technology; John P. O'Doherty - California Institute of Technology; Ralph Adolphs - California Institute of Technology; Damian Stanley - California Institute of Technology – Inferring the beliefs and intentions of others (Theory of Mind; ToM) is critical for social cognition. Impaired ToM is a common characteristic of Autism Spectrum Disorder (ASD), but how the underlying processes are disrupted remains unknown. We addressed this question using a novel task that permits computational modeling of ToM learning processes, while retaining the core features of traditional ToM tasks. Participants (Mentalizers) learned the beliefs and intentions of others (Agents) by observing them make a series of donation decisions for three different charities. Critically, the experiment had 2 modes. In 'Normal' mode, Agents' decisions were implemented with probability $p=0.65$ and reversed with

probability $p=0.35$. In 'Reversal' mode the opposite was true, inducing Agents to anti-choose to get their desired outcomes. The mode switched occasionally and unpredictably. Thus, to correctly predict Agent choices (ag_Choice), Mentalizers had to track Agent belief (ag_Belief) about the mode and the Agent's idiosyncratic intentions towards each charity (ag_Intent). While controls (N=47; matched for age, gender, education and IQ) learned to predict ag_Belief, ag_Intent, and ag_Choice at above chance levels, high-functioning adults with ASD (N=23) could only track ag_Belief (which did not require ToM). Furthermore, a Rescorla-Wagner type learning model accurately predicted control, but not ASD, performance. Interestingly, both groups integrated stated estimates of belief and intent to generate choice predictions, suggesting that ToM-reasoning, but not intent learning, remained intact in ASD. Our new task elucidates specific computations through which we learn about other people and suggests a more nuanced understanding of ToM impairment in ASD.

A-5

PEER INFLUENCE AND SOCIAL COGNITION DURING ADOLESCENT DIGITAL MEDIA USE

Lauren Sherman - UCLA; Leanna Hernandez - UCLA; Patricia Greenfield - UCLA; Mirella Dapretto - UCLA – Previous research has demonstrated that adolescents are susceptible to peer influence on social media. We investigated the specific role played by “quantifiable online social endorsement” – e.g., “likes” or “favorites”—a ubiquitous feature of modern online environments that has nonetheless been little studied. Adolescents underwent an fMRI scan while using a tool that mimics the social photo-sharing app Instagram: they viewed photographs which had ostensibly been “liked” by peers, including their own photos, and decided whether to “like” each photograph. In truth, the number of likes appearing with each photograph was experimentally manipulated such that 50% had 25-50 likes (“popular”) and 50% had fewer than 25 likes (“unpopular”). Participants were significantly more likely to “like” popular photos and refrain from “liking” unpopular photos than predicted by chance ($p < .00001$). Viewing both one's own and others' images with many vs. few likes was associated with significant activation in regions of the Mentalizing Network, including

the bilateral temporoparietal junction and posterior cingulate cortex. The reverse contrast (viewing photos with "few" vs. "many" likes) yielded no significant activation in either case. Viewing one's own images with many vs. few likes also activated reward circuitry (e.g., nucleus accumbens and orbitofrontal cortex). However, reward circuitry was not recruited while viewing others' popular photos. Our behavioral and neuroimaging findings suggest that quantifiable online social endorsement is a means by which peer influence can occur in online environments, and that recruitment of regions implicated in social cognition may underlie adolescents' sensitivity to this subtle indicator of peer opinion.

A-6

FUNCTIONAL CONNECTIVITY DURING ANTISMOKING MESSAGES PREDICTS BEHAVIOR CHANGE

Nicole Cooper - University of Pennsylvania; Steven Tompson - University of Michigan; Matthew Brook O'Donnell - University of Pennsylvania; Emily Falk - University of Pennsylvania – Recent neuroimaging studies have demonstrated that activity in medial prefrontal cortex (MPFC) during exposure to persuasive messages can predict health behavior change. This brain-behavior predictive relationship has been particularly linked to regions of MPFC previously associated with self-related processing and valuation. However, this work has focused almost exclusively on MPFC, rather than expanding to investigate functional networks. Here, we examine the functional interactions between MPFC and other regions during exposure to antismoking messages. Forty-three adult smokers underwent functional magnetic resonance imaging (fMRI) while viewing 60 antismoking images. Thirty images illustrated strong negative consequences of smoking (i.e., a tracheotomy). The remaining 30 images were compositionally similar, but neutral. As a metric of behavior change, participants reported how many cigarettes they smoked per day before the scan, and again one month later. Functional connectivity was estimated for the negative consequence versus neutral images, from a seed region in MPFC functionally localized by a self-related processing task. This connectivity difference was related to individual differences in smoking reduction over the next month. We found that stronger functional connectivity between MPFC and

ffective processing regions such as ventral striatum, anterior cingulate, and insula, as well as executive function (lateral prefrontal cortex), and action planning (supplemental motor area) regions, in negative versus neutral images, predicts larger reductions in smoking. This suggests that increased connectedness between these neurocognitive processes during exposure to emotional health appeals is a precursor of behavior change. Future work will further explore the relationships between these previously unidentified regions and behavior change.

A-7

A SURVEY OF SIMULTANEOUS BEHAVIOR CHANGES

Seth J. Kallman - Columbia University; Kevin N. Ochsner - Columbia University – Psychologists have identified a range of techniques to help regulate our daily habits, such as reappraisal, distraction, and implementation intentions. While these strategies have successfully improved outcomes for a variety of behaviors, few studies have examined what occurs when individuals attempt to regulate many behaviors simultaneously. With this in mind, we performed a survey to assess base rates of desired and attempted changes. We also examined whether the number, percentage, or success of desired changes attempted was associated with positive life outcomes. To this end, 100 participants saw a list of 33 common behaviors (e.g. watching television, having caffeine). They were asked if they would like to change how much they engaged in the behavior and if they would like to do it more or less. If they did want to change their activity frequency, we asked if they were taking any active steps towards this goal and had them rate how successful these efforts had been. Finally, they completed short questionnaires assessing subjective well-being, perceived stress, and self-esteem. We will first present descriptive data showing desired and attempted changes across all the activities. On the whole, these results were remarkably similar to lay ideas about which behaviors might be considered 'vices' or 'virtues.' We will also show correlational evidence that regulatory success, rather than the number or percentage of desired changes attempted, was most strongly related to positive life outcomes. Overall, these results may hold interesting implications for our understanding of simultaneous self-regulatory attempts.

A-8

NEURAL CORRELATES OF VIEWING SELF VS. OTHER-AUTHORED PERSUASIVE

MESSAGES *Jordan L. Livingston - University of Oregon; Rita M. Ludwig - University of Oregon; Danielle Cosme - University of Oregon; Anne Hill - New York University; Emily B. Falk - University of Pennsylvania; Elliot T. Berkman, University of Oregon* – Evidence increasingly suggests that goals that have higher self-relevance are more likely to be achieved. Moreover, activity in self-related regions is often predictive of successful behavior change (Cooper et al., in press). However, the neural mechanisms by which self-relevant information gets translated into effective self-regulation, and the extent to which neural processing of self-relevant information differs from other forms of persuasive communication remains unclear. To further understand the neural mechanisms behind self-relevant persuasion, we investigated the role of self-authored (i.e., highly self-relevant) messages in predicting smoking cessation. Participants (N=17) were smokers from the surrounding community who reported a desire to quit smoking. First, participants completed a behavioral session in which they generated short, self-relevant text messages that they believed would help them to quit smoking in the subsequent weeks. One week later, in an fMRI scan session, participants viewed these messages, as well as messages generated by experts and by yoked others, and rated each message for helpfulness. Participants were subsequently assigned to a 30-day text-messaging intervention in which they received text messages from one of the three conditions. Quitting success was measured at the end of the intervention. Preliminary results on a subset of subjects suggest that viewing self-generated vs. other-generated messages recruits greater activity in typical self-relevant (vmPFC) and self-regulation regions (bilateral vIPFC), suggesting a mechanism by which self-relevant information might influence self-regulation success. Further data collection and analysis are in progress. The content of self-relevant messages and helpfulness ratings for the self-relevant messages will also be discussed.

A-9

SELF-PROCESSING DURING MESSAGE VIEWING PREDICTS INTERVENTION

EFFICACY *Rita M. Ludwig - University of Oregon; Jordan L. Livingston - University of Oregon; Dani Cosme - University of Oregon; Anne Hill - New York University; Emily B. Falk - University of Pennsylvania; Elliot T. Berkman - University of Oregon* – Relevance of a message to the self is a key component in its effectiveness in producing behavioral change. Self-relevant messaging activates the medial prefrontal cortex (MPFC), and activation of the MPFC has been shown to predict health behavior change (Falk et al., 2011). In the present research we unite and extend these findings to investigate whether neural activation changes as a function of the degree of self-relevance and whether that activation predicts behavioral change in response to a message-based intervention. We operationalize self-relevance as inverse of the psychological distance of the message author to the self, hypothesizing that neural activation in response to messages generated by oneself (no distance) will be a better predictor of behavioral change as compared to activation in response to messages generated by one's peer (some) and an unfamiliar other (large). Participants (N=17) in this study were smokers attempting to quit. Participants generated self-directed quitting messages and completed a pre-intervention measure of smoking, exhaled carbon monoxide (CO). One week later participants viewed self-, peer-, and unknown other-generated messages while undergoing fMRI scanning; following this session they were randomly assigned to author condition and received these messages via SMS for 30 days. At this intervention's end CO was again recorded as a measure of behavioral change. Preliminary results suggest that neural activation patterns do respond to author distance, with regions related to self- and self-regulation (MPFC, paracingulate cortex) being preferentially activated participants in the self-generated condition. Further analysis will use this neural data to predict intervention efficacy.

A-10

NEURAL PATTERN SIMILARITY IN FRONTAL CORTEX FOR HEALTH MESSAGES: A REPRESENTATIONAL SIMILARITY ANALYSIS

Teresa K. Pegors - University of Pennsylvania; Steve Thompson - University of Michigan; Matthew B. O'Donnell - University of Pennsylvania; Emily B. Falk - University of

Pennsylvania – Recent neuroscience research has suggested that a variety of social and motivational stimulus characteristics are represented as distributed patterns of neural activity rather than by the overall (mean) response of a given region. Although distinct patterns of activity have been found in frontal cortex for social rewards, monetary value, and even personality traits, variation in neural patterns of activity between naturalistic health messages have not been examined. In the present investigation, adult smokers (n=43) underwent fMRI while viewing 60 antismoking images. Thirty images illustrated strong negative consequences of smoking (i.e., a tracheotomy). The remaining 30 images were compositionally similar, but emotionally neutral. For each subject, the pattern of neural activity within medial frontal cortex (MPFC) was estimated for each image item, and pairwise Pearson correlations were calculated for all item pairs. We found significantly greater dissimilarity in the neural representations of items with the same valence when compared to the similarity of items across valence type (e.g. one negative item and one neutral item). Furthermore, this dissimilarity of within-valence items was driven specifically by high emotion (strongly negatively valenced) items, meaning that there was less neural similarity between two negative items than there was between a negative and compositionally similar neutral item. Given that emotional health messages are often more effective than neutral counterparts, it may be the case that representational range of neural patterns in MPFC could reflect behaviorally relevant characteristics of naturalistic messages and ultimately provide insight into the predictive relationship between brain and behavior.

A-11

THE MERE GREEN EFFECT: AN FMRI STUDY OF PRO-ENVIRONMENTAL

ADVERTISEMENTS *Stephanie Vezich - UCLA; Benjamin C. Gunter - UCLA; Matthew D. Lieberman - UCLA* – Self-report evidence overwhelmingly suggests that consumers prefer green products (i.e. pro-environmental products) to standard products. However, there appears to be little correspondence between these measures and actual purchase behaviors. As an initial step to better understand this disconnect, we exposed participants in an MRI scanner to green and standard ads matched on the

product. After viewing each ad, participants indicated to what extent they liked the ad and to what extent they thought the company was sustainable. We found that while participants report that they like green ads more than control ads and think they are more sustainable, the fMRI data suggest an opposite pattern. In particular, participants showed greater activation in regions associated with positive evaluations and reward (ventromedial prefrontal cortex and ventral striatum) in response to control ads relative to green ads. When looking at the relationship between self-reported attitudes and neural activity in reward-related regions for each ad specifically, we found a positive correlation for control ads but no relationship for green ads. In other words, participants showed greater activity in reward-related regions to the extent that they also reported liking control ads, but there was no such trend for green ads. Taken together, our results suggest that self-report can accurately gauge private preferences when no social desirability concerns are at play. However, private preferences may differ when the message is less mundane. In these contexts, other methods may better track downstream behaviors. Potential directions for future research in this domain are discussed.

A-12

CHOICES FOR MY CHILD: NEURAL MECHANISMS OF PARENTAL FOOD DECISION MAKING

Seung-Lark Lim - University of Missouri - Kansas City; J. Bradley C. Cherry - University of Kansas Medical Center; Ann M. Davis - University of Kansas Medical Center, Children's Mercy Hospital; S.N. Balakrishnan - University of Missouri-Rolla; Amanda S. Bruce - University of Kansas Medical Center, Children's Mercy Hospital – Parental feeding practices shape children's lifelong food preferences. Even when a parent chooses a healthy option for a child, s/he may make an unhealthy choice for him/herself. Thus, advancing our understanding of the neuroscientific foundations of parental food choices for children may provide valuable information about development of health-related behaviors more generally. The objectives of this functional MRI project are to determine the computational and neural mechanisms underlying parental food decision-making processes for their children. Twenty-five mothers (mean age 38.3 years) with children ages 8-14 made a series of food choices for

60 items (= eat or not eat) in two different conditions (own choices; choices for child) after providing separate taste and health ratings for each item. Our results showed dissociable behavioral and neural patterns between the two conditions. Moms used both taste ($b=.49$) and health ($b=.46$) values when they made their own food choices. These were positively correlated with activity in ventromedial prefrontal cortex (vmPFC) and dorsolateral prefrontal cortex (dlPFC), respectively. Interestingly, when participants made choices for what they want their child to eat, decision weight for taste values ($b=.25$) was decreased, while decision weight for health values ($b=.54$) was increased. vmPFC activation was negatively correlated with the mom's taste values, while dlPFC did not show significant correlation with mom's health values. Results suggest mothers use distinct neurofunctional mechanisms when making food decisions for child and self.

A-13

STRUCTURAL CONNECTIVITY BETWEEN EXECUTIVE CONTROL AND REWARD REGIONS CONTRIBUTES TO INDIVIDUAL DIFFERENCES IN BODY FAT PERCENTAGE

Pin-Hao A. Chen - Dartmouth College; Robert S. Chavez - Dartmouth College; Todd F. Heatherton - Dartmouth College – Successful self-regulation relies on the balance between executive control and reward (Heatherton & Wagner, 2011). Using functional neuroimaging, researchers have characterized this balance as reflecting variability in functional connectivity between these two systems (Wagner, Altman, Boswell, Kelley, & Heatherton, 2013). However, being functionally connected implies that these two systems are also structurally connected. It is also possible that individual differences in structural connectivity may reflect long-term self-regulatory outcomes. Accordingly, we examined whether the structural integrity between the two systems reflects individual variability in body fat percentage. Thirty-six chronic dieters completed a food-cue reactivity task after undergoing cognitive depletion in the scanner. Using fMRI, ROIs for the inferior frontal gyrus (IFG) that engages during cognitive control and for the orbitofrontal cortex (OFC) that represents reward were defined using activation patterns from a food-cue reactivity task. A white matter tract connecting these two

ROIs was identified across subjects using diffusion tensor imaging and probability tractography. We then quantified the white matter integrity by extracting each participant's fractional anisotropy values from this white matter tract. Individuals who had the greatest white matter integrity between the IFG and OFC were those who had the lowest body fat percentages ($r = -0.38$, $p = 0.03$). This suggests that structural integrity between these two regions may play a role in achieving long-term success in self-regulation.

A-14

RESPONSE INHIBITION ACTIVITY ASSOCIATED WITH SOCIOECONOMIC STATUS

Christopher N. Cascio - University of Pennsylvania; Gwendolyn M. Lawson - University of Pennsylvania; Martha J. Farah - University of Pennsylvania; Emily B. Falk - University of Pennsylvania – Health and educational disparities have long been associated with socioeconomic status (SES), and recent research suggests that some of these disparities may arise as the result of SES effects on brain development. The aim of the current study is to extend our understanding of SES and brain function in young people by examining individual differences in the response inhibition network (right inferior frontal gyrus and basal ganglia). Adolescent males ($N=71$) between the ages of 16-17 were recruited from the Michigan Department of State Driver Database as part of a larger multi-study project examining adolescent driving behavior. Participants completed self-report measures of SES (parental education and subjective social status [SSS]) and an fMRI go/no-go task. Neither measure of SES in the full sample predicted no-go inhibitory performance, however SES effects were observed in the response inhibition network during inhibitory trials. Parents' education significantly correlated with activity in the response inhibition network, controlling for task performance, $t(64)=2.55$, $\beta=.30$, $p=.013$. The association between parents' education and response inhibition network activity was primarily driven by father's education, $t(61)=3.60$, $\beta=.42$, $p<.001$. SSS measures were not available for all subjects but for the 35 who filled out US and community ladders, community status was also predictive, $t(31)=2.51$, $\beta=.41$, $p=.018$. The current results demonstrate that holding performance constant, adolescents of lower SES, as

defined by parental education (particularly father's), show less responsivity in the response inhibition network during a go/no-go task. Overall, these results reveal SES differences in neural inhibitory control even when behavioral performance is equivalent.

A-15

SANS Poster Award winner

ENHANCING PREFRONTAL CORTEX FUNCTION REDUCES IMPULSIVITY BUT NOT RISK-TAKING DURING COST-BENEFIT DECISION-MAKING

Ann L. Carroll - Harvard University; Jeffrey Edwards - Harvard University; Ekaterina Pivovarova - Massachusetts General Hospital, Harvard Medical School; Joshua W. Buckholz - Harvard University, Massachusetts General Hospital – A wealth of preclinical and human data suggests that dysregulated corticostriatal circuit function contributes to poor self-control. In particular, drug studies, fMRI and receptor imaging work indicate that heightened reward-related striatal dopamine transmission may predispose impulsive decision-making across a range of psychopathologies, including substance abuse and antisocial behavior. A parallel literature comprising lesion and functional imaging studies implicates prefrontal cortex (PFC) hypofunction in poor impulse control. The association between impulsivity, striatal hyper-reactivity and prefrontal hypo-reactivity is especially intriguing given that prefrontal cortex is known to negatively regulate phasic dopamine transmission in the striatum. We have previously suggested that impulse control deficits may arise from an imbalance between excitatory bottom-up (midbrain) and inhibitory top-down (PFC) influences on striatal activity and consequent encoding of action values. If this hypothesis is correct, enhancing prefrontal cortex function should reduce impulsivity, and this effect should be striatum-dependent. Here, we provide behavioral data showing that boosting prefrontal cortex with excitatory non-invasive brain stimulation is associated with increased self-control during intertemporal choice. We used anodal transcranial direct current stimulation (tDCS) to increase the excitability of left dorsolateral prefrontal cortex (DLPFC) while participants indicated their preference for a sooner-but-smaller versus a larger-but-delayed monetary reward (delay discounting). To test for cost-selective effects of PFC tDCS, we also

included an equal number of trials in which participants had to choose between certain-but-smaller and larger-but-risky trials (probabilistic discounting). Fifty-four participants (30 active, 24 sham) were tested twice - during, and 10 minutes immediately following a 30-minute tDCS stimulation session. We found that, compared to sham, active stimulation increased self-control (as indexed by the frequency of larger-but-later choices). This effect was not only evident post-stimulation, but was significantly stronger, suggesting that excitatory tDCS may have some carry-over effects on choice behavior that continue even after the acute period of stimulation. Of note, we did not observe any impact of PFC tDCS on probabilistic decision-making. This suggests that the effect of upregulating prefrontal cortex function on cost-benefit decision-making may be selective for delay costs. Our findings show that boosting prefrontal cortex function enhances impulse control without affecting risk-taking, providing causal evidence supporting the notion that these distinct facets of self-control have dissociable neurobiological architectures.

A-16

COMMON AND DISTINCT NEURAL CORRELATES OF POSITIVE AND NEGATIVE OUTCOMES

Christina H. Lee - University of Toronto; Damla Kerestecioglu - University of Toronto; Andrew A. Jahn - Indiana University; William A. Cunningham - University of Toronto – Previous research supports the idea that positive and negative representations are dissociable at the neural level. Areas associated with representing positive information are the medial prefrontal cortex (mPFC) and nucleus accumbens (NAcc), while areas associated with representing negative information are the lateral prefrontal cortex (LPFC) and anterior cingulate cortex (ACC). However, areas encoding reward have also been shown to decrease activation relative to baseline when presented with a punishment, suggesting the non-independence of evaluative processes. A novel duplex gambling task was used to determine how the presentation of monetary rewards and punishments are represented in the prefrontal cortex using functional magnetic resonance imaging (fMRI). Participants were required to take or pass a monetary gamble comprising of both positive and negative information. The gamble had 4 possible

outcomes: (1) gain the positive value, (2) lose the negative value, (3) receive both the positive and negative value, or (4) receive neither. The analysis revealed that receiving a good outcome was associated with increased activation in medial prefrontal areas, NAcc and hippocampus, while receiving a bad outcome was associated with increased activation in lateral prefrontal areas and ACC. In addition, the interaction of good and bad outcome was associated with activation changes in IPFC and orbitofrontal areas. This provides additional evidence for at least a partial dissociation between the processing of positive and negative outcomes.

A-17

POSITIVE AUTOBIOGRAPHICAL MEMORY RETRIEVAL REDUCES IMPULSIVITY

Karolina M. Lempert - New York University; Megan E. Speer - Rutgers University; Mauricio R. Delgado - Rutgers University; Elizabeth A. Phelps - New York University – Choices between immediate and future rewards, or intertemporal choices, are prevalent in everyday life. Impulsive intertemporal choices underlie societal problems like addiction and obesity. One way to increase patience is to imagine positive future experiences. This may be difficult, however, since the future is inherently less vivid than the past. Another potential way may be to remember positive past events. There is overlap in the neural networks associated with simulating future events and remembering past experiences, but can recalling memories lead to more patient choices? On Day 1 of our two-day study, participants wrote about positive past autobiographical events. On Day 2 (three days later), they performed an intertemporal choice task with two block types – in the “memory” blocks, they mentally simulated the memories that they wrote about on Day 1 before making intertemporal choices (e.g., “\$10 today or \$15 in 7 days?”). In the control blocks, they relaxed and attended to their current state before making intertemporal choices. We quantified discounting rates (a measure of impulsivity) separately in the memory and control conditions. Although participants faced the same decisions in the two conditions, they were more patient after simulating positive past experiences ($N=33$; $t=2.47$; $p=0.01$). A follow-up study revealed the effect was specific for positive, not negative memories ($N=31$; $t=1.12$; $p=0.27$). It

was also driven by autobiographical memory recall, not just imagination of positive scenes ($N=31$; $t=0.9$; $p=0.38$). This work introduces a potential manipulation for reducing impulsivity, and it provides insight into the neural mechanisms underlying intertemporal choice.

A-18

MINDFUL OF YOUR MISTAKES? DISPOSITIONAL MINDFULNESS INCREASES CORRUGATOR SUPERCILII REACTIVITY TO SELF-CONTROL FAILURE

Nathaniel W. Elkins-Brown - University of Toronto; Blair Saunders - University of Toronto; Michael Inzlicht - University of Toronto – Previous studies have documented the positive effects of mindfulness on self-control. But what mechanisms underlie these improvements? Emerging research in social and affective neuroscience has proposed that task-related negative affect (NA) drives the up-regulation of self-control. If this were the case, we would expect that personality traits that influence NA, such as dispositional mindfulness, should moderate psychophysiological correlates of NA during self-control processes. In our study, 70 participants completed an inhibitory control task while we simultaneously measured an event-related potential (ERP) associated with error-monitoring (the error-related negativity [ERN]), and electromyographic (EMG) activity over the corrugator supercilii, the principle muscle involved in frowning. Corrugator activity was amplified within 200ms of error responses and this effect was positively associated with mindful acceptance, but was not associated with any other measurements of self-control or personality. These results provide further evidence that task-related negative affect is integral to self-control processes, and that this relationship is shaped by the tendency to not regulate moment-to-moment thoughts and emotions.

A-19

NEURAL ACTIVATION AND FUNCTIONAL CONNECTIVITY DURING EXTINCTION LEARNING WITH APPETITIVE AND AVERSIVE CONDITIONED STIMULI

Andrea H. Lewis - Rutgers University; David V. Smith - Rutgers University; Heena Mangani - Rutgers University; Mauricio R. Delgado - Rutgers University – Extinction learning involves new learning or updating of previously formed associations between a conditioned stimulus

(CS) and an affective unconditioned stimulus (US). The ability to extinguish CS-US associations is essential in instances where CS exhibit excessive, maladaptive influences on behavior (e.g. fear in PTSD). Recent research suggests that the medial prefrontal cortex (mPFC) plays an active role in extinction learning with both positive and negative CS, given its anatomical connections with affective learning regions such as the striatum and the amygdala. However, the functional relationship between these regions and major networks in the brain during extinction learning remains unclear. The current study used fMRI to examine functional connectivity of affective learning regions with various brain networks, looking specifically at how this connectivity differed for acquisition of CS-US associations as compared to extinction of these associations. Over the course of extinction, several regions of the striatum as well as mPFC showed changes in activation as a function of factors such as stimulus valence and stimulus magnitude. These regions also exhibited differences in functional connectivity with the executive control network (ECN) during acquisition as compared to extinction. In particular, both the ventral striatum and the mPFC showed increased connectivity with the ECN during extinction. Our findings highlight how extinction learning is orchestrated by the interplay between the mPFC and its interconnected brain regions.

A-20

FUNCTION IN DYSFUNCTION: DISSOCIATION AS A COGNITIVE STRATEGY IN DIVIDED ATTENTION

CONDITIONS Jenn K. Lewis - University of Oregon; Katia L. Krane - University of Oregon; Mary-Ann Dobrota - University of Oregon; Don M. Tucker - Electrical Geodesics, Inc. – Defined by a lack of integration between thoughts, feelings, identity, and or experiences, dissociation is a mechanism, often recognized as a learned or habituated dysfunctional response to environmental experiences, particularly those of stress and threat. However, a small body of behavioral research has suggested that dissociative tendencies may hold a cognitive advantage in specific situations, such as divided attention conditions. Despite having a potential effect on multiple domains of cognition, little is known about the neural

mechanisms behind dissociation, and less is clear on how dissociation may affect overall executive functioning. The current experiment explores dissociation's effect on neural responses to highly charged stimuli and their relation to behavioral measures of executive processes. In particular, the study seeks to explore in what situations dissociation may hold an advantage for an individual and act adaptively. Using dense array EEG to record neural responses, researchers examined event-related potentials (ERPs) in participants ranking high or low on dissociation during a divided attention emotional Stroop task. Distinct between group differences were identified in ERPs related to attention and meaning processing, including medial frontal negativity (MFN) and the P300, where high dissociators presented with particularly attenuated ERPs compared to low dissociators. Despite presenting with seemingly blunted neural responses, high dissociators performed at a higher capacity in several behavioral domains compared to low dissociators. These results indicate that high dissociators are employing an alternative cognitive strategy, which is not only effective in divided attention conditions and responses to charged stimuli, but potentially advantageous.

A-21

SANS Poster Award winner

SEPARABLE COMPONENTS OF SPONTANEOUS FOOD CUE REACTIVITY PREDICT DIETERS' SELF-CONTROL SUCCESS IN DAILY LIFE

Richard B. Lopez - Dartmouth College; Pin-Hao A. Chen - Dartmouth College; Todd F. Heatherton - Dartmouth College – Previous neuroimaging work has shown that increased reward related activity following incidental food cue exposure predicts self-control failure. However, there has been little research probing spontaneous activity in other brain systems that may be recruited to support self-regulatory processes when people encounter tempting cues. We examined spontaneous recruitment of executive control regions in chronic dieters, a population that constantly faces self-control dilemmas. We recruited 69 female dieters to complete a food cue reactivity task during an fMRI scanning session, which was then followed by a weeklong sampling of daily eating behaviors. Parameter estimates representing food cue specific activity in a

priori regions of interest (ROIs) were submitted to a principal components analysis (PCA) in order to extract orthogonal components that may reflect reward and control processes. The PCA revealed a control component (on which ROIs in dorsal and ventrolateral prefrontal cortex loaded), as well as two reward components (on which ventral striatum and OFC ROIs loaded, respectively). Next, we conducted a k-means clustering based on factor scores for these reward and control components and found that our sample of dieters divided into three clusters. The sub-group of dieters with higher factor scores for the control component and lower factor scores for the reward component(s) reported the fewest desire instances and were least likely to give in to temptations to eat. This approach identified those dieters who spontaneously recruited regulatory regions in response to incidental food cues. It also demonstrated a novel way to compute brain-derived indices of self-control capacity.

A-22

IMPULSIVE CHOICE BEHAVIOR PREDICTS EXAGGERATED REINFORCEMENT LEARNING SIGNALS WITHIN

CORTICOSTRIATAL CIRCUITRY Edward H. Patzelt - Harvard University; Alexander Millner - Harvard University; Erik Kastman - Harvard University; Hayley Dorfman - Harvard University; Arielle Baskin-Sommers - Yale University; Kent Kiehl - University of New Mexico; Joseph P. Newman - University of Wisconsin-Madison; Joshua W. Buckholz - Harvard University, Massachusetts General Hospital – Intertemporal decision-making involves the generation and comparison of subjective value representations for two options that differ in both absolute value and in time. Prior work indicates that striatum and ventromedial prefrontal cortex support the representation of subjective values during cost-benefit decision-making, and suggests that dysregulation within this corticostriatal circuit predisposes maladaptive choice behavior (impulsivity). Notably, this same circuit is also involved in the expected value representations during instrumental learning, and in the updating of such values following unexpected feedback. This suggests that deficits in two distinct forms of value-based decision-making (intertemporal choice and feedback learning) may arise from a common source: corticostriatal

dysregulation. To test this relationship, we scanned 49 incarcerated offenders with a mobile 1.5T MR device while they performed an instrumental learning task. Impulsive choice behavior was assessed by fitting intertemporal choice data to a hyperbolic discounting model. To assess the relationship between impulsivity and reinforcement learning, we regressed each participant's k value against BOLD estimates derived from imaging models of expected value and prediction error (a-priori anatomical ROIs: striatum, midbrain, and ventromedial prefrontal cortex). Impulsive participants had stronger expected value signals within VMPFC. Likewise, impulsivity was positively associated with the magnitude of prediction error signals within both the midbrain and VMPFC. Together, these results indicate that impulsive choice behavior is linked to hyper-reactivity in mesocortico-striatal reward circuitry during valuation of choices and integration of feedback. This suggests that corticostriatal circuit dysfunction may comprise a common source for deficits in multiple forms of value-based decision-making.

A-23

RISK TAKERS MAY ONLY HAVE PROBLEMS WITH COGNITIVE CONTROL WHEN STIMULI ARE MOTIVATIONALLY COMPELLING

Feng Xue - University of Southern California; Benjamine Smith - University of Southern California; Gui Xue - Beijing Normal University; Stephen J. Read - University of Southern California – Some neuroimaging studies suggest that risk takers may have general defects in cognitive and inhibitory control. However, our recent findings in risky decision-making don't support this view, instead suggesting that these problems occur in response to motivationally compelling stimuli. We recruited 106 gay men who did a modified GO/NOGO task while being scanned in an fMRI scanner. In the GO/NOGO task, we compared highly salient stimuli: pictures of buff naked young men with less salient stimuli: pictures of older, less attractive clothed women. Participants responded significantly less accurately to pictures of naked men (both Go and Nogo trials). They also responded significantly faster on Go trials of naked men. We also found their d' value for male Nogo condition was significantly lower than in the female Nogo condition, suggesting that they have difficulty inhibiting their responses to

motivationally compelling stimuli. In our neuroimaging data, we measured the difference between the (Nogo-Go) contrast in the male condition with that in the female condition. We found activation on the (Nogo-Go) contrast was significantly stronger in the anterior Cingulate cortex and the bilateral lateral Occipital cortex in the male condition. Together with the behavioral results, it shows that those subjects have more difficulty in dealing with motivationally compelling stimuli even though they recruited more cognitive resources. It suggests that they may not have difficulty in cognitive control generally but in resisting risks that are motivationally compelling to them.

A-24

SEXUALLY RISKY MEN USE REWARD AND REFLECTIVE-SYSTEM REGIONS MORE WHEN CONSIDERING RISKY SEX

Benjamin J. Smith - University of Southern California; Feng Xue - University of Southern California; Emily Barkley-Levenson - University of Southern California; Vita Drouman - University of Southern California; Lynn C. Miller - University of Southern California; Stephen J. Read - University of Southern California – 113 gay men (Black, Hispanic, and White, gay men aged 18-30) played a computer dating game allowing them to make decisions about condom use and other sexually risky decisions during fMRI imaging (fMRI but not behavioral data was excluded for 7 additional subjects due to data processing errors). We were interested in the neural processes producing and regulating risky sexual behavior. Subjects who consistently made sexually safe choices in the scanner reported less unprotected anal intercourse in the previous 90 days in real life ($N=95$, $Mdn=2$) compared to subjects who made one or more sexually risky choices during gameplay ($N=25$, $Mdn=5$), indicating that computer game behavior was related to real-life behavior. During risky sexual decision-making, sexually riskier subjects, i.e., those who had unprotected anal intercourse at least once in the previous 90 days ($N=76$), had significantly more bilateral striatal and dlPFC activity in a whole-brain cluster analysis, controlling for baseline activity, compared to sexually safer subjects who reported never using methamphetamine ($N=31$). No significant differences were found between the subset of sexually riskier subjects who used methamphetamine ($N=34$) and

those who had not ($N=42$). Mean decision-making time did not significantly differ between groups. On this decision-making task, not only do risky subjects experience more rewarding affect which drives risky decision-making; they also reflect more consciously more on their decision. Ongoing work examines the relationship between meth use and risky sexual behavior and the influence of internalized homophobia on risky sexual decision-making.

A-25

PAVLOVIAN-TO-INSTRUMENTAL TRANSFER OF CIGARETTE AND FOOD CUES DURING ABSTINENCE IN SMOKERS

Heena Manghani - Rutgers University; Andrea H. Lewis - Rutgers University; Stephen J. Wilson - The Pennsylvania State University; Mauricio R. Delgado - Rutgers University – Deprivation of reinforcers such as nicotine and food can elicit craving responses in smokers and promote reward-seeking behavior. However, it is unclear whether an abstinent state dictates general reward-seeking, or has more selective influence over behavior based on the type of reinforcer. Using a Pavlovian-to-instrumental transfer (PIT) task, we tested differences in reactivity to food and cigarette cues within a single population of smokers under 12 hours of abstinence from both smoking and eating. In this PIT paradigm, participants first associate distinct conditioned stimuli (CS) with food, cigarette, and neutral outcomes. They then learn distinct instrumental responses (i.e., key presses) that lead to each reward. Finally in a subsequent transfer phase, we examine the ability of CS to elicit learned instrumental responses in the absence of the paired outcomes. Results showed an increase in vigorous responding during presentation of each CS—an effect that was exacerbated by smoking history. Interestingly, although there was no difference in self-reported craving for cigarettes and food, reward-seeking behavior to each CS differed. Notably, only the presentation of the cigarette CS elicited more accurate responding (i.e., selective instrumental response associated with that outcome). These findings suggest that cues representative of cigarette outcomes may elicit more motivated discriminatory behavior than cues related to other reinforcers (e.g., food), even when deprivation from nicotine and food is similar. Understanding how reward-seeking behavior is driven by current

state and by conditioned cues associated with distinct reinforcers, may help with improving smoking cessation treatments.

A-26

IMMEDIATE AND LASTING EFFECTS OF HIGH REWARD PROSPECTS ON COGNITIVE CONTROL

Catherine Insel - Harvard University; Catherine R. Glenn - Harvard University; Erik K. Kastman - Harvard University; Megan C. Garrad - Harvard University; Stephanie F. Sasse - Harvard University; Matthew Nock - Harvard University; Leah H. Somerville - Harvard University – Prior work suggests that reward incentives can improve cognitive control. This effect is most prominent when value contingencies are signaled in advance, facilitating the implementation of proactive cognitive control. These reward incentive cues signal information about prospective rewards and the control demands required to obtain them. Therefore, value associations that are formed by reward/control cues may reflect both motivational incentives and inhibitory preparation. However, it remains unknown whether these reward/control associations undergo consolidation to form a sustained motivated memory that would, in turn, influence future control behavior. To investigate this question, adolescent and adult participants performed two response inhibition tasks. The first was a novel rewarded go/no-go task that included intermixed low and high stakes conditions. Participants viewed a cue indicating the stakes of a block, either low or high, followed by a series of target trials. Targets consisted of go trials that required a button press, and no-go trials that required withholding a response. Accurate performance was rewarded \$1.00 or \$0.20 per trial in the high and low stakes conditions respectively, whereas incorrect performance incurred a loss of \$0.50 or \$0.10. Feedback was displayed at the end of each block. Participants next completed a second go/no-go task that involved only the stakes cues and no monetary payout. Participants alternated between responding to only low stakes cues and responding to only high stakes cues. Results for the first task suggest that high reward incentives led to improved performance. There was a main effect of reward stakes on reaction time, whereby go responses were faster in the high stakes condition compared to the low condition. The effect of stakes on no-go performance

was not significant, suggesting that reward-related speeding did not result in a speed/accuracy tradeoff. Results from the second test demonstrated that participants were better able to withhold responses to high than low stakes cues. These findings reveal that when cues are associated with both reward and control information, subsequent control ability increases for high stakes associations. More broadly, these findings suggest that control contingencies are consolidated along with value representations, lasting in sustained inhibition tendencies.

A-27

RISK-TAKING, RESPONSE INHIBITION AND THE RIGHT INFERIOR FRONTAL GYRUS

Nils Muhlert - Cardiff University; Fred Boy - Swansea University; Andrew Lawrence - Cardiff University – The ability to inhibit motor responses has been linked to risk-taking behavior, including gambling. This suggests that those with high trait levels of sensation seeking, the major personality determinant of risk taking, may have poorer response inhibition. We provide converging evidence to support this: first by testing whether performance on a stop-signal response inhibition task relates to levels of sensation seeking, and second, by assessing whether variation in sensation seeking is associated with grey matter volumes of a region causally implicated in response inhibition, the right inferior frontal gyrus (rIFG). For study one, 87 healthy subjects (25 males) completed a measure of sensation seeking together with a stop-signal task. For study two, 152 healthy subjects (45 males) completed the sensation seeking measure and underwent T1-weighted MRI at 3T. We carried out a voxel-based morphometry analysis using DARTEL to examine grey matter volumes, with a region of interest centred on the rIFG. UPPS Sensation Seeking, but not other impulsivity facets, correlated with Stop-Signal task performance, with higher sensation seeking associated with poorer response inhibition. The DARTEL analysis revealed significant negative associations between sensation seeking and grey matter volumes in the rIFG, the right orbitofrontal cortex and right middle temporal gyrus. We provide converging evidence to support the link between risk taking and motor inhibition, both at a psychological and at a biological level. This may explain why individuals with disinhibitory disorders sharing

genetic variation with sensation seeking show poor response inhibition and suggests a key role of the rIFG in self-control.

A-28

NEURAL MECHANISMS OF REWARD AND SELF-REGULATION IN CONSENSUS ESTIMATION AND SOCIAL INFLUENCE

Benjamin Locke Welborn - University of California, Los Angeles; Matthew D. Lieberman - University of California, Los Angeles – Adapting to a complex and dynamic social environment demands effective regulation of the relationship between our own attitudes and those of the broader group or community. We must first be able to accurately estimate group consensus on important issues and then overcome prepotent commitments in order to harmonize our attitudes with those of others. In order to better understand how these complementary processes connect our attitudes to those of the broader community, we have investigated the neural correlates of consensus estimation and social influence in two fMRI studies. In an fMRI investigation of the false consensus effect (FCE; $n=28$), regions implicated in social reward (including the NAcc and VMPFC) demonstrated a positive relationship with between-subjects differences in consensus estimation bias. Conversely, participants' recruitment of right ventrolateral prefrontal cortex (RVLPFC) was associated with the ability to attenuate consensus bias, so as to bring consensus estimates in line with the group's actual attitudes. In a second fMRI study ($n=19$), we explored the neural mechanisms supporting social influence from peer attitudes. Mentalizing regions, including the MPFC and RTPJ, as well as regulatory regions (RVLPFC) were positively associated with participants' sensitivity to social influence. Taken together, these results suggest that dynamic interplay between social reward and self-regulation shapes individuals' vulnerabilities and resistances to both social influence and the FCE. It is our belief that future research can further illuminate the neural processes that allow us to interrogate our own attitudes, as well as those of others, in ecologically valid and motivationally charged circumstances.

A-29

DCN Travel Award winner

WORKING HARDER TO SUCCEED: INCREASED RELIANCE ON LATERAL PFC ENGAGEMENT ACROSS EARLY ADOLESCENCE PREDICTS LONGITUDINAL INCREASES IN RISKY BEHAVIOR

Ethan M. McCormick - University of Illinois - Urbana Champaign; Eva Telzer - University of Illinois - Urbana Champaign – Successful cognitive control is crucial for our everyday behavior; allowing for the selection of context-appropriate actions and the suppression of inappropriate responses. Cognitive control has been shown to be a resource that can be depleted (Muraven et al, 1998); as individuals become accustomed to a particular task, their performance becomes more automatic and less reliant on effortful control. This may be reflected by a disengagement of the prefrontal cortices over task-dependent skill acquisition. A key region involved in cognitive control is the ventrolateral prefrontal cortex (VLPFC) (Aron et al., 2004; Levy & Wagner, 2011). Developmentally, the VLPFC is a late-maturing brain region, which is thought to contribute to the increased occurrence of risk-taking behaviors during this period (Eshel et al., 2007). However, relatively few studies have looked at the development of cognitive control across time in a longitudinal design. We propose that changes in VLPFC engagement across the early adolescent years is an important marker in the development of cognitive control and risk-taking behavior. During an fMRI scan, 20 adolescents performed a go/no-go task at the end of eighth grade and again at the end of ninth grade, and reported on their risk-taking behaviors at both time points. Adolescents who showed an increase in risk-taking over time also demonstrated less bilateral VLPFC disengagement over time during nogo trials where subjects were successful in behaviorally inhibiting their responses. This failure to disengage among risky youths may reflect a greater need for effortful VLPFC regulation of behavior.

A-30

CAN REAPPRAISAL BE TRAINED? EVIDENCE THAT LONGITUDINAL REAPPRAISAL TRAINING ENGAGES PREFRONTAL CORTEX ACTIVITY AND REDUCES AMYGDALA ACTIVITY AND SELF-REPORTED NEGATIVE EMOTION IN BORDERLINE PERSONALITY DISORDER

PATIENTS Bryan T. Denny - *Icahn School of Medicine at Mount Sinai*; Jin Fan - *Icahn School of Medicine at Mount Sinai*; Xun Liu - *Chinese Academy of Sciences*; Kevin N. Ochsner - *Columbia University*; Antonia S. New - *Icahn School of Medicine at Mount Sinai*; Marianne Goodman - *Icahn School of Medicine at Mount Sinai*; Larry J. Siever - *Icahn School of Medicine at Mount Sinai*; Harold W. Koenigsberg - *Icahn School of Medicine at Mount Sinai* – Substantial research has indicated the effectiveness of engaging reappraisal in order to reduce self-reported negative affect via recruitment of prefrontal cortex and down-regulation of amygdala activity in individual sessions. However, there has been far less research into whether reappraisal training can yield adaptive changes in brain and behavior over time, both in healthy populations and in populations for whom emotion regulation often fails. Borderline personality disorder (BPD) is the prototypical disorder involving emotion dysregulation. In this study, we assessed whether BPD patients could be trained to enhance reappraisal via psychological distancing, which involves viewing stimuli as an impartial, objective observer. At each of five sessions, BPD and healthy control (HC) participants were shown negative social emotional images and given instructions to reappraise their responses to half and to look and respond naturally at the other half. Negative emotion self-reports were obtained after each image presentation. Sessions 1-5 were spaced two days apart and afforded training through practice on novel images. fMRI data were acquired at Sessions 1 and 5. We found that BPD patients showed significantly reduced negative emotion self-reports over time. Further, with training, BPD patients increased activity during reappraisal in ventrolateral prefrontal cortex, a region engaged during reappraisal in HC's in this and prior studies. BPD patients also showed longitudinal attenuation of amygdala activity. These data represent the first evidence that longitudinal training can increase reappraisal success and normalize reappraisal neural activity in any patient population and suggest a potential translational role for reappraisal training in BPD treatment.

A-31 LINKING PROCESS AND OUTCOME: AGE-RELATED DIFFERENCES IN VISUAL

FIXATION AND PFC RECRUITMENT DURING INSTRUCTED EMOTION REGULATION

Eric Allard - *Cleveland State University*; Elizabeth Kensinger - *Boston College* – The age-related positivity effect in emotional information processing is assumed to be the consequence of older adults' emotion regulation goal priorities. However, direct evidence linking positivity effects and emotion regulation goal processing (and regulatory outcomes) is rather limited. The present study examined younger and older adults' visual attention patterns toward positive and negative film clips in response to explicit emotion regulation instructions during an fMRI scan session. Participants viewed positive, negative, and neutral film clips in three viewing conditions: passive viewing (no regulation instruction), selective attention (attentional deployment), and reappraisal. We focused our analyses on discriminating hedonic vs. non-hedonic gaze patterns in relation to neural activation patterns during the regulation conditions. Results revealed that gaze was most associated with neural activity for older adults in the reappraisal condition. However, this effect was specific to fixation patterns when amplifying hedonic reactions to positive videos: longer fixation times to positive videos (relative to negative videos) in this condition were associated with enhanced ventral ACC and OFC activity. For younger adults, differential activity patterns emerged for hedonic fixation preferences in the selective attention condition: greater OFC activity linked with fixation during positive video viewing and greater VLPFC activity linked with fixation during negative video viewing. The present results help expand upon notions of age-related positivity effects in overt behavior (i.e., visual fixation patterns) can be more specifically linked to regulatory outcomes as evidenced by age differences in neural recruitment during explicit emotion regulation tasks.

A-32 INTERACTIONS OF EMOTIONAL VALENCE AND AGE IN EMOTIONAL REGULATION

Christopher R. Madan - *Boston College*; John A. Morris - *Boston College*; Christina M. Leclerc - *State University of New York at Oswego*; Elizabeth A. Kensinger - *Boston College* – Aging may affect one's ability to regulate emotions, and the mechanisms used to do so. However, less is known about how emotional valence interacts with age to

influence the recruitment of emotion regulation networks. Here we investigated emotion regulation of positively- and negatively-valenced emotional images in younger and older adults. Initially, we sought to test for brain regions that were activated to a greater degree when regulating positive images than negative images, and vice versa. Surprisingly, no regions demonstrated either pattern in both populations (i.e., a conjunction). However, in both groups, there was disproportionate activity recruited during the regulation of responses to positive images compared to negative ones. In young adults, positively-valenced regulation evoked greater activation in a number of regions, including the medial prefrontal and orbitofrontal cortices, and the caudate, when compared to negative regulation. In older adults, positive regulation evoked greater activations in the VLPFC, insula, and hippocampus. These results emphasize the importance of examining the processes that subserve the regulation of positive as well as negative emotion. They also emphasize that the neural mechanisms of emotional regulation varies with age – as it appears that young and older adults recruited distinct brain regions when regulating their emotions.

A-33

CULTURAL DIFFERENCES IN BELIEFS, PRACTICES, AND NEURAL MECHANISMS OF EMOTION REGULATION

Yang Qu - University of Illinois, Urbana-Champaign; Eva H. Telzer - University of Illinois, Urbana-Champaign – Culture shapes how individuals engage in emotion regulation. Compared with Western culture, East Asian culture encourages individuals to modify their feelings to maintain group harmony (Markus & Kitayama, 1991). Moreover, East Asian dialectical thinking is characterized by a belief that reality is constantly changing, such that misery can turn into happiness and happiness can turn into misery (Peng & Nisbett, 1999). Thus, we hypothesized that East Asians would believe the ability to regulate emotion is more changeable, use reappraisal to change their emotion more often, and recruit less neural resources when regulating emotion. Using a modified fMRI emotion regulation task (Ochsner et al., 2004), 14 American and 15 Chinese participants were instructed to use cognitive reappraisal to decrease their negative emotion. Participants also reported their implicit theory of emotion regulation (Tamir et

al., 2007) and frequency of reappraisal (Gross & John, 2003). Findings demonstrate that Chinese participants self-reported more frequent use of reappraisal, which was mediated by their higher incremental theory of emotion regulation. Chinese participants showed lower VLPFC activation than American participants when decreasing negative emotions. This lower VLPFC activation was associated with higher incremental theory of emotion and more frequent use of cognitive reappraisal. Findings suggest that Chinese individuals' cultural beliefs about emotion regulation shapes their use of reappraisal in their daily lives which is associated with less recruitment of prefrontal regions when engaging in cognitive regulation, which may underlie their ability to engage in effective emotion regulation and maintain group harmony.

A-34

WHEN GOOD BECOMES BAD: CULTURE MODULATES COGNITIVE REAPPRAISAL OF POSITIVE EMOTION

Yang Qu - University of Illinois, Urbana-Champaign; Eva H. Telzer - University of Illinois, Urbana-Champaign – Western individualism places emphasis on maximizing one's positive emotion (Kitayama et al., 2000). In contrast, such maximization is not socially valued in East Asian collectivistic culture. For example, Chinese parents de-emphasize their children's success by pointing out mistakes (Ng et al., 2007). Indeed, experimental evidence suggests that Asians (vs. Americans) tend to dampen positive emotion to a greater extent (Miyamoto & Ma, 2011). However, the mechanisms through which culture modulates regulation of positive emotion remain unclear. The current study used a neuroimaging approach to move beyond documenting cultural differences in behavioral regulation of positive emotion and examine mechanisms underlying such cultural differences. Fourteen American and 15 Chinese participants completed a modified fMRI emotion regulation task (Ochsner et al., 2004), in which they were instructed to either increase or decrease their positive emotion by using cognitive reappraisal. Following reappraisal, participants rated how they felt (0=very negative, 5=neutral, 9=very positive). While American and Chinese participants reported feeling similarly positive when up-regulating positive emotion, Chinese participants reported significantly less positive feelings

when down-regulating positive emotion, suggesting that Chinese individuals are more likely to bring down their positive emotions. Whole brain analyses indicated that Chinese participants showed greater prefrontal cortex (PFC) activation and greater amygdala-PFC coupling when down-regulating (i.e., decreasing) positive emotion, suggesting greater neural regulation. Such heightened amygdala-PFC coupling significantly mediated cultural differences in the behavioral tendency to decrease positive emotions. Our findings suggest that Chinese individuals' cultural emphasis on dampening positive emotions is supported by their ability to engage in neural regulation.

A-35

EMOTION REGULATION IN THE MIDDLE SCHOOL YEARS: PROBLEM BEHAVIORS OR EMOTION DISORDERS

Lysandra D. Sinclair-Harding - University of Cambridge; David Whitebread - University of Cambridge – Sustained exposure to threatening environments may alter the biological stress response and produce deficits in a child's ability to effectively regulate their emotions (Gunnar & Quevedo, 2007). Early established patterns of emotion regulation (ER) may appear maladaptive or disordered in normative environments, (e.g. at school, McCrory et al., 2010) and are not well explained by laboratory studies. In particular, under-controlled negative emotion is linked to problematic externalizing behaviors, whilst over-control is associated with greater internalizing problems. What are the physiological indices underpinning ER behaviors that unfold across childhood and how do these relate to the emotional and behavioural responses typically on display in school? 128 participants (aged 7-9) from five different UK primary schools were observed during two collaborative LEGO construction tasks. Skin conductance data were combined with observation data and compared to self-reports of ER strategies and teacher-reports of child emotional and behavioral tendencies. We tested 1) whether children with higher levels of physiological reactivity demonstrate more maladaptive response-focused strategies and 2) if participants with low physiological reactivity employ more adaptive ER strategies. Preliminary results support both hypotheses. Teacher-reported emotional problems are correlated with skin conductance lability

($p < 0.01$). Prosocial behaviors are related to lower physiological reactivity ($p < 0.05$). These findings will be discussed alongside observational data, building on existing understanding of the physiological factors at play in ER whilst also shedding light on the regulatory strategies that underpin emotion and behavioral tendencies in the applied school setting.

A-36

INCREASED MYSTICISM AFTER BRAIN

INJURY *Irene Cristofori - Northwestern University; Joseph Bulbulia - Victoria University of New Zealand; John Shaver - Victoria University of New Zealand; Marc Wilson - Victoria University of New Zealand; Frank Krueger - George Mason University; Jordan Grafman - Northwestern University* – Mystical experiences are subjectively believed encounters with a supernatural or supernormal world. Though widely reported across human cultures and throughout human history, the neuro-biological basis of mysticism remains unclear. Here, we examined the causal contribution of specific brain regions to reported mystical experience in a sample of participants from the Vietnam Head Injury Study who suffered penetrating traumatic brain injury (pTBI; $N = 104$) and matched controls (MC; $N = 30$). Participants were tested on the Mysticism Scale, that includes statements such as "I have had an experience that I knew to be sacred," measured on a 9-point Likert scale (from - 4 = definitely not true to + 4 = definitely true). Voxel-based lesion-symptom mapping analysis revealed that higher scores on the Mysticism scale were associated with lesions within a right fronto-temporo-parietal network. This network was composed of gray matter structures including the right orbitofrontal cortex, dorsolateral prefrontal cortex, superior and inferior temporal cortex, and inferior parietal cortex; as well as underlying white matter tracts including the superior, anterior, and posterior corona radiata. After grouping our pTBI patients according to their scores on the Mysticism Scale, we found that patients with higher scores had greater lesion overlap in the right dlPFC; whereas patients with lower scores had greater lesion overlap in the right inferior and superior temporal cortex. These findings identify a homeostatic role of different components of the right fronto-temporo-parietal network in mystical experience. In particular, it appears that the dlPFC has a

crucial role in down-regulating mystical experience.

**A-37
GENDER DIFFERENCES IN THE
CORRELATION BETWEEN COGNITIVE
REAPPRAISAL AND ALPHA BAND POWER
IN EEG**

Kyung-Mook Choi - Seoul St. Mary's Hospital, Institute of Biomedical Industry, The Catholic University of Korea, College of Medicine; Kuk-In Jang, Seoul St. Mary's Hospital, Institute of Biomedical Industry, The Catholic University of Korea, College of Medicine; Jung-Ah Min, Seoul St. Mary's Hospital, The Catholic University of Korea, College of Medicine; Jeong-Ho Chae, Seoul St. Mary's Hospital, Institute of Biomedical Industry, The Catholic University of Korea, College of Medicine – Cognitive reappraisal and expressive suppression are major emotion regulation strategies in adjusting to daily life. We hypothesized that cognitive reappraisal and expressive suppression would be related to alpha band power in brain regions. Fifty-nine subjects were examined with the Emotion Regulation Questionnaire, and their EEG band power during eyes closed at rest was recorded on the same day. Reappraisal was positively correlated with alpha power of the frontal region in entire group (males and females). In males, reappraisal was negatively correlated with beta power of left temporal region. In females, reappraisal was positively correlated with alpha power of frontal and central regions, education years, and age. However, the suppression score was not correlated with any of the band powers. No significant differences in alpha power and delta power were observed in any of brain regions between males and females. In beta power, significant differences were observed between males and females in central, parietal, right temporal, and occipital regions, and marginally significant differences were observed in frontal and left temporal regions. In theta power, significant differences were observed between males and females in occipital region, and marginally significant differences were observed in central and parietal regions. These results indicate that the prefrontal activity appearing in the alpha band power is correlated with reappraisal but not suppression in females but not in males. The reappraisal score increases with education year and age in females, indicating that the

strategy is increased with learning and age in females but not in males.

**A-38
REAPPRAISAL OF HIGH-INTENSITY
NEGATIVE STIMULI PREDICTS POST
TRAUMA DELIBERATE RUMINATION** *Ana I.*

Orejuela-Dávila - University of North Carolina at Charlotte; Samantha M. Tracy - University of North Carolina at Charlotte; Sara M. Levens - University of North Carolina at Charlotte – When recovering from a traumatic event, deliberate rumination of the emotional event promotes post-traumatic growth (PTG). For PTG to occur, individuals must also process and regulate the emotions that they experience as a result of the trauma. Previous research has postulated that reappraisal is adaptive in response to low but not high-intensity negative stimuli (Sheppes et al., 2014). The goal of the present study is to examine whether the tendency to reappraise low or high-intensity negative stimuli predicts deliberate rumination in the context of PTG. Ninety-four participants who experienced a traumatic experience within the last 6 months completed an emotion regulation choice task, where they viewed negative pictures of low, medium, and high intensity and chose to either distract or reappraise in response to each photo. Proportion of reappraisal was calculated for each intensity level. Participants also completed questionnaires about their traumatic event and completed the Event-Related Rumination Inventory (ERRI) and Perceived Stress Scale (PSS). Results revealed that as previously documented, proportion of reappraisal decreased as intensity increased. Interestingly, hierarchical regression analyses controlling for impact of the traumatic event, expectedness of the event, and perceived stress reveal that the proportion of reappraisal during high intensity trials significantly predicts deliberate rumination ($\beta=.21$, $p<.05$). Findings of this study indicate that a tendency to reappraise negative stimuli during only high intensity trials is predictive of deliberate rumination, which is necessary for PTG to occur. These results suggest that the tendency to reappraise during high intensity emotions may be adaptive for recovery from trauma.

A-39

REAPPRAISAL CHANGES THE QUALITATIVE EXPERIENCE OF EMOTION

Luke J. Chang - University of Colorado Boulder; Peter J. Gianaros - University of Pittsburgh; Stephen B. Manuck - University of Pittsburgh; Tor D. Wager - University of Colorado Boulder – Successful regulation of emotions is important for maintaining our mental and physical health. Though many studies have reliably demonstrated that strategies such as reappraisal are effective in decreasing negative affective states, the precise mechanism of how this process unfolds remains unclear. One popular account argues that reappraisal directly attenuates the affective experience by recruiting executive control systems. Alternatively, reappraisal may not directly decrease the brain's reactivity to negative stimuli, but instead qualitatively changes the affective experience. Here we develop a sensitive and specific signature of negative affect elicited via negative arousing images and evaluate these competing hypotheses. We find modest evidence that our negative affect signature decreases when participants are instructed to reappraise, accounting for only about 1% of the change in ratings. Instead, using multivariate moderation, we find stronger evidence that the affect signature is reconfigured when reappraising compared to naturally reacting to negative stimuli, evidenced by increased weights in the dACC, and decreased weights in the MPFC, left amygdala, and areas of the visual cortex. In addition, we identify a multivariate representation of reappraisal that can discriminate between reappraisal and reactive states with 97% accuracy in leave-one-subject out cross-validation. Interestingly, this pattern appears to be capturing a distinct process from emotion as it is unable to predict affective ratings. However, when combined into an ensemble algorithm, these two patterns can accurately predict participants' ratings to individual pictures. Together these results suggest that reappraisal recruits distinct neural circuitry from emotional reactivity and appears to change the experience of emotion.

A-40

ADDRESSING THE EMOTION PARADOX: OLDER ADULTS SHOW IMPAIRED REGULATION BUT ENHANCED BOTTOM-UP POSITIVE RESPONSE TO NEGATIVE STIMULI

Daisy Burr - Columbia University; Bruce Dore - Columbia University; Chelsea Boccagno - Columbia University; Jochen Weber - Columbia University; Alexa Hubbard - New York University; Stern Yaakov - Columbia University; Kevin Ochsner - Columbia University – Although many cognitive faculties decline with age, research in affective science suggests that positive affect increases steadily across the lifespan, a phenomenon referred to as the emotion paradox. Reappraisal – a cognitive emotion regulation strategy – entails reinterpreting negative events in order to change emotional responses and relies on control regions that are known to decline with age. While reappraisal is used across the lifespan, there may be qualitative differences in the way that older versus younger adults tend to reappraise. The current study investigates how older versus younger adults respond to emotional images from behavioral and neural perspectives. While undergoing an fMRI scan, participants were asked to respond to negative IAPS images in two different ways: look (i.e., respond naturally) or reappraise (specifically positive reappraisal), and rate their positive and negative affect. In line with previous research, older adults show more positive affect when responding naturally to negative images; our data suggest that this effect is related to recruitment of brain reward regions. Moreover, older adults, relative to younger adults, show decreased regulation success and diminished recruitment of control regions when positivizing. Taken together, these findings are consistent with the notion that older adults show impaired regulation yet amplified bottom-up positive affect in response to negative experiences.

A-41

ABILITY VERSUS MOTIVATION IN AGING: COGNITIVE AND MOTIVATIONAL INFLUENCES ON DOWN-REGULATION OF NEGATIVE AFFECT

Chelsea Boccagno - Columbia University; Bruce Dore - Columbia University; Daisy Burr - Columbia University; Jochen Weber - Columbia University; Alexa Hubbard - New York University; Stern Yaakov - Columbia University; Kevin Ochsner - Columbia University – The ability to cognitively regulate emotional responses to aversive events can enhance psychological and physical well-being. Reappraisal, a widely studied form of emotion regulation,

involves changing one's thinking in order to modify emotional responses. Although reappraisal is used across the lifespan, previous studies indicate there are differences in the extent to which older and younger adults successfully regulate their emotions, as well as in the type of cognitive regulation strategy older versus younger adults use. Little is known, however, about the neural and psychological mechanisms underlying age-related differences in reappraisal. This study investigates how older versus younger adults experience and respond to aversive images. While undergoing an fMRI scan, participants were instructed to respond to neutral and negative IAPS images in one of two ways: look (i.e., respond naturally) or reappraise (specifically, minimize [i.e., dampen negative feelings]). Following each image, participants were asked to rate their affect. Findings reveal that, when instructed to minimize, older adults bilaterally recruit ventrolateral prefrontal cortex (vlPFC) regions, while younger adults unilaterally recruit a region of left vlPFC. Moreover, affect ratings suggest that older adults are impaired at minimizing, suggesting inefficiency in control region recruitment. Findings from a post-scanner task, in which participants were given the opportunity to choose to look naturally at or reappraise aversive IAPS images show that older adults, relative to younger adults, choose to reappraise rather than look. Taken together, these findings suggest that older adults are impaired in regulatory capacity, but more motivated than younger adults to regulate.

A-42
AN EVENT-RELATED POTENTIAL STUDY OF
COMPUTER-MEDIATED COMMUNICATION
PREFERENCES AND EMOTIONAL
REACTIVITY AND REGULATION Sarah

Babkirk - The Graduate Center of The City University of New York, Hunter College of The City University of New York; Peter Luehring-Jones - City College of The City University of New York; Olga Gulyayeva - Hunter College of The City University of New York; Patricia Pehme - Hunter College of The City University of New York; Tracy Dennis - Hunter College of The City University of New York, The Graduate Center of The City University of New York – The explosive rise of social media and computer-mediated communication (CMC) has transformed social-emotional

interactions, but few studies have explored links between emerging communication technology and emotional individual differences. This study tested whether CMC preferences were associated with scalp-recorded event-related potentials (ERPs) reflecting early emotional reactivity (the N1), and motivated attention and sustained emotional processing and modulation (the late positive potential or LPP). EEG was recorded while 22 participants completed two computer-based tasks: a passive viewing task of emotional and neutral pictures, and an emotion regulation task with instructions to increase, decrease or maintain their emotional responses to pleasant and unpleasant images. Participants reported their satisfaction with their social support networks and preferences for CMC versus face-to-face interactions on three subscales: positive social communication, expressing distress, and casual communication. A CMC preference (relative to face-to-face) predicted increased N1 amplitudes to pleasant and unpleasant images, suggesting heightened emotional reactivity. In addition, a CMC preference for casual communication predicted decreased LPP amplitudes when participants were asked to increase responses to unpleasant stimuli, suggesting dampened regulatory flexibility. A CMC preference also was associated with decreased satisfaction with social support networks and reduced number of people available for support. Taken together, these findings suggest that individuals showing heightened emotional reactivity and inhibited range of responses to unpleasant stimuli (dampened up-regulation) may prefer CMC over face-to-face interactions for social-emotional communications – particularly in the context of weakened social support. Implications and future directions are discussed, including a model of the emotion regulatory functions of CMC.

A-43
NEURAL CORRELATES OF EMOTION
DYSREGULATION IN BORDERLINE
PERSONALITY DISORDER: STIMULUS
SPECIFICITY AND DIAGNOSIS SPECIFICITY

Linda van Zutphen - Maastricht University; Nicolette Siep - Maastricht University; Gitta A. Jacob - University of Freiburg; Gregor Domes - University of Freiburg; Simon Maier -, University of Freiburg; Andreas Sprenger - University of Lübeck; Bastian Willenborg -

University of Lübeck; Oliver Tüscher - University Medical Centre Mainz; Rainer Goebel - Maastricht University; Arnoud Arntz - Maastricht University – Leading theories on the etiology of borderline personality disorder (BPD) propose that BPD is best understood as an emotion dysregulation disorder, caused by an increased emotional sensitivity and an inability to regulate emotional responses. In response to emotional stimuli fMRI studies in BPD highlight a failure of the inhibitory effect of cognitive top-down control modulated by the regulatory prefrontal areas on the hyperreactive bottom-up limbic emotion generation areas. However, there are two important issues that should be addressed when trying to understand BPD-pathology. Firstly, the generalizability of emotional sensitivity and emotion regulation difficulties across different stimulus categories. Secondly, the specificity of BPD emotional sensitivity and emotion regulation compared to other personality disorders. For this purpose, 56 BPD patients, 38 non-patients and 25 cluster-c personality disorder patients from four different international institutes performed an emotion regulation task during fMRI. Differences in brain activity were compared between groups in response to two conditions: 'passive view' and 'realizing to be safe'. A region-of-interest approach was used based on the model of cognitive control of emotion as proposed by Ochsner, Silvers and Buhle (2012). Additionally the hippocampus was added. We hypothesized that BPD patients, compared to both control groups, showed an increased activity in emotion generation brain areas during passive viewing, especially for the negative and erotic stimuli. Additionally, we expected that BPD patients would show decreased activity in the emotion regulation brain areas during down-regulation to emotional stimuli along with failure to modulate the limbic areas. Results will be discussed.

A-44 INSTRUMENTAL LEARNING IN MAJOR DEPRESSIVE DISORDER AND ITS NEUROMODULATION

Poornima Kumar - McLean Hospital; Franziska Goer - McLean Hospital; Laura Murray - McLean Hospital; Miranda Beltzer - McLean Hospital; Daniel Dillon - McLean Hospital; Pia Pechtel - McLean Hospital; Andrew Cohen - McLean Hospital; Nancy Brooks - McLean Hospital; Breanna Glaeser - McLean Hospital; Brian Brennan - McLean Hospital – Anhedonia and

negative bias are two core features of major depressive disorder (MDD). Previous studies have found that individuals with MDD show blunted reward learning, but no study has probed punishment learning in unmedicated MDD. The goal of the study is to understand neural mechanisms associated with learning deficits in MDD. We acquired fMRI data from unmedicated 24 MDD and 23 healthy controls during a reinforcement learning task, during which a pair of stimuli was randomly presented and participants had to choose one of the stimuli. The 3 stimulus pairs (gain, loss or neutral) were associated with 80%–20% of feedback (\$10/nothing, -\$10/nothing, 0\$/nothing respectively). To win money the subjects had to learn, by trial and error, the stimulus–outcome associations. Reward and punishment prediction error signals using temporal-difference algorithms were calculated and parametrically modulated with hemodynamic responses. Relative to controls, MDD individuals had reduced reward accuracy ($p < 0.05$), but no differences in punishment accuracy were observed. A significant Group \times Valence interaction was observed in the left putamen ($-26, 2, 10$, $Z = 4.34$, 8mm radius small volume correction applied at FDR $p < 0.05$). Post-hoc t-tests revealed that the MDD group had decreased reward, but increased learning signals in the putamen. In addition, both reward (trend level) and punishment ($p < 0.05$) signals correlated with anhedonia score. Specifically, higher anhedonic individuals exhibited blunted reward and enhanced punishment learning signals in the putamen. These results show that MDD is characterized by abnormal reward and punishment learning, highlighting an important role of anhedonia and negative bias in MDD.

A-45 ASSESSMENT OF STEREOTYPIC BEHAVIORS INDUCED BY IP INJECTION OF APOMORPHINE & STRYCHNINE IN MICE: A NOVEL ANIMAL MODEL OF

SCHIZOPHRENIA Paria Sharafi Badr - Shiraz University of Medical Sciences; Faeghe Baha'addini Beigy - Shiraz University of Medical Sciences; Fateme Pirsalami – Background: Schizophrenia is one of the chronic and debilitating psychotic mental disorder in more than 1% of population in all over the world. The dopamine hypothesis proposes that a dysfunction in dopamine neurotransmission is the cause of the positive

symptoms of schizophrenia. Also a glutamatergic deficiency such as decreased glutamate release and a loss of GABA neurotransmission activity has been reported in schizophrenic brains. In this study, stereotypic behaviors of mice were assessed using Apomorphine and Strychnine as a dopamine agonist and a GABA antagonist, respectively. Materials and methods: In this experimental study, 27 male albino mice weighing 25-30g were collected randomly and divided in 3 groups. Strychnine (0.1mg/ml) and Apomorphine (5mg/ml) were injected singly and intraperitoneally(IP). Time out for injections was 15 minutes. As soon as possible stereotypic behaviors such as climbing, grooming and sniffing were recorded. Effects of antipsychotic drugs were assessed. Results: The results showed that separated injection of Apomorphine and Strychnine, induced stereotypic behaviors such as climbing and grooming ($p < 0.05$). Coinjection of Apomorphine (5mg/kg) with Strychnine (0.1mg/kg), caused significant increase in climbing and grooming behaviors ($p < 0.05$). Consumption of Haloperidol and Clozapine stopped stereotypic behaviors induced by coinjection of Strychnine and Apomorphine. Conclusion: Remarkable result of this study is the role of Strychnine as a GABA antagonist on increasing stereotypic behaviors in mice similar to that of Apomorphine. It is not clear if climbing induced by Strychnine may serve as an animal model of psychosis based on the manipulation of GABAergic system.

A-46

A MULTI-MODAL ASSESSMENT OF POSITIVE VALENCE SYSTEMS ACROSS MOOD DISORDERS

Alexis E. Whitton - McLean Hospital, Harvard Medical School; Michael T. Treadway - McLean Hospital, Harvard Medical School; Manon L. Ironside - McLean Hospital, Harvard Medical School; Eric Jensen - McLean Hospital, Harvard Medical School; Amy Farabaugh - Massachusetts General Hospital; Thilo Deckersbach - Massachusetts General Hospital; Dost Ongur - McLean Hospital, Harvard Medical School; Diego A. Pizzagalli - McLean Hospital, Harvard Medical School – Current diagnostic criteria often fail to differentiate bipolar disorder from unipolar depression. Therefore, this study aimed to identify biomarkers that predict (hypo)mania in a transdiagnostic sample of individuals seeking treatment for mood disorders,

focusing on the domain of Reward Learning within the RDoC Positive Valence Systems matrix. We evaluated predictors of (hypo)mania across three units of analysis. First, behavioral reward learning was assessed during a probabilistic reward task (PRT). Second, feedback-related positivity (FRP) and P300 amplitude to reward feedback during the PRT were used to index reward prediction-error-related, and salience-related neural activity. Third, glutamate within the rostral anterior cingulate cortex (rACC) was quantified using magnetic resonance spectroscopy. To date, 19 depressed subjects (5 with prior hypomania), and 6 controls have been recruited. Within the clinical sample, depression severity was associated with reduced behavioral reward learning in the PRT. Within the whole sample, depression severity ($r = -.44$, $p = .03$), particularly severity of anhedonia ($r = -.54$, $p = .006$) was associated with blunted FRP amplitude to reward feedback in the PRT. In contrast, severity of (hypo)mania was associated with increased P300 amplitude to reward feedback ($r = .48$, $p = .02$), as well as increased rACC glutamate ($r = .68$, $p = .046$). These preliminary findings indicate that depression was associated with reduced behavioral reward learning and blunted FRP (putatively indexing reduced dopaminergic firing). In contrast, (hypo)mania was associated with neural responses indicative of heightened reward salience, and increased levels of the brain's primary excitatory neurotransmitter. These markers may provide a means of identifying risk for bipolarity in individuals seeking treatment for mood disorders.

A-47

BREAKING BAD: RAPIDLY DISENGAGING FROM HAPPY CONTENT IN WORKING MEMORY PREDICTS FUTURE DEPRESSION SYMPTOMS

Tabitha N. Alverio - University of North Carolina at Charlotte; Sara M. Levens - University of North Carolina at Charlotte – There are many different reasons why individuals develop depression—the loss of a loved one, experiencing a trauma, etc. Yet why some individuals suffer depression and others are resilient is unclear. Individual differences in how a person processes emotion content and monitors emotional content with executive processes may provide insight into the development of depression symptomatology. The goal of the

present study is to investigate whether biases in the way a person updates emotional content in working memory (WM) may underlie the development of depression symptoms. 160 participants completed two experimental sessions: In session one (T1) participants completed a series of questionnaires assessing depression, stress and affect, and the Emotion N-back task. To perform the Emotion N-back task participants viewed a series of facial expressions (happy, sad, neutral, angry, and fear) and indicated whether the currently presented emotional expression was the same (match-set) or different (break-set or no-set) as the emotional expression presented two faces earlier. In the second session (T2; approximately four months later) follow-up depression, stress and affect were assessed. Emotion N-back task performance was analyzed to elucidate whether engaging and disengaging from emotional content in the task predicts later levels of depression. Results reveal that time to disengage from positive content in WM predicts later depression symptoms. These findings suggest that assessments of individual differences in emotion processing and executive function may be predictive of depression symptomology. Furthermore, difficulty keeping positive information active in WM may be a risk factor for depression.

A-48

ANTERIOR INSULAR AND CINGULATE CORTEX INVOLVEMENT IN REWARD RELATED ENHANCEMENT OF VISUAL PROCESSING

Meffert Harma - National Institute of Mental Health; Michelle Vantighem - Columbia University; James R. Blair - National Institute of Mental Health – The goal of this study was to determine the neural circuitry that biases sensory processing as a function of reward history. A recent electroencephalography study suggested that the anterior cingulate cortex plays a crucial role in translating reward information to regions involved in sensory processing (Hickey et al., 2010a). Alternatively, or additionally, the anterior insula might play such a role by marking salient events for additional processing (cf. Menon and Uddin, 2010). To investigate the neural circuitry involved in reward related biasing of sensory processing, we adapted the Additional Singleton Task of Hickey et al. (2010a) for fMRI. In this task, reward magnitude is

randomly determined after participants correctly identify a target shape amongst an array of distractor shapes. Importantly, our results supported those of Hickey et al. (2010a) by showing reward-related modulation of activity within both visual cortex and a rostral region of anterior cingulate cortex. Moreover, they extended these earlier findings by indicating important roles for both anterior insula cortex and caudate. Specifically, we suggest that these data reflect reward related biasing of sensory processing that is mediated by an integrated effort of anterior insula and anterior cingulate cortex on the basis of value information received from the caudate.

A-49

SEEING ONESELF ACTIVATES VALUATION REGIONS FOR NARCISSISTS (AND THE REST OF US)

Noam Zerubavel - Columbia University; Kevin Ochsner - Columbia University – Narcissism is characterized by inordinate interest in or admiration for oneself, especially one's own image. Here we present the first neuroimaging research to examine patterns of brain activity evoked by one's own image as a function of narcissism. Specifically, we tested the hypothesis that individual differences in subclinical narcissism would correlate with activity in core valuation regions—ventromedial prefrontal cortex (vmPFC), ventral striatum (VS), and amygdala—evoked by images of oneself (relative to images of group members). To do so, we recruited well-acquainted members of student organizations and photographed their faces. Participants viewed their own and group members' faces while performing a simple cover task in the scanner. In addition, they completed the monetary incentive delay (MID) task as an independent functional localizer to identify regions of interest (ROIs) active during anticipation and receipt of monetary rewards: vmPFC, VS, and amygdala. We found that parameter estimates extracted from each of these ROIs were greater when viewing one's own face relative to the faces of group members. Importantly, we found that this effect was moderated by scores on the Narcissistic Personality Inventory – 16 (NPI-16) for each of the ROIs. These effects remained significant even after accounting for various potential confounds (e.g., facial trustworthiness and attractiveness). More broadly, the naturalistic paradigm we

advance here can be widely applied to investigate the neural correlates of various personality disorders.

A-50

REWARD ACTIVATION ELICITED BY ALCOHOL ADVERTISEMENTS PREDICTS REAL-WORLD DRINKING BEHAVIOR

Andrea L. Worsham Courtney - Dartmouth College; Kristina M. Rapuano - Dartmouth College; James D. Sargent - Geisel School of Medicine at Dartmouth; Todd F. Heatherton - Dartmouth College; William M Kelley - Dartmouth College – Exposure to food cues, tobacco, and alcohol in the media influences eating, drinking, and smoking behavior in adolescents and young adults (Heatherton & Sargent, 2009; McClure et al., 2013; O'Hara et al., 2013). Neuroimaging research has demonstrated that viewing appetitive cues, like food or cigarettes, consistently activates putative reward regions (e.g., ventral striatum and orbitofrontal cortex [OFC]), and the magnitude of activations in these regions can be used to predict real-world behavior (e.g., giving in to desire [Lopez et al., 2014] and weight gain [Demos et al., 2012]). Here we examine whether alcohol advertisements engage the reward system, and whether activations predict self-reported drinking behavior. 57 participants underwent fMRI scanning while viewing images of fast food, alcohol, car, and technology advertisements. They then completed surveys concerning their drinking behavior and brand preferences. Results indicated that a region of the OFC showed greater activity when viewing alcohol ad images. Moreover, the magnitude of the activation predicted real-world drinking behaviors reported by the participants, including drinking frequency and binge drinking. These results are consistent with our prior work demonstrating a relationship between reward activity and eating behavior and suggest a domain general role for reward regions in motivating appetitive behavior.

A-51

SIMPLE PLEASURES: EXAMINING THE NEURAL BASES OF AESTHETICS AND AMUSEMENT

Christine D. Wilson-Mendenhall - Northeastern University; Nicole Betz - Northeastern University; Maria Gendron - Northeastern University; Ajay Satpute - Pomona College; Lisa F. Barrett -

Northeastern University – Neuroscience investigations of pleasant experience typically focus on the reward circuitry that has been studied extensively in non-human animals. Human experiences of the “simple pleasures in life,” though, often differ from behaviorally oriented reward tasks. In an fMRI study, we examined two forms of pleasant experience: visual aesthetics and conceptual amusement. We made use of the simple visual and novel conceptual features of “doodle” designs, which are meaningless visual designs that only become interpretable (and often amusing) when a caption is supplied. Aesthetic color versions of the designs were initially presented without captions to evoke pleasant sensory experiences, and then verbal captions were presented with the same designs (classic “doodles”) to evoke pleasant conceptual experiences. Participants rated the feeling evoked by each design after viewing each block of images. While viewing the color designs and while viewing the conceptual designs, activity in subcortical regions involved in reward processing (e.g., ventral putamen) increased as the intensity of participants' pleasant feelings increased. Activity in key regions of the salience network (e.g., amygdala, anterior insula) also correlated with subjective pleasantness ratings, with color pleasantness associated with more dorsal activity, and with conceptual pleasantness associated with more ventral activity. Consistent with this dorsal-ventral gradient, fronto-parietal regions involved in attention were associated with color pleasantness whereas “default” network regions involved in social inference were associated with conceptual pleasantness. Our results suggest that it is important to understand how a variety of pleasant experiences are constructed via distributed patterns in the brain.

A-52

PARSING AFFECTIVE AND INFORMATIVE REWARD PROPERTIES IN THE STRIATUM: A HIGH-RESOLUTION FMRI INVESTIGATION

Kainan (Sally) Wang - Rutgers University; David V. Smith - Rutgers University; Mauricio R. Delgado - Rutgers University – Reward processing plays a major role in shaping our behavior. At the center of this pathway lies the striatum. Understanding the contribution of the striatum to reward processing has been difficult because rewards themselves consist of different properties. For example,

affective properties modulate emotional experience while informative properties signal how to adapt behavior to maximize future gains. Yet, many neuroimaging studies have been unable to parse reward properties because of paradigmatic constraints and poor spatial resolution. We approached this problem using high-resolution fMRI (1.8 mm³) combined with a paradigm stressing affective and informative reward properties through two distinct tasks. In one task emphasizing affective properties, subjects are instructed to pick from three decks of cards to build up their point bank to be eligible to play for money in the final bonus game. In the other task emphasizing informative properties, subjects are instructed to learn the makeup of three decks of cards so as to use that information to succeed in the bonus game. We found that subjects explored the decks more often in the pursuit of information, irrespective of the magnitude of information. We also found that both reward properties evoke activation within the striatum, with affective properties extending ventrally and informative properties extending dorsally. These results suggest that rewards can be broken down into specific properties that can be mapped onto the striatum. Elucidating how affective and informative reward properties are encoded by the striatum may provide new insights into the links between reward-processing circuitry and behavior.

A-53

SANS Poster Award winner

SOCIAL VALUE MODULATES STRIATAL PREDICTION ERROR SIGNALING

Katherine E. Powers - Harvard University, Dartmouth College; Leah H. Somerville - Harvard University; William M. Kelley - Dartmouth College; Todd F. Heatherton - Dartmouth College – An important feature of adaptive social behavior is the ability to flexibly modify future actions based on the successes or failures of past experiences. The ventral striatum (VS) occupies a central role in this shaping of behavior through feedback-based learning signals called prediction errors. Here, we examined how this striatal response varies as a function of the value associated with different social contexts. Across two studies, participants (N = 52) underwent fMRI scanning while answering multiple-choice questions testing their knowledge about the behaviors and preferences of social groups associated with

high (in-group) and low (out-group) social value. Participants were presented with feedback indicating whether their responses were correct or incorrect on a trial-by-trial basis. Social group membership determined the strength of the prediction error signal in the VS, such that incorrect judgments about in-group relative to out-group members produced a greater striatal deactivation. This dissociation provides evidence that the VS is sensitive to variations in social value and may help sustain in-group relationships by signaling situations that are most in need of social adjustment. Moreover, individuals high in the need to belong showed greater striatal responsivity for incorrect judgments concerning in-group members. These results are suggestive of a neural system highly attuned to social context that functions to advantageously support social relations by translating the value of social cues into motivated action.

A-54

OBSERVATION BY OTHERS FACILITATES ETHICAL CONSUMER DECISION THROUGH INTUITIVE VALUATION SYSTEM

Daehyun Jung - Korea University; Sunhae Sul - Korea University; Minwoo Lee - Korea University; Hackjin Kim - Korea University – Despite the well-known evidence that prosocial behavior can be facilitated by various cues of observation by others, the exact neural mechanism causing this phenomenon is currently not known. The present fMRI study investigated ethical consumer decisions with or without observation by others. Participants were randomly assigned to either control or observation group and made purchasing decisions for social or non-social products in the scanner. Participants in the observation group were told that their decisions would be watched and recorded by others outside the scanner. Behavioral results showed that the observation group, compared to the control group, showed higher purchase rate for social than non-social products. fMRI results showed that trial-by-trial decision biases toward ethical consumption were predicted by the caudate activity and social products elicited stronger bilateral amygdala activation than non-social products in both groups. Interestingly, only the observation group showed such differential activation within the bed nucleus of stria terminalis (BNST), a structure known to respond to threat. Moreover, the BNST showed stronger functional coupling with dorsal amygdala

during social vs. non-social product trials in the observation group. Finally, a direct group comparison revealed that the observation group, compared to the control group, showed increased activity in ventromedial prefrontal cortex (VMPFC) and decreased activity in dorsomedial prefrontal cortex (DMPFC). Taken together, our findings suggest that an increase in prosocial decision with observation by others may be subserved by the intuitive valuation system involving VMPFC working with caudate, amygdala, and BNST, which can be interrupted/regulated by DMPFC without observation.

A-55 ANHEDONIA IS ASSOCIATED WITH REDUCED HIPPOCAMPAL VOLUME IN POSTTRAUMATIC SPECTRUM ADULTS

Jennifer L. Buchholz - McLean Hospital; Lauren A. Demers - McLean Hospital; Lily A. Sonis - McLean Hospital; Elizabeth A. Olson - McLean Hospital; Rena Fukunaga - McLean Hospital; Isabelle M. Rosso - McLean Hospital – Anhedonia is a clinical feature of numerous psychiatric disorders, including posttraumatic stress disorder (PTSD). It is defined as a relative inability to experience pleasure from rewarding activities and stimuli and has been associated with abnormalities of the mesolimbic dopamine reward pathway, which is controlled in part by the hippocampus. In animal models, repeated or chronic stress induces both anhedonia and neuronal atrophy in the hippocampus. However, imaging studies of trauma-related disorders have not investigated hippocampal morphology as a possible neural correlate of anhedonia. We hypothesized a relationship between hippocampal volume and Snaith-Hamilton Pleasure Scale (SHAPS) scores in a sample of nontraumatized and trauma-exposed adults with varying degrees of PTSD symptoms. This preliminary analysis includes twenty-two right-handed adults with PTSD, nine trauma-exposed subthreshold PTSD subjects, and thirteen healthy subjects. Subjects were interviewed using the Structured Clinical Interview for DSM-IV and underwent 3T magnetic resonance imaging. PTSD diagnoses were made using the Clinician-Administered PTSD Scale (CAPS) and anhedonia was assessed using the SHAPS. Hippocampal volumes were corrected for intracranial volume, and correlation analyses examined SHAPS total scores relative to

hippocampal volume. SHAPS total scores were significantly negatively correlated with hippocampal volume in the whole sample ($r(43)=-.39, p=.01$) and retained trend significance within trauma and PTSD subjects ($r(30)=-.31, p=.09$). CAPS scores were not significantly associated with hippocampal volume. Reduced hippocampal volume may be specifically associated with anhedonia symptoms in posttraumatic spectrum adults. This finding demonstrates the need for further research exploring the role of the hippocampus in reward processing in trauma-related psychiatric illness.

A-56 ELECTROPHYSIOLOGICAL CORRELATES OF REWARD PROCESSING IN ADOLESCENTS WITH INTERNET ADDICTION *Qi Li - Chinese*

Academy of Sciences; Xun Liu - Chinese Academy of Sciences – Abstract
Objective: Recent studies have linked internet addiction with a dysfunctional neural reward system. Although some studies have explored reward processing in healthy individuals, no electrophysiological study has been done in adolescents with internet addiction disorder (IAD). The present study aimed to examine reward processing in IAD adolescents with event-related potentials. Methods: Thirty-two IAD adolescents were recruited from Internet Addiction Centre, General Hospital of Beijing Military Region and thirty-two matched healthy adolescents were selected as controls. One IAD adolescent was excluded for insufficient trials to form ERPs. Behavioral scores were compared across groups. Feedback-related negativity (FRN) and positivity (P300) derived from a simple gambling task were also analyzed. Results: Behavioral data showed that IAD adolescents were more willing to make high-risk decisions than controls (54.55 % vs. 46.74%). ERP results showed that FRN was reduced significantly for IAD adolescents compared with controls, which was mainly driven by a more negative FRN to gain feedback. While the amplitude differences of P300 were not prominent between IAD adolescents and controls. Conclusions: Adopting a simple gambling task, the present study investigated the electrophysiological correlates of reward processing in IAD adolescents for the first time. Behaviorally, IAD adolescents relative to controls were more willing to take high-risk decisions. More importantly, relative to controls, they exhibited blunted responses at

the outcome appraisal stage, as index by FRN, to gain outcomes, but not to loss outcomes. Thus, our findings suggest that internet addiction among adolescents is possibly driven by their reduced responses to positive reward.

A-57

DESIGN AND DEVELOPMENT OF MOUSE PARADIGM OF DRUG SELF-ADMINISTRATION: A NOVEL MODIFIED RUNWAY MODEL

Pandi Vijayapandi - University of Malaya; Yasmin Khan - University of Malaya – Behavioral scientists have employed operant runways as a means of investigating the motivational impact of incentive stimuli for the better part of the past 100 years. The current study in our laboratory for a first time demonstrated the modified version of operant runway model of drug self-administration in mice. This body of work suggests that the modified runway method serves as a powerful behavioral tool for the study of the behavioral and neurobiological basis of drug self-administration. In this task, the speed with which a trained animal travels a long straight alley in zigzag manner for positive incentive stimuli, like food or water, and drug of abuse provides a reliable index of the subject's motivation to seek those stimuli. The modified runway paradigm is therefore a particularly appropriate tool for investigating the drug-seeking behavior of animals working for drugs of abuse.

A-58

HOLD ON TO THE POSITIVE: THE ROLE OF UPDATING EMOTIONAL CONTENT IN INDIVIDUAL DIFFERENCES

Sara M. Levens - University of North Carolina at Charlotte – Individual differences in emotion processing have been linked to a host of psychological and behavioral constructs. Importantly, the application of cognitive resources to the processing of an emotional stimulus is governed by executive functions. Therefore individual differences in how emotion and executive functions interact may be central to individual differences in behavior and personality. Updating is an executive function necessary for flexibly responding to stimuli encountered in the environment or recalled from memory. I present a series of studies using an emotion n-back task that examine how emotional content is updated as well as the role of emotion updating in

individual differences. Results reveal that updating emotional content differs as a function of experience; individuals with recent trauma are impaired, whereas individuals with distant trauma update emotional content significantly faster than individuals with no trauma history. Additionally results reveal interesting findings with regard to updating positive content: One, depressed and recovered depression participants disengage from positive information faster than never-depressed controls. Two, time to disengage from positive content predicts future depression symptoms, with rapid disengagement of positive content predicting higher levels of depression symptomatology. And three, time to disengage from positive content differs as a function of attachment style, with insecurely attached individuals disengaging from happy content faster than securely attached individuals. In sum, updating emotional content differs as a function of experience. Additionally, individual differences in updating emotional content reflect both maladaptive and protective biases that may underlie affect regulation and core aspects of personality and behavior.

A-69

IS THERE NEURAL SPECIFICITY FOR BODILY EMOTIONS?

Isaiah Sypher - National Institute of Mental Health; Harma Meffert - National Institute of Mental Health; Roberta Clanton - University of Birmingham; James Blair - National Institute of Mental Health – There is emerging data that suggest the involvement of a core neural system in empathy for bodily expressed emotions, including bilateral anterior insula and dorsal anterior cingulate cortex (Fan, Duncan, de Greck, & Northoff, 2011; Lamm & Singer, 2010). However, these studies have been heavily focused on pain, which may have biased the results (e.g. Morelli, Rameson, & Lieberman, 2012). To address this issue, participants viewed loving, rejecting, painful and neutral hand interactions while they were feeling the emotion of one of the hands or attending to the gender of one of the hands. The data suggest that brain regions such as ventral medial prefrontal cortex, dorsal medial prefrontal cortex and anterior insula exhibit a preference for one of the three emotions used in the current design. In addition, the data indicate the presence of a large network of brain regions recruited while

viewing hand interactions, regardless of emotional category, including bilateral amygdala, premotor and somatosensory regions and visual cortex.

A-60

NEURAL BASIS OF VARIABILITY IN EMOTION INTENSITY PROFILES

Maxime Résibois - University of Leuven; Philippe Verduyn - University of Leuven; Pauline Delaveau - University Paris 06; Jean-Yves Rotgé - University Paris 06; Peter Kuppens - University of Leuven; Iven Van Mechelen - University of Leuven; Philippe Fossati - University Paris 06 – Emotions are processes that unfold over time. Consequently, a full understanding of emotions and emotion characteristics can only be reached when their dynamic nature is taken into account. A particularly salient and dynamic characteristic of emotions is their intensity. During an emotional episode intensity varies over time, resulting in an emotion intensity profile. These profiles can take many different shapes. Using dimension reduction and clustering methods, it has been shown that these profiles mainly differ in explosiveness (i.e., some emotions have an explosive start whereas others do not) and accumulation (i.e., some emotions become stronger over time whereas others do not). A number of psychological determinants of explosiveness and accumulation have already been identified. In contrast, the neural basis of these dynamic processes remains unknown. In the present talk we will present an fMRI study (N=31) aimed at discovering the neural basis of emotion explosiveness and accumulation. Following an emotion induction using negative social feedback, participants were asked to report on the temporal unfolding of their emotional response. Using non-negative matrix factorization, we replicated the finding that emotion intensity profiles mainly differ in degree of explosiveness and accumulation. Moreover, emotion explosiveness and accumulation were found to have a different neural signature with the insula being negatively associated with explosiveness and positively associated with accumulation.

A-61

NEURAL FEATURES OF EMOTIONAL

LABILITY *Randi H. Bennett - Fordham University; Aleta Angelosante - New York*

University Child Study Center; Rachel G. Klein - New York University Child Study Center; Amy K. Roy - Fordham University – Emotion dysregulation in children is typically characterized by frequent temper outbursts, low frustration tolerance, and chronic irritability. While this symptom is commonly observed in internalizing disorders (e.g. depression), it has also been associated with externalizing disorders such as ADHD (Stringaris & Goodman, 2009). Specifically, although diagnostic criteria for ADHD are focused on inattention and hyperactivity, significant emotional lability (EL) is also often present (Faraone et al., 1998). Neurally, previous work has shown disruptions in subcortical connectivity in relation to EL in children with ADHD (Hulvershorn et al., 2014; Posner et al., 2014). However, much of the literature supports frontal involvement in emotion regulation (Ochsner & Gross, 2005). In fact, Arsten and colleagues (2009) posited that deficits in frontal connectivity account for the range of behavioral, cognitive, and emotional symptoms in ADHD. The present study included three groups of children (18 with EL, 16 ADHD controls without EL, and 14 TD controls) and used resting-state fMRI to examine intrinsic functional connectivity of prefrontal circuits. Using a medial PFC seed-based ROI analysis (Kelly et al., 2009), we found that children who exhibited severe EL had significantly decreased mPFC-precuneus ($p < 0.01$) and significantly increased mPFC-postcentral gyrus ($p < 0.01$) functional connectivity in comparison to ADHD and TD controls. This decreased mPFC-precuneus connectivity is in line with previous findings (Franzen et al., 2013; Castellanos et al., 2008) and suggests that typically posited disruptions in default mode network connectivity in ADHD (Uddin et al., 2008) may relate more specifically to EL than to symptoms of ADHD.

A-62

INTEROCEPTIVE AWARENESS AND ACCULTURATION IN BICULTURAL

ADOLESCENTS *Theresa W. Cheng - Harvard Graduate School of Education; Xiaofei Yang - University of Southern California; Lise Hobeika - Ecole Normale Supérieure; Mary Helen Immordino-Yang - University of Southern California* – According to classic theories of emotion, the sense of the body's physiological state (interoception) forms a basis of emotional experience. Across different tasks of interoceptive awareness

(IA), East Asians have been found to be less viscerally perceptive than European Americans, and this trait has been associated with acculturated styles of cognitive processing. This study examined whether cultural effects on IA emerge by adolescence and whether differences in bicultural adolescents' (aged 14-16) degree of acculturation is related to IA. East Asian American and Latino American bicultural adolescents' performance on a heartbeat detection task of IA was correlated with acculturation as measured by the General Ethnicity Questionnaire (GEQ). We separately analyzed questionnaire items measuring ethnic attitudes and ethnic behaviors. The groups did not differ on IA. However, among East Asian American adolescents, stronger identification with Asian attitudes, but not behaviors, was significantly correlated with lower IA. No effect of acculturation on IA was detected among Latino American adolescents. An interpretation of this result is that Asian Americans who are more sensitive to visceral sensations may build their cultural identity to align more closely with the American cultural emphasis on "gut feelings," while Asian Americans with lower IA may be predisposed toward other means of constructing emotion. Latino Americans may show no effect because both American and Latin American cultures value attentiveness to gut feelings. Overall, the results suggest a potential interplay between biological predispositions toward IA and cultural identity development among bicultural East Asian Americans.

A-63
AGING LEADS TO WEAKENED
RELATIONSHIP BETWEEN SUBJECTIVE
EXPERIENCE OF AROUSAL AND SKIN
CONDUCTANCE RESPONSES

Chenjie Xia - Harvard University; Erika Siegel - Northeastern University; Karen Quigley - Northeastern University; Lisa Feldman Barrett - Harvard University, Northeastern University; Bradford Dickerson - Harvard University – Extensive prior work in psychophysiology has shown subjective experience of arousal and valence to be closely related to electrodermal activity (EDA) and facial electromyographic activity (fEMG), respectively. The "maturational dualism" view posits a weakening of mind-body connection as we age, but there is only minimal empirical evidence supporting this

hypothesis. In this study, we examined how age influences the relationship between affective experience and psychophysiological responses when individuals are exposed to affective stimuli. 111 subjects (ages 18 to 81 years) completed the Affective Reactivity Task, where they rated 90 images from the International Affective Picture System on valence and arousal, while we recorded skin conductance responses (SCRs) and activity over both the zygomaticus major and corrugator supercilii muscle regions on the face. As expected, an increased number of skin conductance responses predicted higher arousal ratings; increased zygomaticus or decreased corrugator muscle activity predicted more positive valence ratings. The relationship between increased numbers of SCRs and higher arousal was significantly moderated by age, such that it was stronger for younger than older participants. In contrast, the relationship between fEMG and valence ratings was not moderated by age. In sum, the relationship between subjective arousal and EDA was weakened in older individuals whereas that between valence and fEMG was preserved. These findings lend support to the "maturational dualism" view for arousal experience, and further suggest that the relationship between subcomponents of affective experience and their physiological correlates evolve differently with aging.

A-64
SYMPATHETIC AROUSAL DURING
APPROACH-AVOIDANCE DECISIONS

Alex J. Francisco - University of Missouri - Kansas City; Amanda S. Bruce - University of Kansas Medical Center; Robin L. Aupperle - Laureate Institute for Brain Research – Using an approach-avoidance paradigm, we examined the influence different aspects of a decision may have on skin conductance responses during decisions. By using a defined window for decision making, and using explicit outcome probabilities and potential rewards, we reduced learning effects and allowed for a closer examination of the impact choice certainty, threat, and potential reward can have on sympathetic activity during the decision process. Twenty-eight participants performed an approach-avoidance conflict paradigm, involving decisions to approach or avoid during conflict (potential for a negative emotional image and 2,4, or 6 reward points),

approach-reward (potential for 2 reward points only), or avoid-threat (potential for a negative image, no reward). SCRs were measured during each decision window. Self-report measures of behavioral inhibition/activation, aversions to negative images, and reward motivation were taken. Behavioral measures included approach behavior and behavioral uncertainty. SCRs increased for conflict decisions involving four or six points, compared to two [$t(27) = -2.21$, $p = .036$]. Increased behavioral uncertainty was associated with increased sympathetic arousal during decisions involving four points ($r_s = -.401$, $p = .034$). Higher reward responsiveness was associated with decreased SCRs during decisions involving no reward ($r_s = -.456$, $p = .015$), and individuals averse to negative images had greater increases in SCR as reward increased ($r_s = .422$, $p = .025$). Results suggest that sympathetic arousal during a decision is influenced by potential outcome variables, independent of a learning context. Behavioral uncertainty increased experienced emotional arousal, and increased potential reward significantly intensifies emotional arousal during a decision.

A-65

BARRATT IMPULSIVITY AND NEURAL REGULATION OF PHYSIOLOGICAL

AROUSAL Sheng Zhang - Yale University; Sien Hu - Yale University; Jianping Hu - Yale University; Po-Lun Wu - Yale University; Herta H. Chao - Yale University; Chiang-Shan R. Li - Yale University – Theories of personality have

posited an increased arousal response to external stimulation in impulsive individuals. However, there is a dearth of studies addressing the neural basis of this association. Here, we recorded skin conductance in 26 individuals who were assessed with Barratt Impulsivity Scale (BIS-11) and performed a stop signal task during functional magnetic resonance imaging. Across subjects, higher impulsivity is associated with greater skin conductance response (SCR) during stop trials. Activity of the ventromedial prefrontal cortex (vmPFC) negatively correlated to and Granger caused skin conductance time course (Zhang et al., Soc Cogn Affect Neurosci. 2014, 9:900-8). Furthermore, higher impulsivity is associated with a decreased strength of Granger causality of vmPFC activity on skin conductance, consistent with diminished control of physiological arousal to external stimulation. When men ($n=14$) and women ($n=12$) were examined separately, both demonstrated a correlation between impulsivity and SCR to stop trials; however, the association between impulsivity and vmPFC regulation of arousal was only significant in women. Together, these findings confirmed the link between impulsivity and heightened arousal to salient stimuli in both genders and characterized the neural bases of altered regulation of arousal in impulsive women. More research is needed to explore the neural processes of arousal regulation in impulsive men and in clinical conditions that implicate poor impulse control.

Poster Session B

Friday, April 24, 3:00-4:30PM

B-1

THE NEURAL DISTINCTION BETWEEN DISLIKE AND DEHUMANIZATION

Emile G. Bruneau - Massachusetts Institute of Technology; Nir Jacoby - Massachusetts Institute of Technology; Rebecca Saxe - Massachusetts Institute of Technology; Nir Kteily - Kellogg School of Management; Adam Waytz - Kellogg School of Management; Sara Cotterill - Harvard University – Intergroup bias is often measured using subtle or implicit scales; however, in the most serious cases of real world intergroup conflict, outgroup members are often explicitly and consciously dehumanized. In previous behavioral research, we developed a measure of explicit dehumanization based on the image of the 'Ascent of Man'. We found blatant dehumanization in Americans considering Arabs and Muslims, British considering Muslims, Hungarians considering the Roma, and Israelis and Palestinians considering each other. The novel Ascent scale was a better predictor of conflict relevant attitudes and behavior than measures of subtle or implicit intergroup dehumanization. However, one concern with the Ascent scale is that it may merely reflect extreme dislike for another group, and therefore be a similar psychological construct to intergroup affect. We examined this concern directly in a neuroimaging study by having American participants rate a number of groups (including Americans, Muslims and Gypsies) on the 'Ascent Dehumanization' and Feeling Thermometer scales. We found that the brain regions that respond parametrically to ratings on the Ascent Dehumanization and Feeling Thermometer scales were distinct: while greater dehumanization ratings resulted in activity in medial and lateral precuneus and left premotor cortex, felt coldness instead resulted in activity in left anterior insula/operculum; at relaxed thresholds, parametric warmth (but not coldness) was represented in medial precuneus. This study provides neural evidence that dehumanization and prejudice judgments involve distinct cognitive processes.

B-2

SOCIAL CONSEQUENCES OF SCENE CONSTRUCTION: EVIDENCE OF THE MEDIAL TEMPORAL LOBE SUBSYSTEM ENHANCING PROSOCIALITY

Brendan Gaesser - Boston College; Liane Young - Boston College – Why are we willing to help others? According to recent behavioral work on episodic simulation (i.e., the ability to imagine the self in a specific time and place), imagining scenes of helping a person in need increases intentions to help that person. Here, we provide insight into the cognitive and neural mechanisms that enhance prosocial intentions via episodic simulation. Subjects were scanned as they imagined helping a person in need, remembered helping a person in need, and completed control conditions. The imagination condition was associated with increased activation in brain regions within the medial temporal lobe subsystem of the default network, including most prominently the retrosplenial cortex, a region supporting scene construction and spatial navigation. ROI analyses revealed that activity in the retrosplenial cortex predicted the strength of prosocial intentions. Subjective ratings of scene coherence also predicted prosocial intentions. These data reveal a novel mechanism underlying prosociality, suggesting that our prosocial decision-making is guided, in part, by how vividly we imagine the spatial context of the helping episode.

B-3

GROUP MEMBERSHIP, EMPATHY AND SCHADENFREUDE: COMPETITIVE ATTITUDE IS RELATED TO CAUDATE ACTIVATION IN OTHER'S GAMBLING OUTCOME

Wu Haiyan - Chinese Academy of Sciences; Nan Weizhi - Chinese Academy of Sciences; Yang Guochun - Chinese Academy of Sciences; Liang Jing - Chinese Academy of Sciences; Li Qi - Chinese Academy of Sciences; Liu Xun - Chinese Academy of Sciences – Previous research has shown the effect of group identity on empathy that people are more empathetic to in-group members and may manifest intergroup schadenfreude. However, the potential role of competitive attitude on in-group empathy and out-group schadenfreude has not been investigated. We tried to explore these effects through a manipulation of temporarily-formed group

membership and investigate the potential effect of in-group bias or schadenfreude effect on gambling observation task. At the beginning of the experiment, a grouping procedure randomly assigned participants to a certain group and played a short antagonistic football game. Then, participants complemented a gambling task with fMRI scanning as independent individuals. We identified the peak "reward ROI" in neurosynth (e.g., caudate) and found a significant positive correlation between the hyper-competitiveness score and the left caudate activity when the virtual partner won the gamble ($r = 0.717$, $p = 0.004$). Moreover, the hyper-competitiveness score is also positively correlated with the right caudate activity when the virtual opponent lost the gamble ($r = 0.571$, $p = 0.033$). Such correlation suggested that people with higher hyper-competitiveness may seek more positive feeling in group identity, showing more in-group bias in momentary outcome evaluation.

B-4

NEURAL MARKERS OF SIMULATION AND THEIR RELATION TO INTERPERSONAL FUNCTION: AN FMRI INVESTIGATION

Cora E. Mukerji - Harvard University; **Laura M. Tully** - University of California, Davis; **Sarah H. Lincoln** - Harvard University; **David Dodell-Feder** - Harvard University; **Hong Yin** - Harvard University; **Christine I. Hooker** - Harvard University – Simulation, the generation of internal representations of others' experiences, is a process critical to interpersonal function. Prior research implicates somatomotor and related cortices (SC) in facilitating these representations. The current study aims to (1) isolate SC activation during simulation and (2) examine its relation to empathy and social function in schizophrenia (SZ) and healthy controls (HC). We hypothesized that reduced SC activation would be linked to lower empathic and social function across diagnostic categories. Our study applied fMRI to investigate this hypothesis in a sample of 24 HC and 19 SZ adults. Participants completed a simulation task in the scanner, in which they watched videos of another person experiencing pain in his hand. They were asked to imagine (i.e., simulate) how unpleasant this situation would be for them. Participants also completed a task to localize the SC region associated with hand sensation. Lastly, participants completed measures of social and empathic

function and a 21-day diary measuring real-life interpersonal function. Whole-brain analyses indicated reduced activation in the right SC during hand pain simulation in SZ. Correlational analyses revealed that activation in the hand-region of the left SC was associated with greater empathic concern across SZ and HC groups, controlling for group ($r = 0.31$, $p < .05$). Left SC hand-region activation was also associated with better social adjustment among HC individuals ($r = .45$, $p < .05$). Ongoing analyses examine links between neural simulation and real-life interpersonal function. These findings indicate that neural simulation processes support empathic concern across clinical categories and broader social function among healthy individuals.

B-5

RESTING STATE FUNCTIONAL CONNECTIVITY IN EXTRAORDINARY ALTRUISTS

Kristin M. Brethel-Haurwitz - Georgetown University; **Elise M. Cardinale** - Georgetown University; **Sarah A. Stoycos** - University of Southern California; **John W. VanMeter** - Georgetown University Medical Center; **Abigail A. Marsh** - Georgetown University – Altruistic kidney donors volunteer to undergo surgery so that one of their own kidneys can be transplanted into a stranger, an act often described as one of "extraordinary altruism." The neurobiological basis for this rare form of altruism is not yet well understood. In the present study, we recruited 19 living altruistic kidney donors and 20 matched controls and compared resting state functional connectivity during functional magnetic resonance imaging (fMRI). During the seven minute functional run, participants were instructed to close their eyes and let their mind wander. Imaging data were analyzed using AFNI. Preprocessing included despiking, motion correction, alignment, spatial smoothing, and a single regression model including nuisance regressors, motion censoring, and bandpass filtering. Group analyses were conducted using independent samples t tests. Given the hypothesized role of the amygdala in extraordinary altruism, a hypothesis supported by recent findings of heightened activation of the amygdala in altruists in response to distress cues (Marsh et al., 2014), the amygdala was chosen as a seed region of interest. Supporting the importance of limbic-prefrontal connectivity in empathy and altruistic decision-making,

greater functional connectivity was observed in altruists between seed voxels in bilateral amygdala and several clusters in prefrontal regions, including ventromedial prefrontal cortex. This pattern of results in confirmed extraordinary altruists may have important implications for understanding the roots of prosocial motivation and behavior, and for understanding the nature of human altruism.

B-6

MOTIVATIONAL COMPONENTS OF GROUP IDENTIFICATION SHAPE ALTRUISTIC BEHAVIOR AND NEURAL VICARIOUS REWARD RESPONSES

Leor M. Hackel - New York University; Jamil Zaki - Stanford University; Jay J. Van Bavel - New York University – People regularly act altruistically by paying a cost to benefit others, which has been linked in recent work to neural markers of intrinsic subjective value. However, social preferences are not stable across all contexts; rather, the value of an altruistic act may be shaped by the motivational significance of a beneficiary's social group membership. In a functional MRI experiment, participants (N = 50) met two confederates described as part of an in-group (NYU students) and an out-group (Columbia students). Participants made choices to allocate money to themselves or to one of the two social targets, interspersed with passive viewing of forced allocations to themselves or one of the targets. Finally, participants completed measures of group-level self-investment (i.e., importance of the group) and group level self-definition (i.e., similarity to group members). Behavioral data indicated that altruistic choices depended on group membership and investment in—but not definition with—the in-group. Meanwhile, analyses of fMRI data revealed that passive viewing of in-group as opposed to out-group monetary gains was associated with greater activation in ventromedial prefrontal cortex—linked in past work to experienced value—and that the strength of this activation also correlated with differences in group-level investment, but not definition. Thus, while past work has suggested that perceived similarity to others may influence vicarious reward, this work suggests that group boundaries and motivational components of in-group identification shape both vicarious reward and altruistic decisions, with implications for

the study of altruism, neuroeconomics, and intergroup relations.

B-7

HIGHER EMPATHY LEVELS FOR STRANGERS CORRESPOND WITH HIGHER RIGHT TEMPORO-PARIETAL JUNCTION AND ANTERIOR INSULA INTERACTION

Sara Medina-DeVilliers - University of Virginia; Lane Beckes - Bradley University; James Coan - University of Virginia – We investigated the association between levels of empathy and brain activity interaction between the right temporo-parietal junction (rTPJ) and anterior insula while anticipating an electric shock to a stranger. 25 individuals underwent functional magnetic resonance imaging (fMRI) while holding a partner's hand or a stranger's hand. During the scan, participants were presented with randomly-ordered threat and safety cues. Threat cues indicated a 20% chance of shock. Empathy was measured using the Balanced Emotional Empathy Scale (BEES). BEES scores were then used as a covariate in a psychophysiological interaction model to determine brain activity interaction in specific regions of interest that positively and negatively associated with empathy scores when holding the hands of a partner and stranger who were threatened with electric shock. We found that higher self-reported empathy for strangers associated with higher brain activity interaction between the rTPJ and the anterior insula when participants were anticipating electric shock to the stranger. The rTPJ and anterior insula have been strongly associated with empathy neural networks in previous empathy research. Furthermore, the rTPJ has been associated with more cognitive empathy networks, such as perspective taking, while the anterior insula has been associated with more affective empathy networks, such as emotion sharing. Therefore, we speculate that people with higher trait empathy scores are more likely to employ both cognitive and affective empathy networks when presented with the experience of a distressed stranger. By contrast, we speculate that those lower in trait empathy employ primarily a cognitive empathy network when empathizing with strangers.

B-8

SOCIAL POWER DISRUPTS THE LINK BETWEEN NEURAL AND SELF-REPORTED

EMPATHY Jennifer M. Perry - Tufts University; Petra C. Schmid - New York University; Katharina Koch - Sapienza University of Rome; David M. Amodio - New York University – Social power is often thought to decrease empathy for others, yet questions remain regarding the nature of this effect: are powerful people insensitive to others' suffering? Or is there a disconnect between their sensitivity to suffering and their expression of empathy? We examined these questions by testing the effect of power on subjects' sensitivity to others' pain, as measured by self-report and neural responses. Participants' feelings of power were manipulated with a combination of power posing (expansive vs. restricted posture) and imagination of being in high- vs. low-power situations. Participants then viewed photographs of hands and feet in painful and non-painful situations while EEG was recorded. For each image, participants rated their personal distress, and amplitude of the N2 event-related potential, an index of anterior cingulate activity, was assessed. Participants then viewed the stimuli again, rating the pain experienced by the pictured individuals. Results revealed no effect of power on ratings of self-distress or other-pain, or on N2 responses to painful stimuli. However, for low-power subjects, greater N2 responses to painful stimuli significantly predicted greater pain ratings, suggesting their sensitivity to pain guided their empathic response. This link was not found in high-power participants, suggesting that despite sensitivity to others' pain, their expressions of empathy may be driven by other processes. These findings suggest a more complex relationship between power and empathy that may reflect high-power individuals' strategic responses rather than an inability to experience empathy.

B-9

EMPATHY REGULATION: NEURAL CORRELATES AND INDIVIDUAL

DIFFERENCES Craig Williams - Stanford University; Emile G. Bruneau - Massachusetts Institute of Technology; Jamil Zaki - Stanford University – Empathy can motivate helping, but can also induce feelings of distress and 'burnout.' As such, the ability to flexibly increase or decrease empathy may be adaptive. For example, clinicians may increase their experience of empathy to connect with patients, or selectively

decrease their empathy to alleviate 'burnout.' However, such "empathy regulation" remains relatively understudied. We assessed (i) whether people can up- or down-regulate their empathy for others; (ii) which neural systems track empathy regulation; and (iii) whether empathy regulatory ability tracks salutary outcomes. Thirty participants read emotionally painful and neutral stories about other people and rated their empathic responses while being scanned with fMRI. Participants were instructed to adopt either psychologically close, natural, or distant perspectives while reading. We found that adopting a close perspective enhanced participants' empathy ratings relative to a natural perspective, and increased activity in a region of posterior cingulate cortex involved in considering others' mental states. Conversely, adopting a distant perspective reduced participants' empathy ratings relative to a natural perspective, and decreased activity in fusiform face area and visual cortical regions associated with facial and visual processing. Critically, participants' up- and down-regulatory success failed to track their self-reported trait empathy. Instead, greater regulatory success predicted reduced experience of 'burnout' and compassion fatigue. In summary, we find that (i) individuals can regulate their experience of empathy; (ii) brain regions involved in theory of mind and facial/visual processing track empathic regulation; and (iii) regulatory success tracks adaptive individual differences such as reductions in 'burnout' and compassion fatigue.

B-10

ETHNIC DIFFERENCES IN NEURAL RESPONSES TO PAIN

Elizabeth A. R. Losin - University of Miami, University of Colorado-Boulder; Hedwig Eisenbarth - University of Southampton, University of Colorado-Boulder; Jessica Andrews-Hanna - University of Colorado-Boulder; Elizabeth Delk - University of Colorado-Boulder; Tor D. Wager - University of Colorado-Boulder – Pain negatively impacts health and well-being and treatment for many is inadequate. One reason for this may be that pain is not the same for everyone. An extensive literature demonstrates that ethnic minority individuals tend to report more pain than ethnic majority individuals, given the same clinical condition or level of experimental stimulation. Yet, the psychological and neurobiological

mechanisms underlying ethnic differences in pain report remain unknown. Such mechanisms may lie at many different levels of the pain experience, from differences in pain physiology in the brain to differences in thinking about and communicating pain. To begin to disentangle these potential mechanisms, we used a machine learning-derived pattern of brain activity that has been linked to nociception and central pain processing, the neural pain signature. We compared pain ratings, brain activity (fMRI), and the relationships between them in a sample of 31 non-Hispanic white, 29 Hispanic, and 25 African American individuals receiving thermal stimulation. Consistent with previous studies, we found that African American participants reported more pain than non-Hispanic white participants at the same level of thermal stimulation. In contrast, brain activity within the neural pain signature did not differ among ethnic groups. Furthermore, the neural pain signature did not predict pain ratings equally well across ethnic groups, suggesting that neural mechanisms underlying ethnic differences in pain report may lie outside brain regions most closely tied to nociception in previous work. These findings highlight the need for development of pain biomarkers that account for sociocultural influences on pain perception.

B-11
EXPERIENCING THE PAIN OF OTHERS: THE LINK BETWEEN SOMATOSENSORY CORTEX HYPERACTIVITY AND CONSCIOUS MIRROR-PAIN EXPERIENCES

Thomas Grice-Jackson - School of Psychology of the University of Sussex, Sackler Centre for Consciousness Sciences of the University of Sussex; Hugo Critchley - Sackler Centre for Consciousness Sciences of the University of Sussex, Brighton and Sussex Medical School; Jamie Ward - University of Sussex – For most individuals the observation of others in pain, or vicarious pain, does not elicit a conscious experience of pain in the observer; however, some individuals regularly experience vivid conscious vicarious pain (known here as mirror-pain responders), and a significant portion of the general population report these experiences occasionally. Through the development of an online screening questionnaire the current study presents a method for identifying and profiling the experiences of mirror-pain responders. These

individuals and a group of controls were recruited for a follow-up EEG experiment which assessed suppression of somatosensory cortex alpha oscillations, Mu-suppression (known to reflect somatosensory cortex activity), during the observation of painful and neutral images. The findings display significant Mu-suppression during the observation of pain images for both controls and pain responders. Additionally, pain responders displayed greater Mu-suppression during pain observations relative to controls indicating that their experiences may be manifested in hyperactivity of the somatosensory cortex. Correlations between Mu-suppression and measures from the online questionnaire indicate a link between increased somatosensory activity and an increased tendency to localise conscious vicarious pain experiences to a particular point on the individual's own body (as opposed to generalised bodily pain). Mirror-pain responders report less tendency to engage in perspective taking on a questionnaire measure of empathy and, in this group, less perspective taking is linked to more increased somatosensory activity for painful images. Although experiencing the pain of others is, at one level, 'empathic' it may paradoxically result in less tendency to put oneself in others shoes.

B-12
UPDATING EMOTIONAL CONTENT IN WORKING MEMORY IN INDIVIDUALS DIAGNOSED WITH ADHD

Mary C. Cook - University of North Carolina at Charlotte; Osly D. Galobardi - University of North Carolina at Charlotte; Sara M. Levens - University of North Carolina at Charlotte – Individuals with attention-deficit hyperactivity disorder (ADHD) experience difficulty focusing on everyday tasks. This difficulty has been linked with deficits in executive functioning. Interestingly, it has also been found that people with ADHD exhibit difficulties with emotion regulation, which suggests that in addition to executive deficits, these individuals may process emotional content differently. To study how emotional content interacts with the executive function in individuals diagnosed with ADHD, participants diagnosed with ADHD and a control group performed an emotion n-back task that measures how emotional content is updated in working memory. During the emotion n-back task, participants viewed a series of facial expressions (happy, sad,

neutral, angry, and fear) and indicated whether the currently presented emotional expression was the same (match-set) or different (break-set or no-set) as the emotional expression presented two faces earlier. Results indicated that while there were no significant reaction time differences between groups, participants with ADHD had significantly lower overall accuracy. Though the control group exhibited lower accuracy for sad content than happy, neutral, angry and fearful expressions, individuals with ADHD did not show the same pattern. For sad accuracy levels, there was no difference between controls and participants with ADHD. These findings suggest that individuals with ADHD have difficulty tracking what emotional content is relevant vs. irrelevant in working memory. Furthermore, individuals with ADHD do not bias sad content the same as controls, which may underlie reported deficits of empathy in ADHD.

B-13

LOCALIZING THE EXTENDED PAIN MATRIX AND THE THEORY OF MIND NETWORK USING VERBAL AND NATURALISTIC

STIMULI Nir Jacoby - Massachusetts Institute of Technology; Emile G. Bruneau - Massachusetts Institute of Technology; Jorie Koster-Hale - Harvard University; Rebecca Saxe - Massachusetts Institute of Technology – A challenge for social cognitive neuroscience is the absence of a common framework for relating the results of different studies to one another. One strategy to overcome the variability in individual brain anatomies and function is the use of functional localizers. A good localizer task should be short and give robust results at the single subject level. In this study we compare three localizer tasks, designed to efficiently identify regions of interest in social cognitive neuroscience: the “Extended Pain Matrix” regions, recruited in response to depictions of another person’s physical pain, and the “Theory of Mind network” regions, recruited in response to depictions of another person’s mental states (i.e. beliefs and emotions). Each subject performed all of the tasks. First we used the False-Belief localizer contrasting stories about false beliefs versus physical representations. Second, we contrasted verbal stories describing physical pain versus emotional suffering. Finally, participants watched a Pixar animated short movie,

which included segments depicting physical pain, and beliefs and emotions. All three localizers were efficient in identifying the relevant networks in individuals. There were subtle but stable differences in the spatial patterns of activations evoked by the different tasks. Nevertheless, the regions identified by each localizer were functionally similar. These localizers will all be made publicly available, and can be used to facilitate a methodological framework for relating results across studies.

B-14

QUANTITATIVE META-ANALYSIS: MODULATORY EFFECT OF VIEWING FACIAL EXPRESSIONS OF PAIN AND BODY LIMBS IN PAIN IN OTHERS ON BRAIN

ACTIVATION Josiane Jauniaux - Centre de recherche de l'Institut universitaire en santé mentale de Québec; Ali Khatibi - Centre de recherche de l'Institut universitaire de gériatrie de Montréal; Audrey-Anne Dubé - Centre de recherche de l'Institut universitaire de gériatrie de Montréal; Pierre Rainville - Centre de recherche de l'Institut universitaire de gériatrie de Montréal; Philip Jackson - Centre de recherche de l'Institut universitaire de gériatrie de Montréal – Imaging studies on pain communication have shown that the observation of others' pain involves brain regions such as the bilateral anterior insular and the anterior cingulate cortices. However, differences in experimental paradigms and stimuli used across studies seem to modulate this pattern of brain activation. We aimed to compare, through a coordinate-based meta-analysis using activation likelihood estimation (ALE), the effect of viewing facial expression of pain (FEP) and body limbs in pain (BLP) on brain activation. A literature search in PubMed was conducted using the key words 'pain' AND ('magnetic resonance imaging' OR 'fMRI' OR 'MRI') AND 'empath*'. We excluded studies based on these criteria: (i) clinical population, (ii) no coordinates reported, (iii) use of complex social stimuli. This yielded 36 studies. We extracted peak coordinate activations from the contrasts : (i) FEP > [neutral stimuli or blank screen with fixation], (ii) BLP > [neutral stimuli]. This yielded 117 foci from 8 contrasts for FEP and 452 foci from 28 contrasts for BLP. Analyses revealed brain activation in the anterior insula and the anterior cingulate cortex for FEP and BLP. FEP was associated to the superior and inferior

frontal gyrus and the amygdala. BLP was related to post-central gyrus activation. Viewing FEP and BLP was associated to brain regions involved in the observation and direct experience of pain but FEP specific activation was in brain regions involved in the processing of fear and anxiety, while BLP specific activation was found in regions related to the sensory-discriminative dimension of pain.

B-15

CULTURAL MODES OF EXPRESSING EMOTIONS INFLUENCE HOW EMOTIONS ARE EXPERIENCED

Mary H. Immordino-Yang - University of Southern California; Xiao-Fei Yang - University of Southern California; Hanna Damasio - University of Southern California – Cultural ideals are known to influence emotional expressiveness (Markus & Kitayama, 1991; Tsai, 2007), but do cultural influences on expressiveness influence what emotions “feel like”? 28 Chinese and 29 American young adult participants (aged 18-30 years), recruited in Beijing and in Los Angeles respectively, reported their feelings to a series of true, admiration and compassion inducing stories first in a private interview, then during fMRI (methods adapted from Immordino-Yang et al., 2009). As expected, Americans were more expressive during the interview. While expressiveness did not predict stronger reported feelings or neural responses, more expressive people showed tighter trial-by-trial correlations between their experiences of emotion and activations in visceral-somatosensory cortex (dorsal anterior insula, dAI), even controlling for individuals' overall strength of reactions (neural and felt). Moreover, expressiveness mediated a previously described cultural effect in which dAI activation correlated with feeling strength only among Americans (Immordino-Yang, Yang & Damasio, 2014). Post-hoc analyses with a subset of the sample from whom we had recorded electrocardiograms simultaneously with fMRI (n=44) revealed that more expressive individuals also took longer to decide how strongly they felt and reached peak activation of dAI later in the emotion process, despite that neural and psychophysiological markers of emotion induction were not delayed. The results suggest that differences in expressiveness correspond to differences in how somatosensory mechanisms contribute to constructing conscious feelings. By

influencing expressiveness, culture may therefore influence what emotions “feel like.”

B-16

SENSITIVITY TO CONTEXTUAL CUES WHEN RESOLVING THE VALENCE OF AMBIGUOUS FACIAL EXPRESSIONS IS LINKED WITH AMYGDALA-PREFRONTAL CONNECTIVITY

M. Justin Kim - Dartmouth College; Randi H. Bennett - Fordham University; Kimberly M. Solomon - Dartmouth College; Paul J. Whalen - Dartmouth College – Resolving ambiguity in the face of uncertainty is a critical socioemotional process involving the dynamic interplay between top-down regulation and bottom-up salience. Surprised faces, which are ambiguous in terms of the emotional valence of their eliciting event, are well suited for the purpose of investigating this process. In Experiment 1, we show that surprised faces could be reliably categorized into positive, negative, or truly ambiguous faces based on their bottom-up stimulus-driven features. In Experiment 2, we demonstrate that top-down contextual information can be used to override these bottom-up stimulus-driven properties during valence judgments of surprised faces. Valence ratings based upon contextual information were used to calculate their context sensitivity index (CSI), the degree to which top-down contextual information influenced valence judgments. In Experiment 3, we used functional magnetic resonance imaging to show increased amygdala activity to stimulus-driven negative vs. positive surprised faces. Furthermore, the strength of functional connectivity between this area of the amygdala and rostral anterior cingulate cortex was correlated with CSI, indicating that individuals who were more sensitive to top-down information showed stronger functional coupling between the cingulate and the portion of the amygdala most sensitive to the stimulus-driven features of surprised expressions. Taken together, we show that surprised expressions can be a useful tool in probing the dynamic interplay between top-down and bottom-up processes. Our results demonstrate individual differences in the propensity to use contextual cues to determine the valence of surprised faces, and this propensity is associated with greater coupling between the amygdala and prefrontal cortex.

B-17

FAMILY INCOME PREDICTS NEURAL CORRELATES OF UNINSTRUCTED EMOTIONAL RESPONDING

Peter J. Franz - Columbia University; Jennifer A. Silvers - Columbia University; Catherine S. Insel - Harvard University; Emilia N. Ninova - Columbia University; Isha Shah - Columbia University; Walter Mischel - Columbia University; B.J. Casey - Weill Cornell Medical College; Kevin N. Ochsner - Columbia University – A large body of research indicates that socioeconomic status (SES) is positively associated with physical and emotional wellbeing. While many studies have focused on the relationship between SES and mental health, relatively few have examined the neural mechanisms by which SES might impact psychological wellbeing. In the current study we examined whether SES impacts the way children respond to emotional events. To answer this question, we tested 109 healthy individuals, aged 6 to 22 (M age=14.8, 64 Female) on a well-established fMRI paradigm in which participants viewed neutral and upsetting social images, while being instructed to either (a) respond naturally, (b) imagine they are a part of the social scenes, or (c) imagine themselves as far away from the social scenes. To assess SES, subjects or their parents were asked to report their household income using the Hollingshead SES Index. When viewing the upsetting images, subjects from high-SES families tended to report less negative affect than did subjects from low-SES families. Additionally, we found that high-SES subjects recruited the ventromedial prefrontal cortex, a region strongly implicated in self-relevant processing (Roy, Shohamy, & Wager, 2012) and emotional value assessment (D'Argembeau, 2013), to a greater extent than did low-SES subjects. These results provide evidence that individuals from more affluent backgrounds experience less negative affect, even when responding naturally, in response to aversive social events than their less affluent counterparts, and that this disparity may be due to differences in self-relevant emotional processing.

B-18

AGE-BY-VALENCE INTERACTIONS IN MEMORY RETRIEVAL PROCESSES: AN EVENT-RELATED POTENTIAL STUDY

Jaclyn H. Ford - Boston College; Elizabeth A.

Kensinger - Boston College – Recent functional magnetic resonance imaging (fMRI) studies report significant age-by-valence interactions in neural recruitment during memory retrieval, suggesting that emotion may influence memory processes differently in young and older adults. However, preliminary fMRI data from our lab suggest that age differences shift over the course of retrieval, as participants move from search to elaboration. This finding suggests a time-by-age-by-valence interaction that is difficult to elucidate using fMRI. Thus, the current study used event related potentials (ERPs) to examine these interactions within the first second of retrieval. Participants (ages 18-85) encoded positive, negative, and neutral images paired with neutral titles. ERPs were acquired during a retrieval task in which participants were presented with titles and asked whether each had been seen with an image during encoding. ERPs to hits (correctly identifying an “old” word) and correct rejections (correctly identifying a “new” word) were compared to examine the effects of emotion and age on memory effects. Consistent with prior studies, young adults exhibited an early (200-400ms post-stimulus) anterior old/new effect and a late (600-800ms post-stimulus) posterior effect. Interestingly, old/new effects in young adults were greatest for neutral relative to positive and negative stimuli. Healthy aging was associated with decreased old/new effects, although this decrease was greater for neutral stimuli relative to negative and positive. Critically, our data suggest differences in the time course of old/new effects for positive and negative stimuli in older adults, suggesting that the age-by-valence interactions in neural recruitment are more complex than could be measured using fMRI.

B-19

SOMETHING TO SINK YOUR TEETH INTO: PRESENCE OF TEETH MODULATES EARLY ERPS TO MOUTH EXPRESSIONS

Elizabeth B. daSilva - Indiana University; Kirsten Crager - Indiana University; Danika Geisler - Indiana University; Powell Newbern - Indiana University; Benjamin Orem - Indiana University; Aina Puce - Indiana University – If the whites of the sclera can impact neural processing of eye expressions (e.g. Whalen et al., 2004; Hardee et al., 2008), do seen teeth affect neural responses to mouth expressions? Thirteen participants (8 female;

ages 22-31) viewed isolated avatar images of open mouths, grimaces, and smiles, both with and without teeth. A continuous 256 channel electroencephalogram (EEG) was recorded at 500 Hz (bandpass 0.1 -200 Hz) while participants completed two tasks, evaluating stimulus color or expression valence. Independent components analysis identified and removed EEG trials with eye blinks, muscle movements and electrical noise. For each participant, averaged ERPs in two temporo-occipital electrode clusters were generated by subject and condition; peak P100, N170 and P250 amplitudes and latencies were analyzed in a 3 X 2 X 2 X 2 repeated-measures ANOVA with Mouth Configuration, Teeth Presence, Task and Hemisphere as factors, followed by post-hoc Bonferroni adjustments. P100 and N170 amplitudes were significantly larger when teeth were present, $F(1,12)=5.79$, $p=0.03$, and $F(1,12)=17.72$, $p=0.001$, respectively, with a marginally significant main effect occurring for P250, $F(1,12)=4.34$, $p=0.06$. There was an additional main effect of Mouth Configuration for N170, wherein grimaces and smiles elicited larger N170s compared to open mouths, $F(1,12)=11.01$, $p=0.006$ and $F(1,12)=10.34$, $p=0.007$, respectively. Our data correspond with facial expression studies of N170 enhancement to angry (Krombholz et al., 2007), fearful and happy expressions (e.g. Luo et al., 2010), and point to low-level visual stimulus features, such as teeth, potentially driving neural responses to affect independent of mouth configuration.

B-20
EMOTION RECOGNITION TRAINING INCREASES NEURAL RESPONSE TO HAPPY FACES IN INDIVIDUALS WITH HIGH LEVELS OF DEPRESSIVE SYMPTOMS Michael N. Dalili - University of Bristol; Katherine S. Button - University of Bristol; Michael Browning - University of Oxford; Sally Adams - University of Bath; Meg E. Fluharty - University of Bristol; Emily A. Holmes - MRC Cognition & Brain Sciences Unit; Catherine J. Harmer - University of Oxford; Marcus R. Munafò - University of Bristol; Ian S. Penton-Voak - University of Bristol – Emotion recognition training (ERT) has shown promise in modifying cognitive biases associated with low mood (Penton-Voak et al., 2012) and can be easily delivered via computer or smartphone applications. Using a novel paradigm we conducted a

randomised controlled trial of the effects of ERT on amygdala response to facial expressions of emotion, in order to explore the neural mechanism of action of this intervention in a sample of individuals with depressive symptoms. We randomised 36 adults from the general population who reported high levels of depressive symptoms (≥ 14 on the Beck Depression Inventory-II) to five consecutive daily sessions of the ERT intervention or control procedure, followed by an fMRI scan on the final training day. Region of interest analysis demonstrated significant group differences in the neural response to happy vs. sad stimuli in the left amygdala, with activation greater in the trained versus control groups. This effect was driven by amygdala responses to happy faces, with an 8% increase in amygdala activation in the trained group relative to a 4% reduction in the control group relative to resting state. Our findings suggest that computerised training (ERT) using a novel cognitive bias modification technique targeting emotional processing in depression resulted in greater neural activation to positive faces relative to negative faces. This effect is similar to those of antidepressants in depressed individuals, raising the possibility that ERT may be a valuable and cost-effective adjunctive treatment for depression.

B-21
AFFECTIVE NEUROSCIENCE PERSONALITY SCALE AND CLINICAL SYMPTOMATOLOGY: A NEUROSCIENCE UNDERSTANDING OF THE CROSS BETWEEN PERSONALITY AND PSYCHOPATHOLOGY

Francis L. Stevens - Wheelock College – Increasing biomarkers have been identified to better classify and understand psychopathology. Recent research suggests that personality may have distinct grounding in emotional brain system (Davis & Panksepp, 2011). Davis & Panksepp (2011) hypothesize that these early evolutionary subcortical areas functionally notable for emotion, are the same regions for the basis of one's personality. They see personality as being based on one's primary emotional temperaments, and thus, one's personality has neuroscience markers within these subcortical areas (Panksepp & Biven, 2012). Given the above theory, this study examined the Affective Neuroscience Personality Scale (ANPS) in its relationship to the Brief

Symptoms Inventory (BSI), measure of clinical symptomatology, to see if distinct symptom patterns appear by affective neuroscience type. Understanding the relationships between the brain's biological structure, personality, and mental health conditions would help to provide a comprehensive neuroscience-based model between individual's personality and psychopathology type. Results indicate that the ANPS is not a strong measure in its ability to distinguish amongst various types of psychopathology. The ANPS scale does distinguish between positive and negative affect states by amongst the various scales. Limitations still exist in developing measures with direct neuroscience correlates.

B-22

THE INTERPLAY BETWEEN EMOTIONS AND COGNITIVE TASK PERFORMANCE

Gerly Tamm - University of Tartu, University of Missouri; Nelson Cowan, University of Missouri – Recently, it has been suggested that both working memory accuracy and IQ are tightly connected with individual emotional characteristics (Yoon et al., 2014; Spachtholz et al., 2014; Owens et al., 2014; Storbeck et al., 2015). However, so far, little is known about the interaction of individual emotional state and cognitive performance, taking also into account the time course of the procedure. The first goal was to compare the effects of emotional traits and states on cognitive task performance in general. Second, we expected individuals' emotional states to depend on task performance, so that subjects with higher accuracy in cognitive tasks would have more positive emotional state reports. Self-report questionnaires were used to measure emotions. Seven emotional state reports were made during a 2-hour session, along with a change-detection visual working memory task, a Raven's Matrices test of fluid intelligence, and additional emotion and aptitude tasks. In our pilot sample (n=48), we find that emotional state characteristics correlate with task performance more strongly than emotional traits. The same levels of valence, arousal, and feelings of control (dominance) were maintained throughout the experimental procedure by high-performing subjects (as measured on either change-detection or Raven's tasks). In contrast, low-performing subjects started out the same emotionally, but declined in emotional state and dominance as the

working memory task progressed. Their state improved again when the difficult tasks ended. Our preliminary results demonstrate that task difficulty affects emotional valence, arousal and dominance; however, emotional predispositions can contribute to this.

B-23

TASK-EVOKED BRAIN ACTIVITY AFTER NEGATIVE INDUCTION PREDICTS ENHANCEMENT OF MEMORY FOR NEUTRAL MATERIAL

Morenikeji Adebayo - Harvard Medical School, Massachusetts General Hospital; Joseph Andreano - Harvard Medical School, Massachusetts General Hospital; Alexandra Touroutoglou - Harvard Medical School, Massachusetts General Hospital; Bradford Dickerson - Harvard Medical School, Massachusetts General Hospital; Lisa Feldman Barrett - Northeastern University, Harvard Medical School, Massachusetts General Hospital – Previous research has shown that activity in regions of the salience network (SN) during the encoding of negative stimuli predicts later successful subsequent memory (LaBar & Cabeza, 2006). Behavioral experiments have also shown that arousing experiences temporally adjacent to the encoding of neutral stimuli enhance memory (Anderson et al., 2006). We tested the hypothesis that task-related activation of salience regions during a negative affect induction would predict enhancement of memory for neutral material on an encoding task immediately following induction. 41 young adults each completed two scan sessions, approximately 1 week apart. In the first session participants underwent a negative affect induction, then completed a neutral paired associate memory task. The second session was identical, except a neutral pre-encoding affect induction was used. We measured memory enhancement ($\Delta d'$) by subtracting the signal detection score under neutral induction from the signal detection score under negative induction. We measured SN reactivity by contrasting activity during negative vs. neutral affect induction. Linear regression was used to examine the relationship between salience reactivity and $\Delta d'$ due to affect. A significant relationship between induction activity and $\Delta d'$ was found in two major SN nodes (anterior insula & anterior cingulate cortex). A similar trend approaching significance was also observed

in the amygdala. These findings confirm previous research that shows the motivational relevance of neutral material can be enhanced by affect. They are the first to demonstrate that activity in the SN during affect induction, prior to encoding, predicts the magnitude of memory enhancement for neutral material.

B-24

BRAIN BASES OF SOCIAL AFFECTIVE EXPERIENCE: A META-ANALYSIS OF HUMAN NEUROIMAGING STUDIES

Michael H. Parrish - University of North Carolina at Chapel Hill; Jeffrey A Brooks - University of North Carolina at Chapel Hill; Holly Shablack - University of North Carolina at Chapel Hill; Kristen Lindquist - University of North Carolina at Chapel Hill – Human beings are social animals. It thus stands to reason that affective experiences that occur in social contexts are particularly evocative to humans. Although recent meta-analyses explored the neural basis of human affect and emotion (Kober et al. 2008; Lindquist et al. 2012; Vytal & Hamann, 2009), no research to date has systematically explored how the brain responds during social v. non-social affective experiences. To address this question, we performed a meta-analysis of the neuroimaging literature using 86 studies (182 contrasts) of affect and emotion published between 1992 to 2013. We used the Multivel Kernel Density Analysis to assess whether there are relative differences in neural activity during affective experiences in response to social stimuli (including other people) versus non-social stimuli (not including other people). We found more consistent activation in the left anterior insula (AI) during social v. non-social affective experiences. A second analysis revealed that this effect is driven by the experience of unpleasant affect in social contexts. Unpleasant, social experiences resulted in consistent activity in the AI, anterior cingulate cortex (ACC), caudate, pre-SMA and amygdala; there were no consistent activations associated with pleasant, social experiences, however. The brain areas observed comprise the “salience network” that is implicated in attention (Corbetta & Shulman, 2008) and highly arousing affective experiences (Seeley et al. 2007; Touroutoglou et al. 2011). Our findings thus suggest that social contexts may tune the experience of affect, resulting in greater vigilance and more arousal.

B-25

EFFECT OF LOW LEVEL FEATURES ON AFFECTIVE STATES IDENTIFICATION FOR THE AUDIOVISUAL STIMULI

Jongwan Kim - University of South Carolina; Douglas H. Wedell - University of South Carolina; Svetlana V. Shinkareva - University of South Carolina – Recent research has demonstrated that affective states elicited by viewing sets of pictures varying in valence and arousal are identifiable from the distributed whole brain activation patterns (Baucom, et al., 2012). One of the challenges for studying affective responses to individual stimuli is the possible confounding of lower level features of the stimuli. For example, valence is positively correlated with brightness and arousal is related to loudness and motion. The current work investigated whether affective states can be identified for dynamic naturalistic stimuli presented in an incidental affective processing paradigm while controlling for low level features. Eleven participants were presented with audiovisual stimuli reflecting valence and arousal in an fMRI experiment. Multivoxel pattern analysis was used to predict valence and arousal within participants within areas responsive to naturalistic audiovisual presentation, independent of affective content and primary perception. The visual (hue, saturation, and brightness), acoustical (frequency and amplitude), and six motion components for each stimulus were regressed out as covariates representing possible confounds. Five low-level features components were generated from three separate PC analyses and residuals were used for further analysis. Results demonstrated above chance ($p < .05$) identification of valence and arousal of the stimuli within participants, with accuracies comparable to previous work. Valence of audiovisual stimuli was significantly identified in 10 out of 11 participants and arousal was identified in 8. The results demonstrated that valence and arousal information lies within distributed brain regions responsive to video watching controlling for potentially confounding low level features of the stimuli.

B-26

FACIAL EMOTION RECOGNITION AMONG OLDER ADULTS WITH UNIPOLAR

DEPRESSION *Paulo Shiroma - University of Minnesota* – Background: The “mood

congruency hypothesis" posits the tendency to attribute negative emotions to neutral faces in depressed patients. This negative bias might be a trait characteristic independent of mood improvement explaining why remitted patients are still vulnerable to development of further depressive episodes. The phenomenon of distorted emotion processing among older adults with depression has not been adequately examined.

Methods: Three groups of older adults (≥ 60 years-old) free of antidepressant [active major depression (MDa), $N=30$; remitted major depression (MDr), $N=15$; never-depressed controls (NDc), $N=15$] were compared in a computerized emotion recognition task. Main outcomes were accuracy and reaction time to identify happy facial expression portrayed at different emotional intensities (0%, 25%, 50%, 75% and 100%). Covariates included executive functions, anxiety level, medical comorbidity, level of subjective stress, and level of social support.

Results: Overall, there was a statistically significant difference in accuracy to identify happy expressions ($F=5.77$, $df=60$, $p=0.005$) (ND=83.9% vs MDa=75.4% vs MDr=75.5%). Reaction time was not statistically different among three groups ($F=1.25$, $df=59.7$, $p=0.294$) (ND=521 ms vs MDa=664 ms vs MDr=617 ms). Stratification of facial stimuli by intensity showed a decreased accuracy at 25% and 50% intensity across the 3 groups with ceiling effect at 0, 75 and 100% intensity. **Conclusions:** Negative bias measured by facial emotion identification appears as a vulnerability factor for depression that extends to older adults. Further studies would be necessary to examine whether correction of emotional bias may improve response and prevent relapse in late-life depression.

B-27

ANXIETY MODULATES INSULA ACTIVATION TO PRECISE VERSUS SIMPLIFIED MENTAL REPRESENTATIONS OF RISK

Christina F. Chick - Cornell University; Valerie F. Reyna - Cornell University; Roni A. Setton - Cornell University; Rebecca B. Weldon - Cornell University – We tested whether different mental representations of numerical information could change insula activation to identical risks. We measured trait anxiety in 31 adults, who also completed a risky-choice framing task in an MRI scanner.

With either lives or money at stake, options were presented as gains or losses. Participants chose between (a) a sure option and (b) a risky option that offered either no reward (or loss), or some probability of a larger reward (or loss). For each scenario, sure and risky options were equal in expected value. Subjects were cued to compare the options using either simplified (categorical) or precise (numerical) mental representations. Higher trait anxiety was associated with more activation in the anterior insula when subjects chose a risky loss compared to a sure loss. Moreover, precision of mental representation modulated insula activation to risks. When subjects were cued to represent risks in a simplified manner (e.g., some gain or loss vs. no gain or loss), higher anxiety was associated with more insula activation during risk-averse behavior. However, when subjects were cued to represent risks precisely (e.g., exact probabilities), higher anxiety was associated with more insula activation during risk-seeking behavior. Therefore, higher trait anxiety was associated with higher insula activation for opposite behaviors (choosing a risk versus avoiding a risk), depending on the precision with which subjects represented the identical risk scenario. These results suggest that mental representations of risk can modulate the relationship between anxiety and neural responses to risk, representing a potential new target for intervention.

B-28

SEQUENTIAL FORAGING UNDER ACUTE

AND CHRONIC STRESS *Jennifer K. Lenow - New York University; Sara M. Constantino - New York University; Nathaniel D. Daw - New York University; Elizabeth A. Phelps - New York University* – Many of the decisions that humans make (e.g., whether to change jobs) are analogous to sequential foraging decisions between current known and future unknown quantities. Stress has been shown to influence cognitive, affective, and neurophysiological processes that generally support this class of decision-making, yet we know little about how these influences converge to bias foraging decisions at the behavioral level. For the current study, we measured individuals' levels of stress by assessing subjective responses of chronic and global life stress and by measuring changes in cortisol in response to an acute mild physical stressor (or matched control

task). In a subsequent foraging task, subjects repeatedly decided whether to harvest a currently displayed tree for apples or travel to a new tree, weighing the travel time it takes to get to a new tree against the diminishing returns of the current tree. Optimal foraging theory prescribes that one should leave a current option when its marginal reward rate falls to the average reward rate of the environment. We tested how stress related to the thresholds at which participants left currently diminishing trees in aspiration of a better tree. We find that both acute physiological and chronic subjective stress bias human decision-makers toward overexploiting current resources, indicating a depreciation of overall environment quality. These findings have important implications for understanding how and to what extent stress might affect real-world decisions about weighing current known and future unknown options.

B-29

NEGATIVE INFORMATION-PROCESSING BIAS IN SOCIAL ANXIETY DISORDER MASKS THE BIAS TOWARDS NEGATIVE INFORMATION IN MAJOR DEPRESSIVE DISORDER

Lauren A. Demers - McLean Hospital; Mareen Weber - McLean Hospital, Belmont, MA; Scott, L. Rauch - McLean Hospital; Elizabeth, A. Olson - McLean Hospital; William, D.S. Killgore - McLean Hospital; Diego, A. Pizzagalli - McLean Hospital; Isabelle, M. Rosso - McLean Hospital – Major depressive disorder (MDD) is associated with difficulty disengaging from negative information, while social anxiety disorder (SAD) is linked to a negative interpretation style for ambiguous social stimuli. Although MDD and SAD are frequently comorbid, there is limited research on emotional attention bias in this population. In this study, individuals with MDD and MDD-SAD performed a matching task while exposed to emotional interference. We hypothesized that comorbid SAD would be associated with increased distraction in response to all face stimuli irrespective of affective valence. Twenty-eight subjects with MDD-SAD and 25 with MDD completed the Emotional Interference Task. On each 250ms trial, subjects determined whether two stimuli on the horizontal or vertical axis matched, while ignoring stimuli on the other axis. Stimuli were fearful faces, neutral faces or houses. A three-way repeated-measures ANOVA

examined group (MDD/MDD-SAD), attention (attended/ignored faces), and emotion (fearful/neutral) as predictors of accuracy. There was a significant three-way interaction of group-attention-emotion on accuracy ($F(1,51)=5.62, p=.02$). MDD subjects showed higher accuracy when attending to fearful compared to neutral faces ($t(24)=2.52, p=.02$) and lower accuracy when ignoring fearful compared to neutral faces ($t(24)=-2.25, p=.03$). For MDD-SAD subjects, accuracy was low in both affective conditions. While the MDD group showed an advantage when attending to fear faces and a disadvantage when ignoring them, the MDD-SAD group performed poorly on both emotion conditions. The comorbid group's pattern of enhanced vigilance to all emotional information corroborates prior research showing that SAD is associated with a bias to interpret all social stimuli as threatening.

B-30

STRESS AND EMPATHY: INTACT CAPACITY TO IDENTIFY EMOTIONAL STATE BUT IMPAIRED ABILITY TO TAKE ON ANOTHER'S EMOTION

Siobhan Hoscheidt - Duke University; Daniel Wei - Duke University; Kevin LaBar - Duke University – Empathy is the ability to recognize and vicariously experience the emotions of another person. Empathy is defined along two dimensions: cognitive and emotional. Cognitive empathy is the capacity to identify another person's emotional state independently of one's own affective state. Emotional empathy is a shift in affective state towards that of another person. Cognitive and emotional empathy are most often salient in distress situations, which likely induce stress responses. To date, no studies have directly manipulated and examined the effects of stress on multiple dimensions of empathy. This study examined the effects of stress on cognitive and emotional empathy. Participants underwent a stress induction, the socially evaluated cold-pressor task (SECPT), or a matched control task. Participants completed the Multifaceted Empathy Test (MET) composed of forty pictures (20 positive affect, 20 negative affect) of individuals conveying an emotional state. Cognitive empathy was assessed through the ability to choose the correct descriptor for the emotion depicted in the picture in a multiple-choice paradigm. Participants were asked to indicate how

much they empathized with a person using a scale from “not at all” to “a lot” as a measure of emotional empathy. Stress and control groups performed equivalently on cognitive empathy. Stress participants showed significantly impaired emotional empathy. Results provide evidence that cognitive and emotional empathy are distinct processes and that stress selectively impairs one’s ability to take on the affective state of another. Findings suggest that stress shifts individuals to a less emotionally empathic state, perhaps as an evolutionary adaptation for self-preservation.

B-31 AMYGDALA-PREFRONTAL WHITE MATTER INTEGRITY AND PERCEIVED STRESS

Samantha N. Jacobs - Dartmouth College; James M. Taylor - Dartmouth College; Robert S. Chavez - Dartmouth College; M. Justin Kim - Dartmouth College; Paul J. Whalen - Dartmouth College – The extant literature on amygdala-prefrontal white matter anatomy suggests that increased structural integrity may play a protective role. Decreased fractional anisotropy (FA), a numeric descriptor of water diffusion directionality in white matter, within amygdala-prefrontal pathways has been linked to a host of clinical outcomes, including major depression disorder, social anxiety disorder, and post-traumatic stress disorder. Moreover, recent animal models in rats and non-human primates suggest that chronic, early-life stress is related to decreased myelination in homologous tracts extending anteriorly from the amygdala. The present study builds on this research, proposing a structural underpinning of the diminished capacity to cope with perceived stress. Participants underwent two 61-direction diffusion imaging scans and a high-resolution anatomical scan. After the scan session, participants completed Cohen’s “Perceived Stress Scale”. Amygdala regions of interest (ROIs) were defined separately for each participant using subcortical parcellations of their T1 scan. These ROIs were used as seed regions for probabilistic tractography, and tract correspondence was next compared across individuals. We then correlated mean FA values from each bilateral tract with participants’ perceived stress scores. Bootstrapped confidence intervals and estimates of effect size with 10,000 replicates reveal a significant inverse relationship that is present bilaterally, though stronger in the

right ($r=-0.498$, bootstrapped 95% CIs -0.770 , -0.137) than in the left ($r=-0.428$, bootstrapped 95% CIs -0.701 , -0.018) hemisphere. These results suggest that amygdala-prefrontal integrity may be a biomarker of individual differences in ability to handle stress, and in the future, may aid in identifying those at-risk for developing anxiety disorders.

B-32 THE EFFECTS OF REPEATED QUESTIONING ON EYEWITNESS MEMORY UNDER CONDITIONS OF STRESS *Jessica M.*

Karanian - Boston College; Linda A. Henkel - Fairfield University – Information obtained from eyewitness interviews is notoriously unreliable. Laboratory research demonstrates that repeated questioning can decrease both memory accuracy and confidence. Furthermore, elevated levels of cortisol at the time of memory retrieval can induce significant memory impairments. Despite the common co-occurrence of repeated questioning and stress in real-world eyewitness circumstances, these two factors have not been studied in conjunction. In the present study, we investigated the effects of repeated questioning and stress on eyewitness memory. We hypothesized that the memory impairments that typically result from repeated questioning would be exacerbated under conditions of stress. Accordingly, we implemented a paradigm to recreate a real-world eyewitness experience. All participants ($N=50$) played the role of an eyewitness to a videotaped crime scene in which a theft occurs, and then participants underwent either a stressful ($n=25$) or neutral ($n=25$) psychosocial manipulation. Following a 30-minute delay, participants were questioned about the witnessed crime. Then, regardless of performance, participants were re-questioned. To measure stress levels, two saliva samples were collected (baseline, post-stress), and participants also completed three self-reports of affect. Our preliminary behavioral analyses revealed that participants exposed to the stress manipulation changed significantly more accurate responses to “I don’t know” when re-questioned. Furthermore, when collapsing over conditions (control, stress), self-reports of high negative affect immediately prior to questioning were associated with significantly more response changes from accurate to inaccurate during re-questioning. These preliminary results suggest

that the memory impairments typically associated with repeated eyewitness questioning are exacerbated under conditions of psychological stress.

B-33

REDUCED DORSOLATERAL PREFRONTAL CORTEX ACTIVITY FOLLOWING SOCIAL CHALLENGE IN INDIVIDUALS AT FAMILIAL RISK FOR SCHIZOPHRENIA

Erik C. Nook - Harvard University; David Dodell-Feder - Harvard University; Juston Osborne - Harvard University; Jill M. Hooley - Harvard University; Lynn E. DeLisi - Boston VA Medical Center, Harvard Medical School; Christine I. Hooker - Harvard University – Schizophrenia is associated with severe impairments in social functioning, and a growing body of research shows that individuals who have family members with schizophrenia also show atypical social cognitive abilities. However, little is known about how people who are at familial high risk (FHR) for schizophrenia respond to social situations that are emotionally evocative, even though resilience to social conflict is an important socioaffective skill. Here, we used a well-established social challenge task to test the hypothesis that FHR individuals show reduced activity in regions commonly implicated in emotion regulation following criticism. Twenty-one FHR participants who have at least two relatives with schizophrenia and 19 healthy controls completed the “Expressed Emotion” task while in the fMRI scanner. Participants heard positive, negative and neutral comments about a person, and they were told to imagine that each comment was directed at them. Hence, this task simulates the experience of being criticized, being praised and hearing a neutral comment about oneself. Standard preprocessing and analysis techniques were used to model how each group responded to the critical comment, as compared to the neutral comment. As hypothesized, FHR participants showed reduced activity in the right dorsolateral prefrontal cortex compared to healthy controls after listening to the critical vignette. This result suggests that people at familial risk for schizophrenia may be impaired in regulating negative emotions aroused by social conflicts such as criticism.

B-34

GAME ON!: BIOBEHAVIORAL INDIVIDUAL DIFFERENCES IN THE ACUTE STRESS-REDUCTION EFFECTS OF A MOBILE ATTENTION BIAS MODIFICATION GAME FOR ANXIETY

Laura Egan - Hunter College of The City University of New York; Sarah Babbirk - The Graduate Center of The City University of New York; Samantha Berthod - The Graduate Center of The City University of New York; Olga Gulyayeva - Hunter College of The City University of New York; Peter Luehring-Jones - Hunter College of The City University of New York; Tracy A Dennis - Hunter College of The City University of New York – Exaggerated attention to threat is a potential causal mechanism in anxiety. Attention bias modification training (ABMT) targeting this threat bias reduces both clinical and subclinical symptoms of anxiety. ABMT can be effectively embedded in a gamified format (an iOS application, or app), but little is understood about individual differences that moderate its efficacy. Scalp-recorded event-related potentials (ERPs) were used to examine whether individual differences in distinct neurocognitive responses to threat – attention allocation (P1), configural processing (N170), emotional evaluation (P2), and cognitive control (N2) – influenced acute effects of a gamified ABMT mobile app in 42 (21 females) trait anxious adults. Following app play (ABMT versus placebo), subjective anxiety and stress reactivity (observed and self-reported) were measured. ABMT versus placebo resulted in lower stress reactivity among those evidencing one of three patterns of neurocognitive processing of threat: those showing less attention allocation [P1: $F(1, 37) = 5.71, p = .02, R^2 = .11$] or more configural processing of threat [N170: $F(1, 37) = 7.53, p = .01, R^2 = .15$] prior to training, and those showing sustained attention allocation following training [P1: $F(1, 36) = 4.70, p = .04, R^2 = .08$]. ABMT increased the magnitude of attention control responses to threat, but only among males [N2: $F(1, 37) = 6.70, p = .04, \text{partial } \eta^2 = .11$]. Results illustrate the need to consider individual differences relevant to the role of early neurocognitive processing of threat in the acute stress-reduction effects of gamified ABMT.

B-35

STRESS DIFFERENTIALLY AFFECTS RISK-TAKING IN SOCIAL AND NON-SOCIAL

DOMAINS *Oriel FeldmanHall - New York University; Candace Raio - New York University; Jennifer Kubota - University of Chicago; Morgan Seiler - New York University; Elizabeth A. Phelps - New York University* – Although previous research suggests that non-social risky choices can be compromised under stress, little is known about how we navigate risky social exchanges under stress. Here we examine the interaction between stress and social decision-making. Subjects played a non-social gambling game and a conceptually matched trust game with multiple unique partners—where trust was operationalized as the willingness to invest in partners who can reciprocate monetary exchanges—after either control or stress manipulations. Subjects who were not under stress showed no differences between money spent to gamble and money entrusted to partners. In contrast, stressed subjects spent more money gambling but less money in the trust game, exhibiting increased risk-taking in a non-social context but decreased risk-taking in a social context. To further decompose how stress differentially affects how individuals value risk in social versus non-social contexts, we modeled the effect of feedback (i.e. winning or losing in the gambling task, and partners who reciprocated or defected in the trust task). Regardless of stress, subjects were highly attuned to feedback in non-social contexts, believing that every incremental loss leads to a greater chance of winning on the next trial (gamblers' fallacy). In contrast, non-stressed subjects behaved rationally and did not incorporate feedback when deciding to trust another, in essence treating each new interaction independently from previous experiences. However, these adaptive social decisions broke down under stress, as subjects became highly sensitive to irrelevant social feedback under stress.

B-36
INTOLERANCE OF UNCERTAINTY AND THE REINFORCEMENT RATE OF THREAT: A STARTLE ELECTROMYOGRAPHY INVESTIGATION *Brian Chin - Stony Brook University; Brady D. Nelson - Stony Brook University; Felicia Jackson - Stony Brook University; Greg Hajcak - Stony Brook University* – Intolerance of uncertainty (IU) is the tendency to perceive or experience uncertainty as unpleasant or stressful.

Previous research has demonstrated that IU is associated with aberrations in emotional and motivational responding in anticipation of temporally uncertain threat. However, few studies have examined whether high IU individuals are also sensitive to other features of threat that can vary in predictability. The present study examined whether IU was associated with the startle electromyography response during conditions of low vs. high threat reinforcement predictability. Specifically, 45 participants completed a self-report measure of IU and a fear learning task in which the conditioned stimulus was reinforced with an electric shock to the forearm on 50% of trials in one block and 75% of trials in a second block. The startle response was measured during each threat condition. Results indicated that, across all participants, the startle response was greater during the 75% relative to the 50% reinforcement condition. However, IU was positively correlated with the startle response during the 50%, but not the 75%, reinforcement condition. In other words, despite receiving fewer electric shocks during the 50% reinforcement condition, individuals with high IU demonstrated greater defense system activation. The association between IU and startle was independent of state anxiety. The present study adds to a growing literature suggesting IU is associated with abnormal emotional and motivational responding in the context of uncertain threat. Future research is needed to determine whether increasing tolerance of uncertainty subsequently impacts psychobiological measures of sensitivity to uncertain threat.

B-37
REJECTION SENSITIVITY IS RELATED TO ALTERED NEURAL PROCESSING OF FEAR *Naoyuki Sunami - Western Illinois University; Alicia Vallorani - Western Illinois University; Sandra L. McFadden - Western Illinois University; Masu Omura - Western Illinois University; Elizabeth M. Kiebel - Western Illinois University; Kristine M. Kelly - Western Illinois University* – Rejection sensitivity (RS) is characterized by the fear of and overreaction to interpersonal rejection (Downey, & Feldman, 1996). Multiple studies have shown increased dorsal anterior cingulate cortex (dACC) activity in individuals high in RS when viewing socially threatening stimuli, such as disapproving faces (Burklund, Eisenberger, & Lieberman,

2007) and scenes of rejection (Kross, Egner, Oschner, Hirsch, & Downey, 2007), but not when viewing fear-based images. Other research has shown the dACC to be involved in fear processing (Milad, et al., 2007) as well as trait anxiety (Sehlmeye, et al., 2011) and catastrophizing (Kalisch, Gerlicher, & Anna, 2014). Because RS is associated with both trait anxiety (Koseki, Suyama, Kaneko, & Suzuki, 2014) and social anxiety (Sun, & Woo, 2011), it is possible that individuals high in RS are hypervigilant toward fearful situations in general and not only toward rejection. A sample of 32 undergraduate students completed a measure of RS and then performed an emotion-labeling task while event related potentials were recorded. Individuals high in RS reported typical feelings and exhibited typical neural responses for images intended to elicit sadness, amusement and contentment (images from Mikels et al., 2005). When looking at images that typically evoke fear, however, individuals high in RS had more negative late slow-wave activity ($r = -.47$), consistent with higher distress, more negative appraisal and lower approach motivation (White et al., 2014). The findings suggest that individuals high in RS may be more susceptible to fear in general rather than only fearing rejection.

B-38

ALTERED NEURAL REGULATION OF EMOTIONAL PROCESSING IN

CHRONICALLY VICTIMIZED GIRLS *Michelle*

E. Miernicki - University of Illinois at Urbana-Champaign; Karen D. Rudolph - University of Illinois at Urbana-Champaign; Eva H. Telzer - University of Illinois at Urbana-Champaign – Peer victimization is a common social stressor associated with significant social and emotional costs for youth, such as depression. However, little is known about how victimization leads to depression or why some victimized youth may be more vulnerable to depression than others. We hypothesized that chronic victimization may either be associated with maladaptive neural processing of social and emotional cues, thereby conferring risk for depression (i.e., mediation) or heighten the association between victimization and depression (i.e., moderation). A unique sample of 44 female adolescents was recruited from a longitudinal study that assessed youth annually from the 2nd – 8th grade. Two groups were composed of girls with chronic victimization exposure or non-exposure

based on self-reported victimization from 2nd-8th grade. In 9th grade, adolescents completed self-report measures of depressive symptoms and completed an emotional processing task (Lieberman et al., 2007) during an fMRI scan. Participants were presented pictures of emotional faces and either passively observed or matched the faces to an emotion label. Preliminary results suggest that victimized girls report significantly higher levels of depression than non-victimized girls. At the neural level, chronically victimized girls exhibit altered neural reactivity in affective brain regions during emotional processing, as well as altered functional connectivity between affective (amygdala) and regulatory (PFC) regions. This altered functional connectivity is correlated with depression only in the victimized group but not non-victimized group, and might indicate poor regulatory processing for chronically victimized females. Additional analyses will test whether altered neural reactivity and regulation mediate group differences in depression.

B-39

DCN Travel Award winner

EARLY SOCIAL DEPRIVATION ALTERS PREFRONTAL-AMYGDALA CIRCUITRY INVOLVED IN FEAR LEARNING *Jennifer A.*

Silvers - Columbia University; Daniel S. Lumian - University of Denver; Laurel Gabard-Durnam - Columbia University; Dylan G. Gee - UCLA; Bonnie Goff - UCLA; Dominic S. Fareri - Columbia University; Jessica Flannery - University of Oregon; Eva H. Telzer - University of Illinois at Urbana-Champaign; Kate Humphreys - Tulane Medical School; Nim Tottenham - Columbia University – Early life stress can profoundly influence fear behavior in childhood and beyond. As members of an altricial species, there is perhaps no early life stressor more disruptive for humans than maternal deprivation, which has been shown to accelerate amygdala development and associated fear learning in rodents following maternal deprivation. However, it has yet to be demonstrated how maternal deprivation alters amygdala-prefrontal dynamics that support fear learning in humans, who typically remain dependent on caregivers longer than any other species. To address this issue, we compared 48 previously institutionalized (PI) youth (34F/14M; 6-16 years) to 55 comparison youth who had never experienced institutional care (29F/26M; 6-16 years). To assess amygdala-

prefrontal circuitry associated with fear learning, participants completed a conditioning paradigm while undergoing functional neuroimaging wherein visual cues were paired with either a neutral or aversive tone (CS- and CS+, respectively). Both PI and comparison youth showed robust behavioral evidence of fear learning that was supported by CS+ > CS- discrimination in the basolateral amygdala. However, compared to same-aged controls, PI children showed greater CS+ > CS- discrimination in the centromedial nucleus of the amygdala and more adult-like prefrontal-amygdala functional coupling. These data build on existing evidence showing adult-like prefrontal-amygdala coupling in youth following maternal deprivation and are suggestive of ontogenetic acceleration of fear learning circuitry following maternal deprivation.

B-40

ADAPTIVE ELABORATION: INDIVIDUAL DIFFERENCES IN THE PROCESSING OF NEGATIVE EMOTIONAL INFORMATION PREDICT RESILIENCE

Sara J. Sagui - University of North Carolina at Charlotte; Sean A. Dawson - University of North Carolina at Charlotte; Sara M. Levens - University of North Carolina at Charlotte – Attention to negative emotional information has been linked with rumination and depression, yet little is known about how attention to affective content relates to resiliency. The present study sought to investigate how the degree of attention capture for negative emotional expressions varies by trait resilience. Participants (N=69, mean age 19.3 years old, 85% female) completed an affective priming task where facial expressions of sad, angry, disgust, and neutral emotions were presented first as Primes (for 500ms) and then as Targets. Reaction time (RT) to identify the target's emotional expression was assessed as a function of the primes. Prime effects were calculated by subtracting the RT for an emotion target that followed the same emotional prime from the average RT for an emotion target that followed a neutral prime. Larger priming scores indicate emotion facilitation and less attention capture of an emotion-congruent prime compared to a neutral prime. The Ego Resiliency Scale (ER89) was used to measure trait resilience. Hierarchical regression

analyses controlling for age, gender, and current depressive symptoms revealed that only the sad priming score was a unique significant predictor of resilience ($\beta=.34$, $p<.01$). Specifically, individuals who had less attention capture and elaborative processing of initially presented sad stimuli exhibited higher levels of resilience. These results suggest that the tendency to process rapidly presented sad content less elaborately is adaptive. More broadly, less attention to negative content may facilitate appropriate emotion regulation and responding, promoting less negative emotional engagement during difficult experiences.

B-41

GENDER DIFFERENCE DURING THE FAIRNESS-RELATED DECISION-MAKING PROCESSES IN THE SOCIAL STRESSFUL

SITUATION *Li Zheng - East China Normal University; Ruipeng Ning - East China Normal University; Xuemei Cheng - East China Normal University; Xiuyan Guo - East China Normal University* – Male and female have different typical responses to stress, i.e. fight-or-flight for male and tend-and-befriend for female. When faced with stress or threat, male tend to exhibit more unbowed responses than female. The present functional MRI study aimed to explore the gender difference during the fairness-related decision-making processes in the social stressful situation. Eighteen women and eighteen men were scanned while they were playing an adapted version of the Ultimatum Game (UG) as responders. In the control condition, the participant played one on one with the proposer. In the stressful condition, the participant also played with the proposer, but she/he was informed that the proposer had three friends who supported any division schema given by the proposer. Results revealed that, men rejected more often and reported less fairness ratings compared to women in the stressful condition. At the neural level, we found clusters located in bilateral anterior insula, brain regions observed robustly in prior studies adopting UG paradigm, were activated more strongly when rejecting relative to accepting unfair division schemas in the stressful compared to the control condition for men, but not for women. These Results demonstrated the gender difference in the impact of the stressful context on

responders' fairness-related social decision making.

B-42

BIOLOGICAL MOTION PERCEPTION IN CHILDREN WITH DEVELOPMENTAL BRAIN DYSFUNCTION (DBD) & THEIR PARENTS

Antoinette Sabatino - Geisinger- Autism and Developmental Medicine Institute (ADMI); David W. Evans - Geisinger- Autism and Developmental Medicine Institute (ADMI); Vanessa Troiani - Geisinger- Autism and Developmental Medicine Institute (ADMI) – Humans rely on visual information to perceive and identify the actions of others. From early on in development, infants preferentially attend to displays of biological motion (BioM), and deficiencies in these perceptual abilities can serve as early predictors in infants who eventually develop autism and other DBDs. However, with experience, rudimentary BioM perception develops into higher order abilities of person identification and action recognition. To date, little is known regarding meaningful age-related changes in the perception of BioM and whether passive viewing of BioM stimuli (typically used in infant research) can reflect meaningful BioM attention across the lifespan. Ten children (ages 3-13) with DBDs and their biological parent participated. Participants completed a passive visual task including 6 second clips of point light displays (PLDs) of BioM (a human walking) paired with either object motion (a spinning top) or random motion. Dependent variables were metrics of gaze duration and latency to first fixate at the PLD of BioM collected via a Tobii eyetracker. Children spent less time looking and were slower to fixate to PLDs of BioM ($p < .01$). Children's age was directly related to gaze duration to BioM and indirectly related to latency to fixate on BioM. Latency to fixate on BioM was also related to total scores on a quantitative measure of psychotic traits observed in DBDs. Data collection is ongoing. By comparing eyetracking measures of children and parents, we will demonstrate age related changes in the perception of BioM across development that may also be influenced by genetic factors.

B-43

VISUAL EXPLORATION IN CHILDREN WITH DEVELOPMENTAL BRAIN DYSFUNCTION (DBD) IN RESPONSE TO SOCIAL STIMULI

AND NONSOCIAL STIMULI *Antoinette Sabatino - Geisinger- Autism and Developmental Medicine Institute (ADMI); Vanessa Troiani - Geisinger- Autism and Developmental Medicine Institute (ADMI); David W. Evans - Geisinger- Autism and Developmental Medicine Institute (ADMI) –* Eyetracking research reveals that individuals with Autism Spectrum Disorder (ASD) display an attentional bias towards nonsocial images linked to common categories of circumscribed interests (CI). CI, perseverative attention and reduced visual exploration have been observed in ASD and other developmental brain disorders (DBDs) as well as in typical development, suggesting these behaviors may be best described as a dimensional construct. Fifteen children (2-13 years of age) referred to a neurodevelopmental disorders clinic for developmental concerns, DBDs, and genetic syndromes (e.g., ASD, ADHD, language disorder, 16p11.2 deletion) and a biological parent participated. Participants completed a passive visual search task including complex arrays of social and nonsocial images linked to CI (e.g., trains, computers, electronics) and other everyday items (e.g., clothing, dishes, furniture). Dependent variables were metrics of gaze duration and individual fixations collected via a Tobii eyetracker. Results indicate children looked longer and with greater detail at CI images relative to images of everyday objects ($ps < .001$). Children looked longer and with greater detail at social images paired with everyday objects versus CI images ($ps < .01$). Children's age was related to the number of individual fixations to social images. A parent-child intraclass correlation for gaze duration to CI images approached significance ($ICC(14) = 0.59, p < .06$). Data collection is ongoing. Relationships between additional eyetracking metrics and symptom measures of repetitive behaviors and restricted interests will be explored. By comparing eyetracking measures of children and parents, we will demonstrate how observed differences are indicative of a behavioral phenotype that is continuously distributed and influenced by genetic factors.

B-44

ONE SIZE DOES NOT FIT ALL: METHODOLOGICAL ISSUES IN MEASURING THE FEEDBACK-RELATED

NEGATIVITY (FRN) IN ADOLESCENTS AND

ADULTS Shawn E. Fagan - *The Graduate Center of The City University of New York*; Jill Grose-Fifer - *John Jay College of Criminal Justice of The City University of New York*; *The Graduate Center of The City University of New York* – The feedback-related negativity (FRN) is an ERP component that has been used to investigate the neural correlates of feedback processing. We and other labs have shown that the FRN is still developing during adolescence. However, there is a good deal of variability across studies in how the FRN is measured in terms of both filtering and measurement criteria. In the present study, we reanalyzed our existing data from adults and adolescents ($n=77$), which was recorded while they performed a simple gambling task with unpredictable monetary gains and losses of high and low magnitude. We compared the effects of varying the high pass filter and artifact reject criteria on the amplitude of the FRN. Additionally, we compared results using three different methods of measuring the FRN: a peak-to-peak measure, a mean area amplitude measure over a narrow window around the most negative peak, and a difference wave. Our results show that main effects of magnitude, valence, and age are largely preserved across analyses; however, two- and three-way interactions varied depending on filtering and measurement criteria. The latency of the FRN varied considerably more in adolescents compared to adults; also, adolescent data was more susceptible to artifacts, such as movement. We argue that although some ERP analytical techniques may be well-suited to process adult data, they are not sensitive enough to detect more subtle developmental relationships between age and gender.

B-45

READ MY EXPRESSION: ATTENTIONAL CAPTURE OF ANGRY STIMULI INTERACTS WITH GENDER TO PREDICT INSECURE ATTACHMENT STYLE

Kelsey L. Wolf - *University of North Carolina at Charlotte*; Samantha M. Tracy - *University of North Carolina at Charlotte*; Sara J. Sagui - *University of North Carolina at Charlotte*; Sara M. Levens - *University of North Carolina at Charlotte* – Biases in processing negative content have been linked with insecure attachment style. Critically, studies investigating emotion attention capture

have not investigated the impact of gender, despite the fact that insecure attachment style presents differently for males and females. The goal of the present study was to investigate if attention capture for negative emotional content varies by gender to predict insecure attachment. Participants ($N=250$, 72% female) completed an affective priming task where sad, angry, disgust, and neutral facial expressions were presented first as Primes (for 500ms) and then as Targets. Reaction time (RT) to identify the target's valence (positive or negative) was assessed as a function of the primes. Prime effects were calculated by subtracting the RT to an emotion target with the same emotional expression prime from the average RT for an emotional target with a neutral prime. Larger priming scores indicate less attention capture of the emotion prime, whereas smaller priming scores indicate greater attention capture of the emotion prime. Hierarchical regressions revealed that gender significantly interacts with angry priming scores to predict insecure attachment style. In females, less attention capture of angry primes predicted greater avoidant attachment ($\beta=.16$, $p<.05$), while in males, less attention capture of angry primes predicted less avoidant attachment ($\beta=-.34$, $p<.01$). Results indicate that greater attention capture of angry stimuli is advantageous for females, whereas less attention capture of angry stimuli is advantageous for males. Broadly, this suggests that gender differences in emotional reactivity may influence the way attachment style is developed and maintained.

B-46

REDUCED COGNITIVE INTERFERENCE BY TEMPORAL UNCERTAINTY IN

ADOLESCENCE Alexandra M. Rodman - *Harvard University*; Catherine Insel - *Harvard University*; Alea C. Skwara - *Harvard University*; Erik K. Kastman - *Harvard University*; Stephanie F. Sasse - *Harvard University*; Leah H. Somerville - *Harvard University* – In the face of unpredictable versus predictable cues, our group has previously shown that temporal uncertainty slows cognitive performance in healthy adults. The current study aimed to test whether children, adolescents, and adults are differentially impacted by temporal uncertainty, as measured by cognitive performance and activity of brain systems critical to detecting and resolving uncertainty. $N=109$ healthy

participants aged 9-22 completed an fMRI task that involved making judgments about negative and neutral pictures preceded by either predictable temporal cues, which showed participants a chronological countdown, or unpredictable temporal cues that were entirely random. Consistent with our prior work, reaction times were significantly more slowed to images following unpredictable cues as compared to predictable cues, which suggests that temporal uncertainty leads to cognitive interference. However, findings indicated that the slowing effect of unpredictability vs. predictability varied significantly by age. With increasing age, participants resisted slowing by uncertainty. In addition, a quadratic age analysis showed that adolescents exhibited less uncertainty-based interference than both children and adults. To explore the neurodevelopmental changes that could contribute to this behavioral effect, we examined the relationship between task performance and neural activation in the amygdala. Adolescents showed an overall blunting of amygdala activation compared to children and adults. Moreover, the magnitude of amygdala response to unpredictable vs. predictable images correlated with behavioral slowing, such that individuals with reduced amygdala responses to unpredictable images showed less reaction time slowing in their task performance. These brain-behavior linkages implicate amygdala-based neural systems in uncertainty-related interference processes, and the sensitivity of these systems are dynamically shaped by development. These findings are in line with the theoretical framework of nonlinear neurodevelopmental change in adolescents. Critically, these findings implicate corresponding nonlinear shifts in the neural activity of amygdala-based systems as one potential mechanism for adolescent tolerance of temporal uncertainty. Given that adolescence is an important developmental period for establishing independence and increased explorative behavior, it may be adaptive for adolescents to be less perturbed by unexpected cues from the environment.

B-47

ATTENUATION OF PHYSIOLOGICAL AROUSAL TO UNCERTAINTY DURING THE ADOLESCENT TRANSITION

Maheen Shermohammed - Harvard University; Alea C. Skwara - Harvard University; C. E. Chiemeka

Ezie - Harvard University; Arielle G. Rabinowitz - Harvard University; Leah H. Somerville - Harvard University – Unpredictability is a feature of the environment that has inherent anxiogenic properties, and the intolerance to uncertainty is highly related to clinical anxiety in adults. This perspective would suggest that adolescence, a period in development characterized by the emergence of anxiety disorders, may also be a period of heightened sensitivity to uncertainty. On the other hand, the adolescent transition is associated with intensified novelty-seeking and an increased tolerance to ambiguity in economic decision-making. We sought to shed light on these competing hypotheses by directly assessing developmental changes in physiological arousal to temporal uncertainty from late childhood to early adulthood. In the current study, N=90, healthy participants aged 9-22 viewed negative and neutral pictures preceded by either predictable temporal cues which showed participants a “countdown” that accurately conveyed how many seconds would elapse before a picture appeared, or unpredictable temporal cues that were entirely random. Electrodermal response was continuously recorded from the fingertips as an objective measure of sympathetic autonomic nervous system arousal. Analyses tested whether electrodermal activity during temporal uncertainty relative to certainty differed as a function of participant age. Group analyses focused on three distinct age trends: a linear pattern of developmental change, a quadratic pattern (adolescent-peaking) developmental change, and an adolescent-emergent pattern of developmental change indicating rapid emergence from childhood into adolescence. Results indicated a significant interaction between predictability and the adolescent-emergent age trend. Whereas children and pre-adolescents showed greater physiological arousal to unpredictable relative to predictable contexts, this pattern sharply attenuated into mid-to-late adolescence. These findings suggest that uncertainty becomes less physiologically evocative during adolescence, and supports broader conceptions of adolescence as a period of increased tolerance of uncertainty.

B-48

YOUNG ADULTS REACT MORE LIKE ADOLESCENTS THAN OLDER ADULTS

UNDER TRANSIENT AND SUSTAINED STATES OF EMOTION

Alexandra O. Cohen - Weill Cornell Medical College; Kaitlyn Breiner - University of California, Los Angeles; Danielle Dellarco - Weill Cornell Medical College; Gloria Pedersen - Weill Cornell Medical College; Aaron S. Heller - Weill Cornell Medical College; Marc Rudolph - Oregon Health and Science University; Richard J. Bonnie - University of Virginia School of Law; Kim A. Taylor-Thompson - New York University School of Law; Elizabeth S. Scott - Columbia Law School; Laurence Steinberg - Temple University; Damien A. Fair - Oregon Health and Science University; Adriana Galván - UCLA; BJ Casey - Sackler Institute, Weill Cornell Medical College – For most legal purposes, an individual is considered an adult at the age of eighteen; but sometimes, that age boundary shifts. For example, individuals under age twenty-one are minors for purposes of consenting to government regulated research. Variations in the definition of “adult” exist in many legal and social policies. These distinctions between juvenile and adult often are based on political considerations and conventional wisdom rather than empirical evidence. Although developmental neuroscience research has shown that the brain continues to develop into the early twenties, behavioral and neural distinctions between adolescents and adults continue to be delineated, particularly in the eighteen to twenty-one age range. The present study implements a novel behavioral paradigm, together with psychophysiology and fMRI, to examine impulsivity under transient and sustained states of positive and negative emotion in 87 individuals. We show that 13 to 21 year olds show similarly elevated impulsivity as compared to adults over the age of twenty one in response to transient positive and negative emotional cues as well as when under sustained states of positive emotions. Dynamic developmental changes in a network of ventrolateral prefrontal, orbitofrontal, and subcortical regions parallel these changes in behavior with age. No significant differences in impulsivity were observed across ages in neutral conditions. Our findings suggest that, under emotional arousal, 18 to 21 year olds may behave more similarly to younger adolescents than to older adults. These results may have implications for legal and social policies and judgments of criminal responsibility with respect to young adults.

B-49

NORMATIVE DEVELOPMENT OF VENTRAL STRIATAL RESTING-STATE CONNECTIVITY IN HUMANS

Dominic S. Fareri - Columbia University; Laurel Gabard-Durnam - Columbia University; Bonnie Goff - University of California, Los Angeles; Jessica Flannery - University of Oregon; Dylan G. Gee - Weill Cornell Medical College; Daniel S. Lumian - University of Denver; Christina Caldera - University of California, Los Angeles; Nim Tottenham - Columbia University – Incentives guide behavior throughout our lives, perhaps most importantly during the early years of life. The ventral striatum (VS) is a critical piece of an incentive valuation circuit, sharing afferent and efferent anatomical connections with subcortical and cortical structures additionally supporting incentive valuation (Haber and Knutson, 2010). Resting-state functional connectivity (rsFC) is a powerful, task-free method with which to track the development of functional neural organization. rsFC may reflect maintenance of relationships between regions supporting related processes (Vincent and Buckner, 2007). We employed a seed-based analysis to investigate VS rsFC development in a cross-sectional sample of typically developing individuals aged 4-23 years old ($n=66$). We probed changes in VS rsFC with targeted regions supporting incentive valuation—amygdala, hippocampus and mPFC. Strong positive VS-amygdala connectivity emerged in childhood; however, VS-hippocampal rsFC emerged only in adulthood, consistent with studies showing hippocampal recruitment in incentive-based processes in adults (Foerde and Shohamy, 2011). Specific mPFC regions (subgenual ACC; sgACC) exhibited robust positive connectivity with the VS in childhood, which significantly declined with age. Given associations between testosterone, VS function in adolescence (Op de Macks et al., 2011) and ACC structural development (Koolschijn et al., 2014), we examined changes in testosterone levels as a mechanism underlying VS rsFC development. Testosterone significantly mediated age-related decreases in VS-sgACC rsFC. Our findings suggest normative VS rsFC development is dynamic, characterized by early establishment of connectivity with mPFC and limbic structures supporting incentive valuation, and substantial functional reorganization with later

developing regions during transitions into and out of adolescence.

B-50

ADOLESCENT AMYGDALA RESPONSE LINKED WITH ATTACHMENT SECURITY TO PARENTS

PARENTS Sarah Stoycos - University of Southern California; Larissa Del Piero - University of Southern California; Darby Saxbe - University of Southern California – The amygdala has been implicated in response to emotionally salient information and as playing a role in attachment to parents (Lemche et al., 2006). Specifically, Tottenham et al., (2012) found that children and adolescents exhibited increased amygdala activation in response to photos of their mothers rather than strangers. The current study used an ecologically valid paradigm to investigate adolescent neural response to parents in association to attachment security. Twenty-one adolescents (Mean age = 16.9 years) were shown emotional video clips of their parents and asked to rate the valence of the clips while undergoing functional neuroimaging. The video stimuli were collected during an earlier laboratory visit as part of the ongoing longitudinal study from which the adolescents and their parents were recruited. Self reported attachment was measured using the Inventory of Parent and Peer Attachment—Revised (Armsden & Greenberg, 1987). The magnitude of the bilateral amygdala percent signal changes (in comparison to baseline) were significantly positively correlated with attachment security to parents (right amygdala: $r(19) = .49, p = .03$; left amygdala: $r(19) = .45, p = .05$). Percent signal change in the ventral striatum compared to baseline was marginally associated with attachment security to parents, $r(19) = .42, p = .08$. These results support prior literature highlighting the role of the amygdala and ventral striatum in attachment salience for adolescents. In conclusion, the more adolescents feel they can securely rely on their parents, the more active their bilateral amygdalae are in response to videos of their parents.

B-51

NEURAL CORRELATES OF THE PROPENSITY FOR RETALIATORY BEHAVIOR IN YOUTH AT RISK FOR REACTIVE AGGRESSION

Stuart F. White - National Institute of Mental Health; Michelle Ventieghem - Columbia University;

Sarah J. Brislin - Florida State University; Isaiah Sypher - National Institute of Mental Health; Soonjo Hwang - National Institute of Mental Health; James R. Blair - National Institute of Mental Health – Good animal models of physical reactive aggression exist, but the social aspects of human aggression, including retaliatory propensity during social provocation, are poorly understood. Retaliatory propensity, assessed with the Ultimatum Game, has been associated with increased activation in both threat (amygdala, PAG) and decision-making circuitry (ventromedial prefrontal cortex [vmPFC], dorsolateral prefrontal cortex [dlPFC], dorsomedial frontal cortex [dmFC], anterior insula cortex [AIC]). Differing risk between individuals for reactive aggression is poorly understood. To address this, this study investigated youth with Disruptive Behavior Disorders (DBD; Conduct Disorder, Oppositional Defiant Disorder) with high [DBD+CU] and low [DBD-CU] levels of callous-unemotional traits, who show increased risk for reactive aggression, but distinct neural correlates in threat response and decision-making circuitries. Retaliatory propensity was assessed in 30 DBD youth and 26 healthy youth using a variant of the Ultimatum Game during fMRI. DBD youth showed increased retaliatory propensity that was positively associated with reactive aggression. Furthermore, youth with DBD-CU, but not DBD+CU, showed increased responding in threat circuitry (amygdala, PAG). Youth with DBD showed increased responding in dlPFC decreased functional connectivity between amygdala/PAG and vmPFC, left dlPFC and dmFC relative to healthy youth. DBD-CU showed increased threat response to social provocation consistent with hostile attribution bias models of reactive aggression. However, all DBD youth showed dysfunction in decision-making regions and connectivity between threat and decision-making circuitries. The role of decision-making in response to social provocation will require further investigation.

B-52

AFFECTIVE REACTIVITY AND REGULATION ACROSS ADOLESCENCE: NEURAL RESPONSES TO DYNAMIC PEER EMOTIONS

Jessica E. Flannery - University of Oregon; Nicole R. Giuliani - University of Oregon; John C. Flounoy - University of Oregon; Jennifer H. Pfeifer - University of Oregon – Adolescence is characterized by physiological,

neurological and social changes. The field currently conceptualizes these neurobiological changes and associated social sequelae in terms of an imbalance between systems supporting reactivity and regulation, as well as expects nonlinear patterns of neural reactivity (peaking in adolescence) and linear improvements in neural indices of regulation. Previous research suggests that during emotion labeling or reappraisal, LPFC and MPFC responses increase, and responses in amygdala and mOFC decrease, relative to passive viewing of affective stimuli. However, past work in this area has relied heavily on paradigms using static, adult faces. The current fMRI study (N=60 neurotypical female youth, evenly distributed between 10-22 years of age) utilized a dynamic peer affect-labeling paradigm. Main effects of Label were observed in bilateral LPFC, bilateral amygdala, and mOFC. Main effects of View were observed in bilateral amygdala and mOFC. Although these effects were quite robust, direct comparisons between conditions revealed that Label recruited bilateral LPFC significantly more than View; meanwhile, View recruited mOFC significantly more than Label. Interestingly, however, there was a significant nonlinear (quadratic) pattern of lateral PFC recruitment during Label, reaching a nadir during mid-adolescence; and a significant linear decrease with age in mOFC during View. These findings differ from predictions typically made by common neurobiological models of adolescent development, and highlight the importance of social context in our understanding of adolescent emotion processing. Furthermore, these data allow us to investigate the differential influence of basic versus complex emotions across age.

B-53

THE EFFECTS OF EARLY ADVERSITY ON EMOTIONAL APPRAISAL: IMPLICATIONS FOR AMYGDALA-PREFRONTAL CIRCUIT DEVELOPMENT

Michelle VanTieghem - Columbia University; Laurel Gabard-Durnam - Columbia University; Dylan Gee - University of California, Los Angeles; Jessica Flannery - University of Oregon; Christina Caldera - University of California, Los Angeles; Kate Humphreys - Tulane University; Eva Telzer - University of Illinois at Urbana-Champaign; Todd Hare - University of Zurich; Nim Tottenham - Columbia University – Previous

research suggests that early adverse caregiving alters the developmental trajectory of amygdala-prefrontal circuitry, resulting in heightened emotional reactivity and adult-like fear learning. This research has focused primarily on the function of this circuit when processing facial expressions of clear valence, such as those of fear and happiness. However, adult studies have shown that facial expressions with ambiguous affect (i.e., surprised) can elucidate trait-like emotional biases that are associated with amygdala-mPFC circuitry. Further, typically developing children show a negative bias to surprise faces that declines with age. The current study examined the effects of early adversity on emotional appraisals of surprised faces in a sample of previously institutionalized (PI) youth and comparisons between the ages of 6-14 (N=167, mean age=9.8, M=65). Participants viewed a standardized set of surprised, happy, and angry faces and rated whether each face “felt good or felt bad” as quickly as possible. Resting-state fMRI scans were acquired for a subset of participants to examine the functional integrity of amygdala-mPFC circuitry. PI youth showed more positive (i.e. adult-like) appraisal of surprised faces relative to comparisons ($p<0.05$). Preliminary findings suggest that stronger (i.e. more mature) amygdala-mPFC connectivity was associated with more positive appraisal of surprised faces across both groups ($p<0.05$). Although PI youth showed elevated levels of social anxiety at the group level, those individuals with more positive appraisals showed lower levels of social anxiety ($p<0.01$). These findings suggest that more positive appraisal of ambiguous emotional cues may reflect an ontogenetic adaptation following early adversity.

B-54

THREE-YEAR-OLDS' FACIAL EMG RESPONSES TO EMOTIONS EXPRESSED BY FACES AND BODIES

Elena Geangu - Lancaster University; Ermanno Quadrelli - Milano-Bicocca University; Emanuela Croci - Milano-Bicocca University; Chiara Turati - Milano-Bicocca University – Although emotional mimicry has been proposed as an important mechanism of affect sharing and empathy (Hoffman, 2000), there is little to no evidence showing its presence in infants and preschool children (Jones, 2009). In this study we investigated 3-year-olds' facial mimicry responses to facial and bodily expressions of

emotions by using electromyography (EMG). Three-year-olds (N=18) were presented with static images (500ms) of female faces and bodies expressing happiness, anger, fear, and neutral emotions. EMG was recorded from zygomaticus major (specific for happy facial expressions) and frontalis (activated in angry and fearful facial expressions) muscles. A 2(Condition) x 2(Muscle) x 4(Emotion) ANOVA for the average activation (800-1200 ms from stimulus onset) showed a marginally significant interaction muscle-emotion ($F(3,51) = 2.775, p = .051$) and a significant interaction condition-muscle-emotion ($F(3,51) = 2.938, p = .042$). For faces, but not for bodies, a significant interaction muscle-emotion was revealed ($F(3,51) = 4.484, p = .007$). The zygomaticus activation was higher for happy compared to angry ($t(17) = 2.994; p = .004$) and fearful faces ($t(17) = 2.904; p = .005$), while the frontalis activation was higher for angry compared to happy faces ($t(17) = -1.762; p = .048$). This pattern of results suggests emotionally congruent muscle activation in response to other's facial expressions. The findings will be discussed with respect to the use of facial EMG as a measure for emotional mimicry in pre-schoolers and infants, and their implications for investigating early empathy development.

B-55

BY THE SOUND IT. AN ERP INVESTIGATION OF INFANT PROCESSING OF HUMAN ACTION SOUNDS.

Elena Geangu - Lancaster University; Ermanno Quadrelli - Milano-Bicocca University; James Lewis - West Virginia University; Viola Macchi Cassia - Milano-Bicocca University; Chiara Turati - Milano-Bicocca University – Recent evidence suggests that adults perceive human action (HA) sounds as a distinct category from human vocalizations (HV), environmental (ENV), and mechanical (MEC) sounds, activating different neural networks (Lewis et al., 2011). However, little is known about when such specialization develops. Infants show a relative fast specialization for processing voices (Blasi et al., 2011; Nazzi et al., 1998), but it is unknown whether this ability extends to human actions sounds as well. Our study aimed to investigate whether 7-month-olds process HA sounds as a distinct category compared to HV, ENV, and MEC sounds. Infants were randomly presented with 1000ms auditory recordings specific to each category, while continuous EEG was

recorded (500Hz) with a high density system (Geodesic Sensor Nets, EGI). Event-related potentials (ERPs) time-locked to the stimulus onset were further analysed. Results show that HA lead to increased positive amplitude compared to the other categories at anterior left temporal locations (470-570ms) ($F(3, 42) = 4.65; p = .016$). Human sounds (HA + HV) lead to larger amplitudes compared to non-human sounds (EN + ME) at parietal (550-650ms) ($F(3, 42) = 3.40; p = .026$) and frontal locations (550-750ms) ($F(3, 42) = 6.79; p = .001$) across both hemispheres. HV lead to increased negative amplitude at posterior temporal electrodes (470-570 ms) ($F(3, 42) = 5.22; p = .004$). The current study suggests that 7-month-old infants process HA sounds as a distinct auditory category. Results are discussed in terms of their implications for our understanding of infant action processing development.

B-56

THE NEURAL CORRELATES OF SOCIAL COMPARISONS: DIFFERENTIAL ACTIVATIONS FOR SELF-RELATED COMPARISONS

Gayannee Kedia - University of Graz; Thomas Mussweiler - University of Cologne; Ruth Adams - Klinikum der Universität München; David Linden - Cardiff University – Humans have a drive to compare themselves to others and this tendency determines how they perceive themselves and others, how they feel about their achievements and failures and make decisions in social context. Social comparison constitutes a fundamental social cognitive process but to now its neural substrates remain unknown. Previous research has demonstrated that the comparison of two external persons activate a frontoparietal network associated with numbers and simple nonsocial magnitudes. The closer two magnitudes the slower the comparison and the stronger the activation of this network. In the present fMRI study we investigated whether self-involving comparisons also rely on this comparative frontoparietal network or whether they rather engage specific neuroanatomical correlates. To that end, we asked female participants to compare their own attractiveness or the attractiveness of a female familiar other to a series of unknown women whose pictures were sequentially displayed on the scanner projection screen. Behaviorally, we observed a distance effect

for both Self-Other and Other-Other comparisons. In both conditions, participants were slower for comparisons with targets whose attractiveness was similar to their own (or their familiar others). At the neural level, this distance effect came with the activation of frontal regions previously associated with person and magnitude comparisons (i.e. the DLPFC and dACC). Interaction contrasts, however, also revealed a more pronounced effect of distance for Self-Other comparisons in the anterior insula, a structure known for its role in self-relevant information processing. Taken together, these results suggest that comparisons involving the self engage specific brain regions.

B-57

A NEURAL CODE ABOUT THE PERSONALITY OF THE SELF, CLOSE AND UNFAMILIAR OTHERS IS REPRESENTED IN THE MEDIAL PREFRONTAL CORTEX

Frank Van Overwalle - Vrije Universiteit Brussel; Elien Heleven - Vrije Universiteit Brussel – The medial Prefrontal Cortex (mPFC) is involved in inferences about the personality traits of the self and others. We investigated whether the mPFC also represents the neural memory code for persons that possess these traits, as this code might be critical for normal social interaction. To localize these codes, we used fMRI repetition suppression, which is a rapid suppression of fMRI responses upon repeated presentation of the same stimulus, in this case, the person as he or she is (i.e., with a set of traits). Participants had to infer a person's traits from brief trait-implicating behavioral descriptions. In each trial, the critical (target) sentence was preceded by a sentence (prime) that implied the same person or not. Experiment 1 demonstrated that a neural code of close others (family and friends) is located in the mPFC. Experiment 2 showed that a code of unfamiliar others (with Star Trek-like names) is located in the anterior intraparietal sulcus, and also in the mPFC although its exact location differed between participants. This may indicate that the mPFC serves as a varying and temporary placeholder to code unfamiliar persons. Experiment 3 revealed that a neural code about the self is located in the mPFC and precuneus. Furthermore, activation in the mPFC (for close others and the self) is correlated with the size of the participants' social network. Together, these person codes provide us with an atlas of

brain areas which contain critical memory on (the personality of) the self and others.

B-58

NEURAL REPRESENTATIONS OF FAMILIAR PEOPLE AND SITUATIONS

Sara C. Verosky - Oberlin College; Jason P. Mitchell - Harvard University – Thinking about the self and others involves a network of regions that includes the medial prefrontal, posterior cingulate, and lateral inferior parietal cortices. Interestingly, many of these same regions tend to show decreased activity during most goal-directed tasks, and only show increased activity under conditions that foster internally directed thought. While we know these regions are sensitive to social dimensions such as the similarity between others and the self, little is known about specific content represented in them. The current study used functional magnetic resonance imaging (fMRI) and multivoxel pattern analysis (MVPA) to examine representations of familiar people. While in the scanner, participants indicated how much they and four familiar others would enjoy being in various situations. Participants answered ten questions about each of six types of situation; for example, how much they would enjoy reading comic books, novels, and People magazine. Unique patterns of activity in medial prefrontal cortex and posterior cingulate cortex were associated with thinking about different familiar people. We also discovered unique patterns of activity in those same regions, as well as in bilateral parietal regions, for thinking about different situations. Together, our findings demonstrate that social brain regions overlapping with the default network carry information about people and situations, both of which are important for simulating events removed from the present.

B-59

NEURAL DISSOCIATIONS BETWEEN MEANINGFUL AND MERE INCONSISTENCIES DURING IMPRESSION UPDATING

Peter Mende-Siedlecki - New York University; Alexander Todorov - Princeton University – We rapidly form impressions of other people, but these initial impressions are often incomplete and must be updated in light of inconsistent information. While recent work has begun to characterize the neural bases of impression updating, the functional contributions of

these regions to the updating process remain unclear. Using fMRI, we tested whether increases in activity in the updating network reflect changes in the stored representations of other people in response to behavioral inconsistency, or merely a response to the inconsistency itself. Participants encountered a series of individuals whose behavior was either “meaningfully” inconsistent (switching from either moral to immoral or immoral to moral) or “merely” inconsistent (switching in a surprising, but not trait-relevant manner). Left vIPFC and left IFG responded preferentially to “meaningful” inconsistency—specifically when behaviors changed in character from moral to immoral, consistent with prior work. However, bilateral TPJ, dorsal ACC, and PCC responded preferentially when behavior changed in a “merely” inconsistent fashion. Furthermore, we began to assess the behavioral consequences of individual differences in updating. Combining across three neuroimaging investigations impression updating, we examined the degree to which activity in key nodes of the updating network might underscore individual differences related to updating. We observed that individuals who show stronger vIPFC activity when updating based on negative behaviors, as compared to positive behaviors, scored lower on a composite updating index (i.e., endorsed less flexible views regarding personality and reported a lower frequency of changing their minds about other people in everyday life).

B-60

SOCIAL BUTTERFLY OR LONER? INDIVIDUAL DIFFERENCES IN SOCIAL INTEREST ARE REFLECTED IN SCALED ACTIVATIONS OF ORBITOFRONTAL

CORTEX FACE-PATCHES Vanessa Troiani - Geisinger Autism & Developmental Medicine Institute; Ingrid R. Olson - Temple University – Humans are extraordinarily tuned to the social world, driven to connect with other humans from the earliest moments of life. Social motivation engages intrinsic motivational mechanisms to attend and approach social stimuli. Individual differences in social motivation may be reflected in differential activations in brain regions that support both social and reward processing. A candidate neural region is orbitofrontal cortex (OFC), a region broadly implicated in value computations, with

activations reflecting scaled value responses to objects (including money & food). OFC also contains patches of face-sensitive cells, which we speculate encode the social and emotional value of conspecifics. We tested the hypothesis that individual variation in social motivation is linked to activation of OFC face patches. Location and fMRI response properties of OFC face-selective patches were characterized in 20 healthy adults. Results showed that medial OFC (mOFC) responses were face-selective and behaviorally relevant, as activation in this region correlated inversely with social interest/enjoyment as measured by the aloof subscale of the broader autism phenotype (BAP-Q). In contrast, the ventral striatum and lateral OFC responded equally to faces and food. Furthermore, differences in mOFC activation across subjects were distinct from face memory (Cambridge Face Memory Test) responses in the fusiform, suggesting a distinct function of mOFC in social motivation, rather than perceptual aspects of face processing. These findings suggest that regions of the OFC are selective for social stimuli and that the function of this region in the extended face network is linked to social motivation.

B-61

EFFECTS OF MOOD ON THE PROCESSING OF EMOTIONAL STIMULI IN SELF-RELEVANT AND NON-SELF-RELEVANT CONTEXTS

Eric C. Fields - Tufts University, Massachusetts General Hospital; Matthew O'Connor - Tufts University; Erich Tusch - Brigham and Women's Hospital; Rohan Natraj - Tufts University; Gina R. Kuperberg - Tufts University, Massachusetts General Hospital – In previous work (see Fields & Kuperberg, *NeuroImage*, 2012; Fields et al., *SANS*, 2012), we have explored the processing of emotional words in social context by recording event-related potentials (ERP) while participants read two-sentence social vignettes in second-person (self-relevant) or third-person (other-relevant) with a neutral, positive, or negative critical word in the second sentence. For example: "A man knocks on Sandra's/your hotel room door. She/you see(s) that he has a *gift/tray/gun* in his hand." In the present work, we explored the effects of mood on the processing of these scenarios by inducing either a positive or negative mood in participants (between subjects) creating a 2 (Mood: positive, negative) x 2 (self-relevance: self, other) x 3 (valence: neutral,

positive, negative) design. Results revealed a different pattern effects across the two mood conditions on the late positive component (LPC) that is often evoked by emotional stimuli. In the Happy condition, the LPC was larger to positive and negative words than to neutral words, but negative and positive words did not differ. In the Sad condition, the LPC to negative words was larger than the LPC to positive or neutral words, which did not differ from each other. These effects, in turn, were stronger for the self-relevant condition than the other-relevant condition. Thus, it seems that positive words may draw additional attention and processing in a happy mood, particularly for stimuli that are self-relevant.

B-62

INCREASED ATTENTION AND MEMORY FOR BELOVED-RELATED INFORMATION DURING INFATUATION: BEHAVIORAL AND ELECTROPHYSIOLOGICAL DATA

Sandra J.E. Langeslag - University of Missouri at St. Louis; Jamie R. Olivier - Erasmus University Rotterdam; Martine E. Köhler - Erasmus University Rotterdam; Ilse M. Nijs - Erasmus University Rotterdam; Jan W. Van Strien - Erasmus University Rotterdam – Emotionally salient information is well attended and remembered. It has been shown that infatuated individuals have increased attention for their beloved. It is unknown whether this attention bias generalizes to information related to the beloved. Moreover, infatuated individuals report to remember trivial things about their beloved, but this has not yet been tested empirically. In two studies, we tested whether infatuated individuals have increased attention and memory for beloved-related information. In a passive viewing task (Study 1), the late positive potential, an event-related potential (ERP) component reflecting motivated attention, was enhanced for beloved-related vs friend-related words/phrases. In a recognition task (Study 2), memory performance and the frontal and parietal ERP old/new effects, reflecting familiarity and recollection, respectively, were not enhanced for beloved-related compared with friend-related words/phrases. In free recall tasks in both studies, memory was better for beloved-related than friend-related words/phrases. This research reveals that attention and memory are enhanced for beloved-related information. These

attention and memory biases for beloved-related information were not due to valence, semantic relatedness, or experience, but to arousal. To conclude, romantic love has profound effects on cognition that play a clear role in daily life.

B-63

SELF-ESTEEM AND AUTOBIOGRAPHICAL MEMORY RECONSTRUCTION

Rachel Amey - University of Delaware; Chad Forbes - University of Delaware; Jordan Leitner - University of California, Berkeley – Past research highlights an intimate reciprocal relationship between one's self-concept and their autobiographical memories. For instance, the desire to increase or maintain a positive sense of self is hypothesized to play an important role in biasing autobiographical memory reconstruction processes and vice versa. However, the neurocognitive mechanisms are still less understood. The current research examined how self-esteem biases neural processes associated with self-oriented and basic perceptual processing to affect memory for socially accepting or rejecting individuals. Continuous EEG activity was recorded while participants viewed photos of individuals who were ostensibly deciding to reject or accept the participant. Following this task, participants were given a surprise memory test for the faces presented during the task (and foils). Self-esteem was assessed post-task. Time-frequency analyses conducted on neural activity elicited in response to socially accepting and rejecting faces revealed that individuals higher in self-esteem exhibited increased communication (i.e., phase locking) between the Medial Prefrontal Cortex (mPFC) and Right Superior Temporal Sulcus (rSTS) in the theta band to both accepting and rejecting faces and subsequently remembered these faces better as well. Conversely, those with lower self-esteem had less accurate memory for accepting and rejecting faces when phase locking between these regions was high. These findings suggest that self-esteem biases autobiographical memory encoding processes by influencing how the mPFC and rSTS process social feedback and alludes to intriguing relationships between self-perceptions and conceptualizations for one's social world.

B-64

SOCIAL COMPARISON MODULATES THE NEURAL RESPONSE TO REGRET

Zhiyuan Liu - East China Normal University; Lin Li - East China Normal University; Li Zheng - East China Normal University; Xiuyan Guo - East China Normal University – The emotion of regret was considered to be associated with the counterfactual processing of aversive outcomes and sensitive to various social contexts. In the present functional magnetic resonance imaging (fMRI) study, we investigated how the social comparison could modulate behavioral and brain responses to the emotion of regret by employing a modified sequential risk taking task that induces the feeling of regret. In the task, after participants decided to stop a trial, not only the chosen option (collected gain), but also the alternative option (missed gain) was revealed in this trial. At the same time, a pseudo-participant's outcome was showed for participants, too. Participants were informed to compare self outcome with pseudo-participant's. They may collected more gain than pseudo-participant (positive social-comparative feedback, PSC feedback), or collected less gain than pseudo-participant (negative social-comparative feedback, NSC feedback). At the behavioral level, participants rated less regret for the PSC feedback compared with the NSC feedback when encountered with aversive outcomes. At the neural level, increased ventral striatum and ACC activation were found in the PSC feedback relative to the NSC feedback when participants encountered with aversive outcomes. These findings indicated the modulation of social comparison in the emotion of regret, i.e., even though met with aversive outcomes, people might feel less regret if they did better (collected more gain) than others.

B-65

THINKING ABOUT SIMILAR OTHERS: REGIONS SUPPORTING EVALUATION AND MEMORY FOR OTHERS VARYING IN SIMILARITY TO THE SELF

Eric D. Leshikar - University of Illinois at Chicago; Brittany S. Cassidy - Brandeis University, Indiana University; Angela, H. Gutchess - Brandeis University – Prior work suggests medial prefrontal cortex (MPFC) involvement when thinking about the self as well as similar others. In this investigation, we examined

cortical regions responsive to thinking about others varying in degrees of similarity to the self (high, medium, low). Prior work has found that ventral medial prefrontal cortex (VMPFC) is active when thinking about similar others. However, this work has predominantly defined similarity on a single dimension (e.g., political orientation) and has not probed the regions that support memory formation. In this study, participants generated positive/negative impressions for face-behavior pairs, employing a variety of different traits, and then were tested on their memory for the generated impressions. Using a post-recognition rating, impression trials (encoding) were back-sorted into high-, medium-, and low-self-similarity. We predicted that impression memory would be best for those most similar to the self which was confirmed by our behavioral results. Turning to our fMRI data, we first identified regions tracking similarity to the self. Dorsal anterior cingulate cortex (dACC) activity increased linearly with increasing similarity to the self (high>medium>low), suggesting that this region might code for how similar others are to the self. We then investigated regions supporting impression memory, finding a dissociation within medial temporal lobe regions. For others similar to the self, activity in the amygdala supported memory, whereas the hippocampus supported memory for dissimilar others. This result implies a prominent role for the amygdala in binding socioemotional content that is particularly relevant to the self.

B-66

THE INTERACTION OF MOTOR AND SOMATOSENSORY SIMULATION: A MOTOR-BASED SENSORY CONGRUENCY PARADIGM.

Eliane Deschrijver - Ghent University; Roeljan Wiersema - Ghent University; Marcel Brass - Ghent University – Research has suggested that when we simulate an observed action, we do not only motorically simulate the behavior but also simulate the somatosensory consequences of this action (e.g., Keysers, Kaas & Gazzola, 2010). In the current study, we investigated the electrophysiology of somatosensory simulation in action observation by means of a new motor-based sensory congruency paradigm and EEG. We presented index or middle finger tapping movements of a human or a wooden hand, while simultaneously presenting 'tap-like' tactile

sensations to the either corresponding or non-corresponding fingertip of the participant. The results showed effects of somatosensory simulation in the early somatosensory evoked potentials P50 and an animacy effect in the N100/N140. Interestingly, we also observed a congruency effect in the P3 for human hands only, with non-corresponding observed hand

movements eliciting a smaller P3 than all other conditions. We argue that the motor-based sensory congruency paradigm can help understand higher order social processes such as self-other distinction, by signaling whenever simulated sensory information does not match sensory information coming from one's own body.

Poster Session C

Saturday, April 25, 3:00-4:30PM

C-1

SANS Poster Award winner

SPONTANEOUS NEURAL ENCODING OF SOCIAL DISTANCE

Carolyn M. Parkinson - Dartmouth College; Adam M. Kleinbaum - Tuck School of Business, Dartmouth College; Thalia Wheatley - Dartmouth College – Psychological distance—i.e., distance from one's first-hand experience in space, time, social ties or hypotheticality—is thought to comprise a fundamental aspect of meaning that is processed automatically, even when unrelated to the task at hand. Previously, we demonstrated that social, temporal, and spatial distances from oneself are represented in a parsimonious neural code when participants perform tasks involving distance judgments. The current study sought to test if psychological distance is spontaneously encoded in naturalistic contexts, and to identify the brain systems involved. More specifically, we tested for the automatic encoding of social distance, which is thought to inform many facets of everyday behavior, such as trust, empathy, and cooperation. To do this, we combined social network analysis with multivariate pattern analysis of functional magnetic resonance imaging data. After reconstructing the social network of all students in a large graduate program, a subset of these individuals participated in a neuroimaging study in which they passively viewed individualized stimulus sets consisting of short videos of classmates at varying distances from themselves (e.g., friends, friends-of-friends, other acquaintances) in the social network of their graduate program. Across participants, social distance could be decoded from distributed patterns of brain activity in the right inferior parietal cortex. These results are consistent with suggestions that psychological distance—in particular, social distance—is a fundamental aspect of meaning that is automatically encoded, and that social relationship knowledge—both about our direct social ties and about relationships between third parties—comprises an important component of person perception.

C-2

NEUROANATOMICAL MARKERS OF SOCIAL HIERARCHY RECOGNITION IN HUMANS. A COMBINED ERP - MRI STUDY

Hernando Santamaría - Pompeu Fabra University; Miguel Burgaleta - Pompeu Fabra University; Nuria Sebastian Galles - Pompeu Fabra University – Social hierarchy is an ubiquitous principle of social organization across animal species. Although some progress has been made to understand how humans infer hierarchical identity, the neuroanatomical basis for perceiving key social dimensions of others remains unexplored. Here, we combined Event Related Potentials and structural Magnetic Resonance Imaging to reveal the neuroanatomical substrates of early status recognition. We designed a covertly simulated hierarchical setting where participants performed a task either with a superior or with an inferior player. Participants showed higher amplitude in the N170 component when presented with a picture of a superior player compared to an inferior player. Crucially, the magnitude of this effect correlated with brain morphology of the posterior cingulate cortex, superior temporal gyrus, insula, fusiform gyrus and caudate nucleus. We conclude that early recognition of social hierarchies relies on the structural properties of a network involved in the automatic recognition of social identity.

C-3

SOCIAL SUPERIORITY MODULATES COGNITIVE ALTERATIONS IN OBSESSIVE COMPULSIVE DISORDER

Hernando Santamaría - Pompeu Fabra University; Carles Soriano - Bellvitge Hospital; Miguel Burgaleta - Pompeu Fabra University; Narcís Cardoner - Bellvitge Hospital; Alba Ayneto - Pompeu Fabra University; José Menchón - Bellvitge Hospital; Nuria Sebastián - Pompeu Fabra University – Objectives. Error monitoring, cognitive control and motor inhibition control are proposed as cognitive alterations disrupted in obsessive-compulsive disorder (OCD). Likewise, OCD is also associated with an increased sensitivity to social evaluations. Since experiencing a social role can modulate an array of cognitive functions, altered cognitive functioning in OCD could be affected by the social context. We examined the effect of a social hierarchy simulation over

electrophysiological indices of cognitive alterations in OCD.

Methods. A case-control cross-sectional study measuring event-related potentials (ERP) for error monitoring (Error-Related Negativity), cognitive control (N2) and motor control (LRP) was conducted. We analyzed twenty OCD patients and twenty control participants, matched for age, sex, handedness and educational level. ERP were recorded during a social game consisting of a visual discrimination task, which was performed in presence of a simulated superior or an inferior player. **Results.** Significant social effects (different ERP amplitudes in Superior vs. Inferior player conditions) were found for OCD patients, but not for controls, in all ERP components. Furthermore, performing the task against a simulated inferior player reduced abnormal ERP responses in OCD to those levels observed in healthy controls. The hierarchy-induced ERP effects were accompanied by hierarchical differences over reaction times and intra-individual variability measures only in OCD patients. **Conclusions.** Social context modulates neuromarkers of abnormal cognitive functioning in OCD. We conclude that experiencing a social superiority position reduced excessive error monitoring activity and enhanced cognitive and motor control mechanisms. These results open the door to investigating new therapeutic choices.

C-4

DOMINANCE IN TARGET FACES PREDICTS MOTOR RESONANCE

Nadya Styczynski - Brandeis University; Yanyi Jiang - Brandeis University; Simian Cai - Brandeis University; Sara R. Pedersen - Brandeis University; Jennifer N. Gutsell - Brandeis University – Similar neural circuits are activated during action and action observation, and such motor resonance is believed to support action understanding and interpersonal coordination. Motor resonance, however, has been shown to be biased by personal and group characteristics of the target such as familiarity, status, and group membership. Using the suppression of electroencephalographic (EEG) mu oscillations during action observation as an index of motor resonance, the current study explores the role that mere differences in the dominance related facial features can have in how people process other's actions. To this aim we first conducted a pilot study to categorize target images of faces as high

dominance, neutral, or low dominance based on ratings of the participants' face image. In addition, a different sample of participants watched videos of hands performing simple actions ostensibly belonging to individuals with faces varying in dominance, while EEG was recorded. Participants showed greater mu-suppression for the more dominant-faced individuals, supporting the theory that motor resonance occurs more when viewing motivationally relevant individuals rather than likable individuals. This finding implies that subtle differences in physical appearance, such as dominance in a face, can affect motor resonance, and thus potentially lead to more submissive individuals being less understood by peers.

C-5

PERCEIVING SOCIAL STATUS: AN ERP INVESTIGATION OF THE EFFECTS OF STATUS LEVEL AND DIMENSION

Ivo Gyurovski - University of Chicago; Carlos Cardenas-Iniguez - University of Chicago; Jasmin Cloutier - University of Chicago – Whereas the possession of a high status has been linked to greater recognition and prestige (Fiske 2010; Magee & Galinsky, 2008), little work has focused on the impact of social status on person perception. Following-up on previous functional brain imaging work (Cloutier et al., 2012; Cloutier & Gyurovski, 2014; Cloutier & Gyurovski, 2013), we conducted an ERP investigation of the impact of distinct status levels and dimensions on person perception. To do so, 29 participants (4 excluded due to excessive noise) were presented with faces paired with either high moral, low moral, high financial, low financial status. Following the training procedure to paired faces with status conditions, EEG data were collected, while participants were asked to form impressions of the targets and indicate their status. Time course analysis was performed on the wave forms. The results revealed an early main effect of status level in early attentional components (between 150 and 250 ms), such that greater anterior negativity was observed in response to High versus Low status. The data produced an interaction between status level and dimension in later components of interest (between 400 and 600 ms) such that greater positivity was observed in response to High Financial and Low Moral status versus Low Financial and High Moral status. These findings are

discussed in the context of the neural correlates of the influence of social status on person perception (Cloutier et al., 2012; Cloutier & Gyurovski, 2014).

C-6

THE VALUE OF STATUS: HOW SOCIAL STATUS IMPACTS REWARD LEARNING

Jessica E. Koski - Temple University; Jessica A. Collins - Massachusetts General Hospital, Harvard Medical School; Ingrid R. Olson - Temple University – High status individuals are judged as more trustworthy and competent, and viewing high status people is associated with activity in neural regions involved in reward processing. Here we tested whether status biases reward-based decision-making in a modified version of the Iowa Gambling Task (IGT). Participants learned to associate high or low status semantic information with 2 faces each, and these 4 faces then served as stimuli in our social gambling task. In each trial (400 total) the four faces were presented simultaneously and participants were instructed to choose a person to “invest” with. They were told that some people were better than others and that they should aim to make as much money as possible by choosing these individuals more often. Two of the faces were associated with a net gain (“good” choices) and the other 2 with a net loss (“bad” choices), and these reward contingencies reversed after 200 trials. We compared IGT scores (good - bad choices) when high status faces were good choices to when low status faces were good choices. Our data revealed higher IGT scores when high status faces were good choices indicating participants picked the high status faces more often even if this resulted in monetary loss. When high status faces were initially good choices, participants suffered a greater decrease in IGT score at the reversal than when low status faces were initially good choices. These data suggest status information biases reward learning and interferes with task performance.

C-7

OXYTOCIN FACILITATES SOCIAL COMPARISON WITH OUT-GROUP BUT NOT WITH IN-GROUP MEMBERS

Eun Young Kim - Yonsei University; Sunhae Sul - Dartmouth College; Min Woo Lee - Korea University; Kyungok Lim - Seoul National University College of Medicine; Na Young Shin - Seoul National University; Sung Nyun Kim - Seoul

National University College of Medicine; Jun Soo Kwon - Seoul National University College of Medicine; Hackjin Kim - Korea University – Oxytocin is known to influence various social processes including social comparison (Shamay-Tsoory et al., 2009). Based on the previous findings that oxytocin increases in-group favoritism and inter-group competition (e.g., De Dreu et al., 2010), the current study examined the differential effects of oxytocin on social comparison with out-group vs. in-group member using a double-blind placebo-controlled design. Thirty-one male participants were randomly assigned to either placebo or oxytocin treatment and performed a social-comparison task adapted from Kang et al. (2013), in which they played a card selection game with either an in-group or out-group member. In each trial of the task, participants chose one of three unrevealed cards. The outcome of the choice was then presented with that of the game partner. Participants were asked to decide whether to accept or to repeat the trial. Behavioral results showed that compared to the placebo-treated participants, the oxytocin-treated participants were more likely to accept the loss trials but only if they lost relatively fewer points than an out-group member. No such pattern was observed for the trials with an in-group member. These findings suggest that oxytocin selectively increases social comparison with out-group members, providing one possible mechanism underlying the facilitating role of oxytocin in inter-group competition.

C-8

DIFFERENTIAL EXPRESSIONS OF INTERGROUP GUILT PREDICT BIASED RECRUITMENT OF NEURAL NETWORKS INTEGRAL FOR COGNITIVE CONTROL

Adam B. Magerman - University of Delaware; Chad E. Forbes - University of Delaware – The experience of guilt promotes approach-oriented behaviors, including greater interest in prejudice reduction, and has been associated with increases in cognitive control and the inhibition of future unwanted behaviors (e.g., Amodio et al., 2007). Less is known, however, about how differences in the experience of guilt following accidental harmful behaviors towards racial ingroup and outgroup members modulate changes in cognitive control and inhibition of future unwanted behaviors. Given that individuals

typically favor ingroup members more than outgroup members, we hypothesized that individuals will experience increased guilt after exhibiting harmful behaviors towards ingroup members compared to outgroup members. Further, feelings of guilt will be associated with increased connectivity between the ACC and DLPFC (two regions integral for cognitive control) and greater accuracy on subsequent trials. This study utilized a modified version of the Police Officer's Dilemma and lexical decision task. On each trial, participants' goal was to shoot armed targets or not shoot unarmed targets. Following each decision, participants were presented with a word and asked to identify whether it was either a guilt-related word or a non-word. Faster reaction times to guilt words indexed participant's feelings of guilt following shoot/no-shoot behaviors. Results revealed that White participants experienced increased guilt after erroneously shooting the White target compared to the Black target. Further, increased guilt was associated with greater post-error ACC-DLPFC connectivity and greater overall accuracy during the task. Our findings suggest that Whites seem to experience less guilt and are less inclined to exhibit cognitive control when accidentally harming outgroup members.

C-9

SANS Poster Award winner

TRUSTING OUTGROUP, BUT NOT INGROUP MEMBERS, REQUIRES CONTROL: NEURAL AND BEHAVIORAL EVIDENCE

Brent Hughes - Stanford University; Jamil Zaki - Stanford University – Ingroup favoritism, although sometimes adaptive, often damages people's ability to trust and cooperate with outgroup members. Intergroup failures in trust produce a number of pernicious consequences, such as escalated conflict, and reducing conflict requires first understanding why and how trust collapses across group boundaries. To investigate this issue, we asked participants to make single-shot decisions about whether to trust ingroup or outgroup members with real money. Decisions to trust ingroup members were accompanied by engagement of reward-related neural structures (e.g., striatum). By contrast, decisions to trust outgroup members produced activity in neural systems associated with top-down control (e.g., dACC). Individual differences in trust-related activation in these systems further correlated

with individual differences in intergroup trust bias: the extent to which participants unevenly trusted ingroup over outgroup members. These data suggest that trusting outgroup, but not ingroup members requires the exertion of executive processes. A follow-up behavioral experiment further supported this prediction: whereas time pressure did not affect trust of ingroup members, it reduced trust of outgroup members. Together, these findings suggest that intergroup failures in trust are multiply determined: whereas people find it intuitive and rewarding to trust ingroup members, they may need to uniquely exert control to override intuitive distrust of outgroup members. These findings deepen our knowledge of prosociality and intergroup cognition, and have a number of implications for intervening to reduce conflict.

C-10

THE IMPACT OF CHILDHOOD INTERRACIAL CONTACT ON BRAIN RESPONSES TO FACES: A PARTIAL LEAST SQUARES

ANALYSIS *Tianyi Li - University of Chicago; Carlos Cardenas-Iniguez - University of Chicago; Marc G. Berman - University of Chicago; Jasmin Cloutier - University of Chicago* – The potential for childhood interracial exposure to shape race perception is well-documented. Accordingly, evidence from our previous study focusing on the amygdala suggests that greater interracial contact in childhood alters brain responses to familiar Black individuals (Cloutier, Li, & Correll, 2014). Whereas the presentation of perceptually familiar faces attenuated White perceivers' amygdala response to both Black and White faces, reduction in amygdala response to familiar Black faces was more pronounced among perceivers with higher levels of childhood interracial contact. In the current study, we further explore the impact of early interracial contact on brain responses by implementing a Partial Least Squares (PLS) analysis to uncover activity across a network of brain regions covarying with interracial contact. The PLS approach is a multivariate approach to find significant relationships between signal changes in brain regions and experimental variables (e.g., behavioral responses or experimental contrasts). Initial analyses revealed a correlation between interracial contact and a large network of

brain areas, including components of the so-called social brain, in response to all faces. In addition, consistent with the long-standing idea that greater interracial contact promotes positive racial attitudes and minimizes prejudice, interracial contact and implicit prejudice demonstrated differential correlations with activity in dorsal-frontal brain regions.

C-11

AGE DIFFERENCES IN NEURAL RESPONSES TO RACE EXIST WITHIN THE PREJUDICE NETWORK

Brittany S. Cassidy - Indiana University; Anne C. Krendl - Indiana University – Much work has characterized a network of brain regions responding to different aspects of race perception. For instance, amygdala activity characterizes affective responses while the engagement of regions involved in cognitive control (e.g., dorsolateral and ventrolateral prefrontal cortex [dlPFC; vlPFC]) reflects impulse regulation. This network may be particularly impacted in older adults because aging has been widely associated with impairments in regulatory function. Indeed, emerging behavioral research has shown that age-related regulatory decline exacerbates older adults' prejudice. During fMRI, 15 younger and 39 older adults viewed Black and White faces and cars. Older adults were normal functioning, but varied in their relative amount of cognitive decline. When perceiving Black versus White faces, younger adults displayed increased engagement of dlPFC and vlPFC – two regions implicated in initiating and maintaining regulation – as compared to older adults. For the same contrast, younger adults also displayed enhanced posterior cingulate activity compared to older adults, suggesting less individuation of Black versus White faces with age. Given the critical role of the amygdala within the prejudice network, we extracted parameter estimates from anatomically defined amygdala ROIs to assess a potential relationship with regulatory function. Importantly, poorer executive ability predicted increased left amygdala response to Black over White faces, suggesting enhanced affective response given less regulatory ability. These findings are the first to reveal age differences in neural recruitment within key nodes of the prejudice network that impact the processing and regulation of attitudes toward racial outgroup members.

C-12

BEHAVIORAL AND NEURAL EVIDENCE FOR THE EFFECT OF RESIDENTIAL MOBILITY ON SOCIAL PERCEPTION

Brandon W. Ng - University of Virginia; Shigehiro Oishi - University of Virginia; James P. Morris - University of Virginia – Prior work has demonstrated that the experience of moving—residential mobility—induces anxiety, stress, and anticipated social exclusion (Oishi, 2010). Simply priming participants to think about moving causes loneliness and motivates the desire to affiliate and reconnect with others (Oishi et al., 2013). Past research has demonstrated that basic social perceptual processes, such as attending to social cues are the essential ingredients to forming social bonds (Pickett et al., 2004). For instance, chronically lonely individuals typically display heightened sensitivity to social cues, relative to controls (Gardner et al., 2005). Moreover, social exclusion has been found to motivate perceptual attention to happy faces in particular, since a smile has been hypothesized to be one of the greatest indicators of a potential affiliative partner (DeWall et al., 2006). However, research examining how residential mobility may attune social perception remains scarce. In two studies, we hypothesized that residential mobility would motivate engagement with happy faces—to cues of acceptance. In Study 1, participants were primed with residential mobility, stability, or were in a control condition and subsequently completed a face evaluation task. Indeed, participants primed with residential mobility demonstrated increased explicit liking toward happy faces, but not for any other faces. In Study 2, we utilized ERPs to investigate how early in the timecourse of visual processing this motivated social perception occurs. In line with hypotheses, mobile-prime participants demonstrated faster N170 latencies toward happy faces, relative to stable-prime participants. Taken together, the results demonstrate that residential mobility sharpens social perception to cues of acceptance.

C-13

OXYTOCIN REGULATES TEMPORAL PERCEPTION OF SOCIAL INTERACTIONS

Rui Liu - State Key Laboratory of Brain and Cognitive Science, Institute of Psychology,

Chinese Academy of Sciences; Zhi Yang - State Key Laboratory of Brain and Cognitive Science, Institute of Psychology, Chinese Academy of Sciences; Wen Zhou - State Key Laboratory of Brain and Cognitive Science, Institute of Psychology, Chinese Academy of Sciences; Yi Jiang - State Key Laboratory of Brain and Cognitive Science, Institute of Psychology, Chinese Academy of Sciences – Communication through body gestures permeates our daily life. Efficient perception of the message therein reflects one's social cognitive competency. Here we report that such competency is manifested temporally as shortened subjective duration of social interactions: motion sequences showing agents acting communicatively are perceived to be significantly shorter in duration as compared with those acting independently. The strength of this effect is negatively correlated with one's autistic-like tendency. Critically, intranasal oxytocin administration fosters the temporal compression effect in socially less proficient individuals whereas the administration of atosiban, a competitive antagonist of oxytocin, abolishes the very effect in socially proficient individuals. These findings clearly indicate that perceived time, rather than being a faithful representation of physical time, is highly subjective and imprinted with one's social traits. Moreover, they highlight the role of neuropeptides in mediating time perception.

C-14 WITHDRAWN

C-15 VAGAL TONE AND OXTR METHYLATION EXPLAIN INDIVIDUAL DIFFERENCES IN SOCIAL COGNITIVE ABILITY

Katie Lancaster - University of Virginia; Julie Han - University of Virginia; Joyce Huang - University of Virginia; Lacy Jennings - University of Virginia; James P. Morris - University of Virginia; Jessica, J. Connelly - University of Virginia – Individuals differ in the ease with which they navigate their social worlds, but what are the origins of this variability? Deficits in autism spectrum disorders (ASD) suggest that one's biology may exert considerable influence over basic social cognitive processes. We hypothesize that a spectrum of social cognitive ability exists also in healthy individuals, and is constrained by similar mechanisms. In particular we examine two interrelated biological factors which are

disrupted in ASD: vagal tone, and the neurohormone oxytocin. Vagal tone, measured by resting sinus arrhythmia (RSA), is an index of parasympathetic control of the autonomic nervous system. Feedback through both the vagal and oxytocinergic systems is thought to modulate social behavior. The mechanism of action for oxytocin is dependent upon availability of its receptor, which is regulated in part by expression of the oxytocin receptor gene (OXTR). In the current study, we examined DNA methylation of OXTR, an epigenetic modification shown to inhibit gene expression and hypothesized to negatively affect endogenous oxytocinergic action. Forty-two neurotypicals completed a measure of social perception, the Reading the Mind in the Eyes test, were assessed for baseline RSA, and provided a blood sample for epigenetic analysis. Results revealed that baseline RSA was associated with increased social perceptual performance while OXTR methylation was associated with decreases in both baseline RSA and social perceptual performance. Importantly, baseline RSA did not mediate the relationship between OXTR methylation and social perception, suggesting that parasympathetic and epigenetic mechanisms are independent predictors of individual differences in social cognitive ability.

C-16

THE NEURAL EFFECTS OF COMPUTERIZED SOCIAL COGNITIVE TRAINING

Erin T. Guty - Harvard University; Cambria Litsey - Harvard University; Mia Schulam - Harvard University; David Dodell-Feder - Harvard University; Christine I. Hooker - Harvard University – Navigation of the social world is dependent upon our ability to accurately perceive and reason about the beliefs, emotions, and intentions of others. Indeed, research from a variety of fields, including clinical and non-clinical domains, has demonstrated a robust link between social cognitive ability and real world social functioning. These findings highlight the potential utility in devising methods to enhance social cognitive ability. However, extant methods for training social cognition, particularly for schizophrenia, have focused on training the impaired social behaviors themselves rather than targeting the underlying processes and representations that give rise to social behavior. Here, we evaluate the effects of training social cognition through the use of neuroplasticity-

based learning in healthy adults. Specifically, participants from the community underwent social cognitive training with computerized exercises designed to tap the neural mechanisms sub-serving social cognition for a period of 8 hours over 2 weeks. Participants underwent fMRI scanning before and after training during which they performed a theory of mind (ToM) task that involved reading stories about character's emotions or physical appearances. We find training-related increases in activation in the somatosensory-related cortex from pre- to post-training during the ToM task. This finding suggests that social cognitive training may lead to beneficial neural changes in regions supporting social cognition, which may in turn enhance real world social behavior.

C-17

ATTENTION VERSUS RECOGNITION: DIFFERENCES IN EMOTION PROCESSING DEFICITS IN AUTISM SPECTRUM DISORDER AND ALEXITHYMIA

Alicia Vallorani - Western Illinois University; Naoyuki Sunami - Western Illinois University; Sandra L. McFadden - Western Illinois University; Masu Omura - Western Illinois University; Ariel J. Wilson - Western Illinois University; Phillip C. Berg - Western Illinois University; Lindsey K. Robinson - Western Illinois University – Autism Spectrum Disorder (ASD) is defined by impaired social interactions, communications and restricted interests (American Psychiatric Association, 2013). Alexithymia is a sub-clinical disorder described as an inability for individuals to process and label emotions (Samur et al., 2013). Recent research suggests that the social-emotional deficits generally attributed to ASD, including emotion recognition (Cook, Brewer, Shah, & Bird, 2013), empathy (Bird et al., 2010) and eye-fixation (Bird, Press, & Richardson, 2011), are attributable to comorbid Alexithymia. Other research, however, suggests that Alexithymia is nothing more than a deficit in verbal IQ (Montebarocci et al., 2011). With this in mind, the current study explored if Alexithymia or ASD accounts for deficits in emotion processing and labeling. A sample of 79 undergraduate students completed measures of Alexithymia and then performed an emotion-labeling task while event related potentials were recorded; 29 participants also completed the Autism Spectrum Quotient test. Data analysis revealed a significant relationship between Alexithymia and ASD ($r = .37$). Individuals high in ASD

reported typical responses to emotion-evoking images (from Mikels et al., 2005), but showed altered early and late slow wave activity when viewing images that typically evoke sadness. Individuals high in Alexithymia did not show differences in neural activity, but were less likely to report feeling sad in response to sadness-eliciting stimuli. The findings suggest that individuals with ASD may not attend to sad emotional content whereas individuals with Alexithymia may have deficits in feeling or labeling sadness.

C-18

INTRODUCING RISC: A NEW INVENTORY FOR TESTING SOCIAL PERCEPTION IN NEUROPSYCHOLOGICAL POPULATIONS

Kathrin Rothermich - School of Communication Sciences and Disorders, McGill University; Marc D. Pell - School of Communication Sciences and Disorders, McGill University – Nonliteral language, such as jocularity, sarcasm, or white lies, occurs frequently in daily communication. During natural social interactions, linguistic and paralinguistic information about nonliteral speech unfolds simultaneously in several communication channels. However, there are four common limitations in studies investigating social communication and speaker intentions: (1) using only uni-modal stimulation, i.e. visual; (2) designing static experiments depicting stimuli that are far away from everyday communication; (3) neglecting important factors such as discourse context and relationship type; and (4) insufficient stimulus control and number of trials to perform neuroimaging experiments. Relational Inference in Social Communication (RISC) is a newly developed database, which entails short video vignettes depicting social interactions, including sincere, sarcastic, jocular, and white lie exchanges. For the first time we also manipulated the type of social relationship between communication partners (e.g. friends vs. couple) and carefully controlled the availability of contextual cues (e.g. preceding conversations) while keeping lexical-semantic content constant. First validation data reveals an overall accuracy for identifying speaker intentions above 80 %, indicating that our material is suitable for testing healthy and neuropsychological populations. Results further show that both relationship type and context are influencing the categorization of literal and nonliteral interactions. This demonstrates that is

important to consider social as well as discourse context when studying speaker intentions. By including crucial aspects that have often been neglected in previous research, RISC represents a contemporary set of naturalistic video stimuli that creates a useful resource for future neuroscientific research.

C-19

EPIGENETIC VARIABILITY OF THE OXYTOCIN RECEPTOR GENE PREDICTS INCREASED NEURAL RESPONSE TO EMOTIONAL FACE EXPRESSIONS

Meghan H. Puglia - University of Virginia; Travis S. Lillard - University of Virginia; James P. Morris - University of Virginia; Jessica J. Connelly - University of Virginia – Understanding the precise nature of oxytocin's influence on complex human social behavior has proven difficult. Most human work on oxytocin has focused on intranasal administration without regard to individual biological variability in the oxytocinergic system. Work focusing on individual variability has measured either hormonal levels assayed from the blood or common genetic variants. However the use of these markers is limited because they have no known function. The current study utilizes an imaging epigenetic approach to further parse the effects of individual variability in the oxytocinergic system on social processes. We find that a functional epigenetic variant, DNA methylation of the oxytocin receptor gene (OXTR), is associated with neural variability in healthy adults during an emotional face-perception fMRI paradigm. Importantly, this modification is variable in the general population, can be assayed in the blood, and impacts the expression of the gene. Our results indicate that higher levels of OXTR methylation are associated with greater amounts of activity in regions associated with face and emotion processing including amygdala, fusiform and insula. Furthermore, these higher methylation levels are also associated with decreased functional coupling of amygdala with regions involved in affect appraisal and emotion regulation including dorsal anterior cingulate cortex and orbitofrontal cortex. This pattern of activity may be indicative of diminished emotion regulation to negative stimuli and increased risk of pathology. Our findings highlight the importance of including epigenetic mechanisms in the description of the endogenous oxytocin system and further

support a central role for oxytocin in social cognition.

C-20

OXYTOCIN MODULATES HUMAN COMMUNICATIVE BEHAVIOUR

Miriam de Boer – Radboud University, Donders Institute for Brain, Cognition, and Behaviour; Mark Blokpoel - Radboud University, Donders Institute for Brain, Cognition and Behaviour; Idil Kokal - Radboud University, Donders Institute for Brain, Cognition and Behaviour, Max Planck Institute for Psycholinguistics; Arjen Stolk - Radboud University, Donders Institute for Brain, Cognition and Behaviour; Eelke Visser - FMRIB Centre, Nuffield Department of Clinical Neurosciences, University of Oxford; Rogier Mars - Radboud University, Donders Institute for Brain, Cognition and Behaviour; FMRIB Centre, Nuffield Department of Clinical Neurosciences, University of Oxford; Department of Experimental Psychology, University of Oxford; Karin Roelofs - Radboud University, Donders Institute for Brain, Cognition and Behaviour; Radboud University, Behavioural Science Institute; Iris van Rooij - Radboud University, Donders Institute for Brain, Cognition and Behaviour; Ivan Toni - Radboud University, Donders Institute for Brain, Cognition and Behaviour – Human referential communication is often adjusted to the presumed knowledge and characteristics of the addressee ("audience design"). Here we explore if and how oxytocin, a neuropeptide known to promote prosocial behaviours and to sharpen processing of socially-relevant information, modulates qualitative and quantitative markers of audience design. Fifty-eight healthy male adults participated in a randomised, double-blind, placebo controlled experiment involving the intranasal administration of oxytocin. Markers of audience design were quantified during performance of an online interactive referential game, which challenges participants into continuous negotiation of novel communicative behaviours with their addressees. Crucially, participants were made to believe that they were playing this game with either an age-peer or a child addressee. In fact, a confederate performed the role of both addressees, while remaining blind as to whether they played as adult or as child. There are two novel findings. First, oxytocin drives interlocutors to adjust their communicative behaviour towards the

actual performance experienced in addressees, and away from their beliefs on the abilities of those addressees. Second, oxytocin enables participants to find communicative strategies that could unambiguously cover the complex problem-space of the game. Currently, we are investigating how these findings can be correlated with changes in resting state connectivity between regions known to support the generation and understanding of novel communicative behaviours.

C-21

EARLY INFLUENCE OF COMPARISON ON SOCIAL INFORMATION PROCESSING - EVIDENCE FROM TWO EEG STUDIES

Katharina Banscherus - University of Cologne; Jutta Stahl - University of Cologne; Thomas Mussweiler - University of Cologne; Gayannée Kedia - University of Graz – A large body of research has shown that comparisons play a fundamental role in how we perceive ourselves and other people. Yet, when exactly comparisons take effect during the stream of social information processing on the neural level remains unclear. To bridge this gap, we designed two EEG studies investigating the neural time course of attractiveness and trustworthiness comparisons. Size comparisons served as the non-social control condition in both studies. To determine the moment of comparison, we used a distance effect (DE) paradigm. The DE refers to the fact that stimuli close on a certain dimension (low distance) take longer to compare than stimuli that clearly differ on that respective dimension (high distance). In Study 1, participants performed attractiveness and size comparisons during EEG recording while being presented with two images displaying female faces simultaneously. Depending on the condition, images varied in distance with regard to either attractiveness or size. In Study 2, participants compared the trustworthiness and size of two simultaneously presented faces. These pairs likewise varied in distance. Our analysis revealed that comparison related differences occurred around 200 milliseconds (N2) after stimulus onset for attractiveness/size and already after 100 milliseconds (N1) for trustworthiness/size comparisons. Both, social (attractiveness/trustworthiness) and non-social (size) comparisons followed the same time course. These studies suggest that comparative information is processed very

early throughout stimulus evaluation and emphasize how basic comparison is in social information processing.

C-22

CONSCIOUS AND UNCONSCIOUS INTEGRATION OF EMOTIONAL EYE GAZE AND AFFECTIVE CONTEXT

Qian Xu - Chinese Academy of Sciences; Ying Wang - Chinese Academy of Sciences; Yi Jiang - Chinese Academy of Sciences – Social cues, such as facial expression and the direction of eye gaze, are usually perceived within natural context. However, the perceptual integration of these social cues and their context remains largely unexplored. Here we looked into the integration process using emotional gaze cues along with task-irrelevant affective pictures. Participants viewed happy or fearful faces whose eyes could gaze at an affective picture or not (gaze congruency), and the valence of the affective picture was either congruent or incongruent with the facial expression (emotion congruency). Results showed a significant interaction of gaze congruency and emotion congruency for fearful faces but not for happy faces, regardless of whether the stimuli were visible or rendered invisible through the continuous flash suppression paradigm. Interestingly, the integration process showed dissociable patterns with respect to the participant's trait anxiety and the stimulus visibility: compared with low trait anxiety, high trait anxiety boosted the integration of invisible fearful information though reduced the effect in the visible condition. To sum up, fearful gaze cues can trigger affective social information integration independent of conscious awareness, and the effect is modulated by one's trait anxiety level.

C-23

THE IMPACT OF PERCEPTUAL LOAD ON THE NON-CONSCIOUS PROCESSING OF FEARFUL FACES

Lili Wang - Huaiyin Normal University; Chunliang Feng - Beijing Normal University; Xiaoqin Mai - Renmin University of China; Yue-jia Luo - Shenzhen University – Emotional stimuli can be processed without consciousness. In the current study, we used event-related potentials (ERPs) to assess whether perceptual load influences non-conscious processing of fearful facial expressions. Perceptual load was

manipulated using a letter search task with the target letter presented at the fixation point, while facial expressions were presented peripherally and masked to prevent conscious awareness. The letter string comprised six letters (X or N) that were identical (low load) or different (high load). Participants were instructed to discriminate the letters at fixation or the facial expression (fearful or neutral) in the periphery. Participants were faster and more accurate at detecting letters in the low load condition than in the high load condition. Fearful faces elicited a sustained positivity from 250 ms to 700 ms post-stimulus over fronto-central areas during the face discrimination and low-load letter discrimination conditions, but this effect was completely eliminated during high-load letter discrimination. Our findings imply that non-conscious processing of fearful faces depends on perceptual load, and attentional resources are necessary for non-conscious processing.

C-24

SYNCHRONIZED FMRI AND MOTION-TRACKING REVEALS THE CO-ACTIVATION OF MULTIPLE SOCIAL CATEGORIES *Ryan M. Stoller - New York University; Jonathan B. Freeman - New York University* – Humans readily sort one another into multiple social categories, though cues used to do so are not always clear-cut. Atypical category members may be readily encountered (e.g., feminine men, White people with Afrocentric features). Recently, behavioral studies using hand-motion tracking have suggested that categorizing such individuals is accomplished through dynamic competition between parallel, partially-activated social categories that rapidly resolve into a stable categorical percept. During event-related fMRI, participants categorized faces by either gender or race. Faces varied in category typicality, such that some faces belonging to one category contained partial cues belonging to the opposite category (e.g., male face with feminine cues). fMRI was coupled with online hand-motion tracking, where participant hand-motion towards the unselected category response indexed the degree to which atypical category members activated the opposite category in parallel. Multivariate pattern analyses revealed that neural representations of atypical (vs. typical) category members were more similar to the opposite category representation in several regions of the ventral-temporal

cortex. Importantly, on-line hand-motion towards the opposite category response predicted neural-pattern similarity of atypical faces to the average representational pattern of the opposite category in fusiform cortex. Thus, despite consistent final categorizations of atypical faces as belonging to one category, their multi-voxel representational patterns showed similarity to their opposing categories. These results bolster current computational models of social categorization, and offer a promising methodology for the investigation of parallel and competitive processes.

C-25

RETRIEVAL-RELATED REACTIVATION OF VISUAL PROCESSING REGIONS EXHIBITING FUNCTIONAL CONNECTIVITY WITH THE AMYGDALA DURING SUCCESSFUL ENCODING OF NEGATIVE AND POSITIVE INFORMATION *Sarah M. Kark - Boston College; Elizabeth A. Kensinger*

- Boston College – Prior work has shown increased connectivity between the amygdala and visual areas during successful encoding of negative information (Mickley-Steinmetz, Addis, & Kensinger, 2010). In the present functional magnetic resonance imaging (fMRI) study, we examined retrieval-related reactivation of visual areas that were functionally coupled with the amygdala during successful encoding of negative and positive information. Seventeen participants (aged 19-35) studied line-drawings of International Affective Picture System (IAPS) images that had negative, positive, or neutral valence, followed by the complete color photos. After a 20-minute delay, participants viewed line-drawing outlines created from studied photos and from nonstudied lures. Participants were asked to indicate whether each line-drawing was old or new. During encoding, increased coupling between the amygdala and visual cortices (BA18, 19) predicted subsequent memory for negative items while increased coupling between the amygdala and middle and inferior temporal gyri (BA20, 21) predicted subsequent memory for positive items. Conjunction analyses were used to examine retrieval-related reactivation of visual processing regions that showed functional coupling with the amygdala during successful encoding. There was significant retrieval-related reactivation in the fusiform gyrus (BA37) for negative items and middle

temporal gyrus (BA20) for positive items. However, there was no significant encoding-to-retrieval overlap in amygdala connectivity within the ventral visual stream for negative or positive items. Together, the results demonstrate retrieval-related reactivation of visual areas functionally coupled with the amygdala during successful encoding of negative and positive information. These findings emphasize the enhancing effect amygdala engagement during encoding on subsequent retrieval-related reactivation in occipitotemporal regions.

C-26

SANS Poster Award winner

MULTI-VOXEL PATTERNS AT ENCODING CLASSIFY VIVIDNESS OF EMOTIONAL MEMORIES

John C. Ksander - Boston College; Christopher R. Madan - Boston College; Drew Linsley - Boston College; Katherine Mickley Steinmetz - Wofford College; Elizabeth A. Kensinger - Boston College – Emotion tends to enhance subjective evaluations of memory quality even without other measurable improvements in memory performance. It is debated whether these subjective enhancements reflect a recognition criterion bias or maintenance of information that cannot be objectively measured. The present study offers insight into this debate by examining the relationship between brain activity during memory formation and subsequent vividness ratings, using a novel multivariate approach. In an event-related fMRI task, participants studied positive, negative, and neutral complex scenes. Memory was tested using a recognition task with a modified Memory Characteristics Questionnaire (Mickley Steinmetz et al., 2012). Distributed patterns of activation elicited in medial temporal lobe regions successfully decoded vividness ratings of positive, but not neutral or negative items., We found that vividness for positive scenes was decoded in the bilateral hippocampus, left amygdala, and left parahippocampal cortex. Furthermore, each participant's vividness for positive scenes could be decoded using patterns from the other participants. Importantly, information about positive scenes' vividness was not in the univariate analyses. These findings suggest that encoding processes within the medial temporal lobe influence subsequent memory vividness evaluations, but also that they interact with emotional valence. These

findings suggest that subjective vividness of positive scenes is a distributed representation in the medial temporal lobe regions, that is, to an extent, common across subjects. In this way, multivariate analyses of brain activity are well positioned to uncover the neural basis of emotional effects on memory.

C-27

NEUROPHYSIOLOGICAL CORRELATES OF FEEDBACK SENSITIVITY IN AN EMOTION PERCEPTION DECISION

Spencer K. Lynn - Northeastern University; Yael Arbel - MGH Institute of Health Professions; Lisa Feldman Barrett - Northeastern University – Emotion perception is a judgment made under uncertainty (a given facial expression can mean different things) and risk (there are costs to being wrong about the meaning of a facial expression). A person's sensitivity to benefits or costs may influence how effective he or she is at making such judgments. Participants (n=25) completed an anger detection task under perceptual uncertainty ("angry" and "not angry" categories shared morphed facial scowl intensities) and economic risk (correct detections and correct rejections of anger earned points, false alarms and missed detections of anger lost points). Decision feedback, statements of points earned or lost, was delivered on each trial. Point values were skewed to favor a "not angry" response bias. Participants attempted to earn as many points as they could over 890 trials. We created event related potentials time-locked to the onset of the four feedback types and performed temporal PCA on the average voltage at the Fz, Cz, and Pz electrodes. To compare relative feedback sensitivities we analyzed sums and differences of component amplitudes. Perceptual sensitivity correlated (two-tailed $\alpha=.05$) with amplitude of central components peaking near 150 and 450 ms ($r^2s=.22-.46$) and parietal components peaking near 450 ms ($r^2s=.18-.29$). Adequacy of response bias correlated with amplitude of frontal components peaking near 100 and 450 ms ($r^2s=.17-.19$). Reward and punishment sensitivity, reflected in cortical activity, affected judgments about the emotional states of others by influencing people's abilities to discriminate emotional states and optimally balance their exposure to the economic risk of miscategorization.

C-28

FACING THE FACTS: ASSESSING THE ROLE OF FACE-BEHAVIOR INCONGRUITIES IN SOCIAL COGNITION THROUGH THE MODULATION OF THE N400

Jennifer L. Crawford - Brandeis University; Laura E. Paige - Brandeis University; Brittany S. Cassidy - Indiana University; Angela H. Gutches - Brandeis University – Research has begun to investigate how the interplay of facial features and behaviors affect character judgments, showing that people make more extreme judgments about others when their face and behavior are congruent (e.g., both suggest trustworthy or positive traits, rather than the face looking untrustworthy but the behavior suggesting positive character). The neural response to person perception when face and behavioral information are either congruent or incongruent is not fully understood. Previous fMRI work revealed the role of the dorsal-medial prefrontal cortex (dmPFC) in updating social information, showing greater dmPFC activation for incongruent compared to congruent social and emotional information. However, the neural mechanism involved in the updating of face- and behavior-based impressions has not been elucidated. We used event-related potentials (ERPs) to explore how incongruent versus congruent face-behavior information is processed as a function of the amplitude of the N400, an ERP component involved in semantic processing, ranging from approximately 300-500ms. The amplitude of the N400 response is most susceptible to experimental manipulation. Participants viewed differing pairs of faces (varying on degree of trustworthiness) and behavioral sentences (reflecting positive or negative character), which allowed us to record the neural activity underlying the processing of both congruent and incongruent face-behavior relationships involved in social cognition. ERP analyses indicate that when presented with incongruent face-behavior information, the amplitude of the N400 increases compared to congruent face-behavior information. This suggests that when confronted with conflicting information about a person's facial characteristics and behavior, semantic-processing networks may be recruited to resolve this incongruency.

C-29

THE ROLE OF EMOTION WORDS IN THE EXPERIENCE AND PERCEPTION OF EMOTION: A META-ANALYSIS OF THE

NEUROIMAGING LITERATURE

Jeffrey A. Brooks - The University of North Carolina at Chapel Hill; Holly Shaback - The University of North Carolina at Chapel Hill; Michael Parrish - The University of North Carolina at Chapel Hill; Maria Gendron - Northeastern University; Ajay B. Satpute - Pomona College; Katie Hoemann - Northeastern University; Kristen A. Lindquist - The University of North Carolina at Chapel Hill – Recent work supporting a psychological constructionist approach to emotion suggests that the language we use to describe emotions can also partially constitute them (Lindquist et al. in press). A constructionist approach hypothesizes that affect is represented in the brain differently when experienced or perceived in the context of emotion words. To observe the differences in neural activity when emotion words were present vs. not present in an experimental task, we performed a meta-analysis of the neuroimaging literature on emotion. We included 809 contrasts across 352 studies in a Multilevel Kernel Density Analysis (MDKA) performed in NeuroElf. When emotion words were present (v. not present) in experimental tasks, there was more frequent activity in the thalamus ($p < .001$) and at a lower threshold ($p < .02$), the dorsal anterior insula, left inferior frontal gyrus, and caudate nucleus. By contrast, when emotion words were not present in experimental tasks (v. present), there was more frequent activity in the right amygdala ($p < .001$). Together, these findings are consistent with evidence from studies of "affect labeling" (Lieberman et al. 2007), which show decreased activity in the amygdala when participants label the meaning of facial expressions of emotion. Our findings are also consistent with the constructionist view that words help make meaning of otherwise ambiguous affective states by increasing sensory processing of affective stimuli and reducing their uncertainty. Implications for the role of emotion words in emotional experiences and perceptions will be discussed.

C-30

SEMANTIC PRIMING OVERRIDES AFFECTIVE PRIMING DURING THE N400 AND LPC: A REPLICATION OF A FULLY CROSSED ERP STUDY USING A NOVEL TASK

Nathaniel M. Delaney-Busch - Tufts University; Anne Choong - Tufts University; Barbara Storch - Tufts University; Jen Kurzrok -

Tufts University; Gina Kuperberg - Tufts University – Semantic priming describes the faster response to target words preceded by semantically associated versus unassociated words. Affective priming describes the faster response to emotional words preceded by words of the same emotional valence. A large event-related potential (ERP) literature suggests that semantic priming results in facilitated lexico-semantic processing, reflected by an attenuation of the N400, but the ERP signatures of affective priming have been mixed. In a previous ERP study, we fully crossed semantic (Associated vs. Unassociated) and affective (Same Valence vs. Opposite Valence) priming, where participants explicitly judged semantic association of each word-pair. While we found the expected effect of semantic priming, we saw no N400 or late positivity effect to affective priming, suggesting that when experimental conditions that encourage semantic associative processing, affective priming does not influence lexico-semantic processing. In the present experiment, we asked participants to explicitly judge whether each word pair had the same (or opposite) valence, to overtly focus attention on emotional features of the prime and target. Again, we saw no effect of affective priming on the N400 (which was still sensitive to semantic priming) or the late positivity (which was still sensitive overall to the valence of the targets). Instead, we found an early N1 effect of affective priming. This suggests that when primes and targets in an experiment share a salient relationship other than valence, affective priming influences early automatic processes, but not later lexico-semantic or evaluative processes, which may be more control-oriented.

C-31 LONG-RANGE WHITE MATTER CONNECTIVITY PREDICTS FACIAL EMOTION PERCEPTION

Ashley Unger - Temple University; Kylie H. Alm - Temple University; Jessica Collins - Massachusetts General Hospital, Harvard Medical School; Jackie O'Leary - Temple University; Tehila Nugiel - Temple University; Ingrid R. Olson - Temple University – The extended face network contains groups of neurons that perform distinct functions on facial stimuli: regions in the posterior ventral visual stream appear to perform basic perceptual functions on faces, while more anterior

regions, such as the ventral anterior temporal lobe (vATL) and amygdala, function to link mnemonic and affective information to faces. These regions are interconnected by long-range white matter tracts; however, the functional significance of these pathways is poorly understood. One study found face emotion processing deficits in a small sample of individuals with brain lesions affecting the inferior longitudinal fasciculus (ILF), a tract connecting ventral extrastriate cortex to the vATL and amygdala, and the inferior fronto-occipital fasciculus (IFOF), which connects extrastriate cortex to portions of the frontal lobe (Philippi et. al, 2009). Here, our goal was to extend that research to a sample of neurologically normal adults. Study participants completed several face perception tasks, including a difficult emotion discrimination task. Diffusion tensor imaging and deterministic tractography were used to delineate the ILF and IFOF. Regression analyses revealed a significant relationship between the microstructural properties of the left ILF and IFOF and individual differences in emotion discrimination ability. ILF/IFOF microstructure also predicted gestalt pattern and facial identity recognition, however no relationship to face-perception was found in a control tract, the uncinate fasciculus. We propose that the ILF and IFOF play an important role in face perception and the processing of emotions.

C-32 LOGICAL REASONING IMPROVES IN THE CONTEXT OF AN ANGRY VOICE AND IS CHARACTERIZED DIFFERENTLY FROM NEUTRAL IN ITS NEURAL UNDERPINNINGS

Kathleen W. Smith - York University; Laura-Lee Balkwill - Humanist Canada; Oshin Vartanian - University of Toronto; Vinod Goel - IRCCS Fondazione Ospedale San Camillo – Logical reasoning about provocative (negative) material has been shown to involve the ventromedial prefrontal cortex (Goel & Dolan, *NeuroImage* 20 (4), 2003). We investigated what the effect on reasoning about neutral material would be if that material were presented in an emotional context. Study participants underwent functional magnetic resonance imaging while engaged in logical reasoning about neutral syllogism arguments presented auditorially in a sad, angry, or neutral tone of voice. Sad voice induction led to reasoning

performance and neural underpinnings similar to the neutral voice condition, whereas anger voice induction led to improved logical reasoning as well as neural underpinnings that were dissociated from those associated with the neutral voice condition. From this, we conclude that reasoning in an angry auditory context is characterized differently from reasoning in a neutral context.

C-33

TRANSCRANIAL DIRECT CURRENT STIMULATION OF THE EXTRAstriate BODY AREA MODULATES IMPLICIT ANTI-FAT BIAS.

Valentina Cazzato - University of Udine, University of Bradford; **Stergios Makris** - University of Udine, Edge Hill University; **Cosimo Urgesi** - University of Udine, Bangor University – Explicit negative attitudes and beliefs towards obese individuals are well documented (e.g. Ata & Thompson, 2010). Several studies have shown that the Extrastriate Body Area (EBA) in the lateral occipital cortex is critical for body aesthetic perception (Calvo-Merino et al., 2010; Cazzato et al., 2014). Nevertheless, it is still unclear whether EBA serves a role in implicit weight-stereotypical bias, thus reflecting a top-down modulation in the aesthetic preference for slim as compared to overweight/obese bodies. Here, we tested the causal role of EBA in triggering implicit weight and aesthetic stereotypical associations (i.e. “ugly” with overweight and “beauty” with slim) by modulating EBA excitability by means of transcranial direct current stimulation (tDCS). An ad-hoc personality-IAT (i.e. “bad” with overweight and “good” with slim), which focused on body-concepts nonrelated to aesthetic representations, was developed as a control condition. Anodal, cathodal, or sham tDCS (2 mA, 10min) over the right and left EBA was administered to 12 female and 12 male participants. Preliminary results showed that applying cathodal stimulation over left-EBA reduced the weight-bias for the personality-IAT in male participants, as compared to anodal and sham stimulation over the same hemisphere. The effect was specific for the polarity and hemisphere of stimulation. To the opposite, female participants did not show any significant tDCS modulation in both IATs. The present results suggest that negative attitudes towards obese people may

depend on neural signals from the extrastriate visual cortex.

C-34

SELECTIVE ENCODING OF THREAT RELEVANT SIGNALS IN THE HUMAN BRAIN.

Marwa El Zein - Cosimo Urgesi - University of Udine; **Valentin Wyart** - Laboratoire des Neurosciences Cognitives, Institut National de la Santé et de la Recherche Médicale, Département d'Etudes Cognitives, Ecole Normale Supérieure; **Julie Grèzes** - Laboratoire des Neurosciences Cognitives, Institut National de la Santé et de la Recherche Médicale, Département d'Etudes Cognitives, Ecole Normale Supérieure – The ability to correctly decode others' emotional expressions and to rapidly and accurately select the most relevant course of action bears survival advantages. Such ability depends not only on the proper identification of the emitted signal, often complex or ambiguous under natural settings, but also on the evaluation of its significance for the observer. Particularly, an angry face is more relevant when looking towards an observer who becomes the target of the threat, whereas a fearful face looking away from the observer may signal a potential threat in the environment. Here, using electroencephalography, we aim to identify the mechanisms underlying the categorization of facial expressions and the impact of threat relevance on these mechanisms. We manipulated parametrically the intensity of fearful and angry expressions and their relevance during a Fear-Anger categorization task. Behaviorally, threat relevant emotions benefited from an increased perceptual sensitivity as observed on the slope parameter of the psychometric function. Further supporting this result, single-trial EEG signals regressed against the intensity of emotional expressions revealed that intensity correlated better with EEG signals for relevant emotions as soon as 170 ms after stimulus onset. Interestingly, relevant emotions were exclusively encoded in motor structures at 200 ms after stimulus onset, when time-frequency decompositions of motor EEG signals in the mu-beta band were regressed against intensity. To conclude, our data provides converging evidence that gaze direction contextually tunes emotion categorization in a selective fashion, by enhancing sensitivity to the emotion most

relevant to the observer in the associated social context.

C-35

EMOTIONAL PROSODY PERCEPTION IN HEALTHY AGEING – EVIDENCE FROM ERPS AND RECOGNITION RATES

Silke Paulmann - University of Essex; Chelsea Harmsworth - University of Essex; Riccardo Russo - University of Essex – Existing research on emotional speech perception across the life-span suggests that the ability to understand emotions from speech can be altered in healthy ageing (e.g. Ruffman et al., 2008). However, the extent and underlying cause remains to be determined. We believe that the questions why and how emotional speech perception is altered in healthy ageing can only be adequately addressed by acknowledging that emotional speech perception is a multi-step process mediated by a diverse brain network (e.g. Kotz & Paulmann, 2011). Any disruption in the 'processing line' may lead to an altered ability to perceive the emotional intention of a speaker. Thus, here we investigated different stages of emotional speech perception by means of time-sensitive event-related brain potentials (ERPs) and behavioural responses in a group of healthy ageing (65+ years) and a University student population. Specifically, we investigated early emotional salience detection (as reflected in the P200 ERP component) as well as performance on an emotional prosody recognition task. A significant P200 effect showing that neutral prosody can be distinguished from emotional (i.e. anger, disgust, sad, pleasant surprise) prosody was found for both groups suggesting that emotional salience detection is not altered in healthy ageing. In contrast, emotional prosody recognition accuracy rates in elderly are significantly reduced. This suggests that elderly might experience problems in using the correctly identified acoustic input to accurately categorize specific emotions at later processing stages.

C-36

A SLIPPERY SLOPE: NEURAL ADAPTATION TO DISHONEST BEHAVIOR

Neil Garrett - University College London; Stephanie C. Lazzaro - University College London; Dan Ariely - Fuqua School of Business, Duke University; Tali Sharot - University College London – Humans are proficient at adapting

to new contexts including aversive circumstances such as bereavement and disability (Fredrick & Lowenstein, 1999; Brickman et al., 1978). In this study we explore the possibility that individuals adapt, not only to external circumstances and stimuli, but also to aversive properties of their own immoral decisions. Our results show that interpersonal deception in a 2 party game increases linearly over time in a context in which deception benefits both parties (deceiver and deceived) and when it accrues benefits to the deceiver only. This implies that small acts of dishonesty when repeated escalate into greater ones. fMRI results suggest that the biological mechanism for this escalation over time is neural adaptation of the right amygdala and rostral anterior cingulate cortex in response to an individual's own dishonest behaviour. Finally, we show that the degree of neural adaptation acts as a "teaching signal", escalating the likelihood of subsequent dishonest behaviour. Our findings are the first to suggest that adaptation can occur in response to our own decisions and that this could be a mechanism by which dishonest behaviour is given licence to escalate.

C-37

THE NEURAL BASIS OF DISHONEST DECISIONS IN GAIN AND LOSS CONTEXTS

Xiaoli Ling - East China Normal University; Jing Yang - Shanghai University of Sport; Peng Sun - East China Normal University; Zhiyuan Liu - East China Normal University; Li Zheng - East China Normal University; Xiuyan Guo - East China Normal University – This fMRI study sought to investigate how the loss and the gain contexts modulated dishonest behaviors during ultimatum bargaining and the underlying neural basis. During the experiment, the participants were first played the ball-guessing game, in which they gain or loss RMB 20 (gain or loss context) and then played an adapted version of the Ultimatum Game as responders during which they split 60 chips. Participants were informed beforehand that the chips were worth twice as much to them as to the proposer and this information was only known to them, but not the proposer. They could tell the truth or lie by sending alternative message "one chip was worth RMB 2 to me" (no deception) or "one chip was worth RMB 1 to me" (deception) to the proposer. At the behavioral level, higher deception rates

were observed for loss context than gain context. At the neural level, greater deception-related activation (relative to honest) in the bilateral dorsolateral prefrontal cortex and right caudate nucleus were found during in the gain context compared to the loss context. These preliminary findings suggested that the neural basis of deception decisions was modulated by the contexts (i.e. loss vs. gain) and pointed to an important role for DLPFC in deception behavior.

C-38

THE NEURAL CORRELATES OF DETECTING DECEPTION IN HUMAN BODY

MOVEMENTS. Stergios Makris - *Edge Hill University*; Cosimo Urgesi - *Università degli Studi di Udine* – There is mounting research evidence showing that watching others' actions triggers action resonance in the motor cortex (Fadiga et al, 2005). Furthermore, motor resonance processes have been found to be modulated by erroneous actions, such as fake or deceitful actions (Tidoni et al, 2013). However, the underlying neural mechanisms for detecting deceptive movements are still not fully understood. In the present study we presented short video-clips of actors performing an every-day action (i.e. reaching, grasping and lifting a metal cube). There were three types of videos; true actions (TA), fake actions (FA; actors purposely performing an action incongruent to the real weight of the cube), deceit actions (DA; actors unintentionally performing an action incongruent to the cube after being deceived about the real weight of the object). The experimental task involved participants watching the video-clips and then having to indicate the weight of the object (heavy or light). At the same time we interfered by means of online repetitive transcranial magnetic stimulation (rTMS) over brain areas associated with the action observation network; namely the superior temporal sulcus (STS), the anterior intraparietal area (AIP), as well as the ventral and dorsal premotor cortices. The results have indicated a strong modulation of performance in the task for both fake and deceit actions, following the downgrading of brain areas associated with action observation and action resonance. Therefore, our findings provide causative evidence about critical brain areas and

mechanisms for recognizing fake and/or deceptive body movements.

C-39

DECREASED AMYGDALA ACTIVATION AND FUNCTIONAL CONNECTIVITY ASSOCIATED WITH CALLOUS UNEMOTIONAL TRAITS DURING MORAL JUDGMENTS OF CAUSING FEAR

Elise M. Cardinale - *Georgetown University*; Andrew A. Breeden - *Georgetown University*; Emily L. Robertson - *Georgetown University*; Leah M. Lozier - *Georgetown University*; Abigail A. Marsh - *Georgetown University* – The present study examined the role of emotion processing in moral judgment in adolescents ages 10-17, with varying degrees of externalizing conduct problems and callous unemotional (CU) traits. CU traits correspond to the emotional and interpersonal characteristics of adult psychopathy. CU traits are consistently linked to deficits in fear processing and severe, persistent behavior problems. However, no study has yet examined the role that deficits in fear processing play in moral decision-making in children with CU traits. We aimed to address this gap using the Emotionally Evocative Statements Task (EEST). The EEST contains 120 statements designed to elicit anger, disgust, fear, happiness or disgust or which are neutral. During fMRI scanning, participants viewed each statement and indicated whether it would ever be morally acceptable to say that statement to another person. A group x emotion interaction emerged in the left amygdala such that, in children with CU traits, the left amygdala was significantly less active during evaluations about causing others to feel fear. Preliminary generalized psychophysiological interactions (gPPI) analyses also revealed decreased functional connectivity between the left amygdala and right medial temporal lobe as well as the ventral medial prefrontal cortex during judgments about causing others fear among children with high levels of CU traits. Together, these results suggest that children with CU traits may rely on distinct neural mechanisms when evaluating the moral permissibility of causing others to feel fear.

C-40

THE PLEASURE OF REVENGE: RETALIATORY AGGRESSION ARISES FROM A NEURAL IMBALANCE TOWARD REWARD

David S. Chester - *University of Kentucky*; C. Nathan

DeWall - University of Kentucky – Most of daily life hums along peacefully but provocations tip the balance toward aggression. Negative feelings are often invoked to explain why people lash out after an insult. Yet people might retaliate because provocation makes aggression hedonically rewarding. To test this alternative hypothesis, 68 participants underwent fMRI while they completed a behavioral aggression task that repeatedly manipulated whether aggression was preceded by an instance of provocation or not. After provocation, greater activity in the central node of the brain's reward network (the NAcc) predicted more aggression. Greater NAcc activation also helped predict participants' history of real-world violence. Functional connectivity between the NAcc and a regulatory region in the lateral prefrontal cortex related to lower retaliatory aggression. It appears that provocation tips the neural balance towards hedonic reward, which fosters retaliatory aggression. The pleasure of inflicting pain appears to drive retaliatory aggression, but self-regulatory processes can keep aggressive urges at bay.

C-41

SANS Poster Award winner

PERCEPTIONS OF MORALS AS SUBJECTIVE OR OBJECTIVE RELY ON THEORY OF MIND

Jordan Theriault - Boston College; Adam Waytz - Northwestern University; Larisa Heiphetz - Boston College; Liane Young - Boston College – Ideological conflict tends to stem from disagreement over moral issues, and the resolution of such disagreement requires a sophisticated understanding of how people process moral beliefs. Although some developmental psychologists have claimed that moral beliefs are largely perceived as objective, this work has largely focused on uncontroversial, "prototypical" morals (i.e. clear acts of harm). Meanwhile, recent work in social psychology has uncovered considerable variability in adults' perceptions of morals as objective. The present research examined the conditions under which people process a broad range of moral propositions as objective (fact-like) or subjective (preference-like), employing a combination of behavioral methods, functional magnetic resonance imaging (fMRI) and transcranial magnetic stimulation (TMS). In the scanner, participants evaluated statements concerning morals, facts, and preferences. Behaviorally and neurally, morals, overall, were processed as similar to

preferences. Morals and preferences produced similar patterns and magnitudes of activity across brain regions that support theory of mind (ToM). However, widely endorsed morals were perceived as more objective (fact-like), and, similar to facts, elicited reduced activity in ToM brain regions. Reduced activity in right temporoparietal junction (RTPJ) in particular correlated with behavioral ratings of morals as objective, and, when RTPJ activity was disrupted using TMS, moral propositions typically perceived as subjective were perceived as more objective. Our findings illustrate the role of mental state reasoning (as indexed by RTPJ activity) in perceptions of moral objectivity. Our findings reveal that ToM activity, while similar overall between moral beliefs and preferences, has a distinct profile in each domain.

C-42

SANS Poster Award winner

BALANCING THE MORAL BANK: NEURAL MECHANISMS OF RECIPROCITY

Yuanbo Wang - Brown University; Jorie Koster-Hale - Harvard University; Fiery Cushman - Harvard University – Reciprocity depends on two processes: encoding information about social partners' generosity, and retrieving that information in order to guide subsequent choice. We know much about these processes in isolation, but less about the way in which they are integrated. In this study we identify neural correlates of encoding and retrieval that underlie reciprocity in a sequential prisoner's dilemma. We recruited twenty-nine subjects to play a round-robin economic game in the fMRI scanner. Each participant interacted with multiple players characterized by variable degrees of generosity. Based on prior research and computational models (see Koster-Hale, & Saxe, 2013 for a review), we predicted that participants would maintain player-specific representations of the probability of giving via a prediction error update mechanism. Further, we predicted that the current value of this "generosity" parameter would be recalled during opportunities for reciprocation. We find evidence for signals of both types in dorsomedial prefrontal cortex (dmPFC): BOLD signal tracks prediction error values during encoding (update), and generosity parameters during reciprocity (retrieval). This echoes prior research on the role of dmPFC in trust (Behrens, et al., 2009).

Notably, these signals track lack of generosity. Specifically, we observed decreased activation in the region for unpredicted generous behavior during encoding, and decreased activation when reciprocating to a generous partner. Thus, our results suggest that dmPFC may be responsible for storing and retrieving information about other's social behaviors, specifically negative character traits and then using them to guide reciprocity.

C-43

SOCIAL INTELLIGENCE FROM THE

GROUND UP *Rami Gabriel - Columbia College Chicago, Research group in Mind, Science and Culture* – This paper seeks to expand our tools for understanding non-representational mental processes and behaviors. Taking a bottom-up approach based on basic mammalian sensory-motor systems, homeostasis, and affective mechanisms, along with communication abilities, a model is presented of how the embodied storing and perception of information in body-world loops functions as a form of social intelligence. The affordance theory, elements of Affective Neuroscience, the somatic marker hypothesis, and Pushmi-Pullyu representations provide the functional foundations for how perception and social interaction are forms of communicative social intelligence. In addition to providing an evolutionary story for the existence and perpetuation of complex social abilities, this model leaves room for the behavioral complexity of cultural learning.

C-44

TRUST IN ACTION: MODULATION OF THE ACTION OBSERVATION NETWORK BY

TRUSTWORTHINESS *Harry Farmer - University College London; Matthew Apps - University of Oxford; Manos Tsakiris - Royal Holloway, University of London* – Previous research has demonstrated the existence of an action observation network (AON) comprised of brain areas involved in both the execution and observation of actions. This network had been assumed to play an important role in social cognition. The current study employed fMRI to investigate whether the trustworthiness of an observed actor modulated activation of the AON. Participants watched a trustworthy and untrustworthy actor make either overt or hidden movements corresponding to their

decisions in a modified trust game. The study found greater activation of both dorsal premotor and parietal regions in the AON for actions made by an untrustworthy actor. In addition, it was found this modulation was stronger for covert unobserved actions than for overtly observed actions. These findings suggest an evolutionarily important role for the AON with a focus on the simulation and prediction of potentially threatening actions.

C-45

THE ENGAGEMENT OF ANTERIOR INSULA DURING THE MODULATION OF SOCIAL COMPARISON ON FAIRNESS-RELATED DECISION-MAKING

Xuemei Cheng - East China Normal University; Li Zheng - East China Normal University; Lin Li - East China Normal University; Xiuyan Guo - East China Normal University – We investigated how social comparison influenced fairness-related decision-making and its underlying neural mechanism by using fMRI. During the experiment, participants played a modified Ultimatum Game (UG) as responders. They were not only informed of the amount of money the proposer offered to them but also the average amount the same proposer offered to others, resulting in three conditions in which participants received more, equal and less money compared with the average amount. As the classical UG, participants could reject or accept the proposed offer. Acceptance led to the suggested division while rejection resulted in both receiving nothing. Behavioral results demonstrated that participants were more likely to accept unfair offers when they received more than others. Meanwhile, they made more rejections when they received less than others. At the neural level, more activation of anterior insula was found when participants received unequal offers compared with the average amount; no matter they were more than the average amount or less. These results indicated that social comparison played an important role during people's fairness-related decision-making and anterior insula engaged in this social comparison process.

C-46

THE NEURAL BASIS OF INTERPERSONAL

TRUST *Brian W. Haas - University of Georgia; Megan M. Filkowski - University of Georgia* – Interpersonal trust is a fundamental social-cognitive process that strengthens social

bonds and improves the productivity within large social groups. Although interpersonal trust affects a large variety of human behaviors and the way many decisions are made, the neural substrates associated with the tendency to trust other people remains poorly understood. We carried out a multimodal study designed to characterize individual differences in the tendency to trust other people. We used high resolution structural MRI (VBM8-DARTEL) to examine how individual differences in the tendency to trust other people were associated with localized patterns of gray matter volume. We used a control of trust task and fMRI to examine how individual differences in the ability to control attitudes of interpersonal trust were associated with localized patterns of brain activity and functional connectivity. Converging results indicate that interpersonal trust is subserved by a network of brain regions that include the ventromedial prefrontal cortex and insula, among others. Amygdala gray matter volume was associated with the tendency to trust other people as well as the tendency to distrust other people. Greater precuneus activity and functional connectivity was associated with an improved ability to control attitudes of interpersonal trust. Combined these studies provide evidence that individual differences in the way humans trust each other is reflected in the structure and function of the brain.

C-47

SOCIAL CONFORMITY, DISGUST AND HOMOPHOBIA: AN FMRI STUDY

Marco Tullio Liuzza - Sapienza University of Rome, Santa Lucia Foundation; Emiliano Macaluso - Santa Lucia Foundation; Patrizia A. Chiesa - Sapienza University of Rome, Santa Lucia Foundation; Salvatore M. Aglioti - Sapienza University of Rome, Santa Lucia Foundation – Homophobia has hypothesized to be related with disgust, a core emotion that plays role in the discrimination of minorities whose behaviors and/or values are considered to be deviant from the majority norms. In the present fMRI study we used a social conformity paradigm to assess whether heterosexual (Het, N = 15) and non exclusively heterosexual (NEH, N = 17) individuals conformed or not to the mean rating on the attractiveness of male bodies provided by a putative group of gay students. We found that NEH but not Het conformed to the mean attractiveness rating

of the (putative) sexual minority group. In particular, the NEH showed significantly increased ratings after being exposed to an upward (i.e. a higher rating) social pressure from the minority group. Importantly, conformist behavior was found to be related to explicit, but not implicit, homophobia. From the whole brain main effect of the social pressure emerged a network that included areas found in previous studies on social conformity (e.g. bilateral precuneus, right middle frontal gyrus and left inferior frontal gyrus). Most importantly, we focused our BOLD analysis on regions of interests taken from a meta-analysis on discrete emotions and found that activity in the left anterior insula for the upward and downward social pressure vs. agree contrast negatively predicted conformity in Het but not in NEH. In conclusion, the present study suggests that brain areas involved in the experience of disgust might indeed play a role in stigmatizing sexual minorities.

C-48

NEURAL BASIS OF GUILT: AN FMRI ALE META-ANALYSIS

Anthony J. Gifuni - McGill University; Adam Kendall - McGill University; Fabrice Jollant - McGill University – Background. Guilt is the feeling of having committed some wrong against oneself or another person. It is therefore an important component of many social behaviors. While guilt is a part of normal human experience, there is also a relationship between guilt and several mental disorders, including depression, post-traumatic stress disorder, obsessive-compulsive disorder, psychosis, antisocial personality disorder and suicide. Understanding the normal and pathological physiology of guilt is important. In recent years, a number of neuroimaging studies have investigated the neural correlates of guilt. Here we quantitatively summarized the published neuroimaging studies. Methods. A systematic review of literature conducted until November 2014 found 10 studies meeting inclusion criteria, including 9 using functional Magnetic Resonance Imaging (fMRI) and 1 using Positron Emission Tomography (PET) for a total of 190 participants. As few studies were conducted in patients, we restricted our analyses to healthy individuals to reduce heterogeneity. A meta-analysis was then conducted using the activation likelihood estimation program GingerALE. An additional Meta-Analytic Connectivity Modelling (MACM) analysis was

conducted to investigate functional connectivity of significant clusters. Results. The analysis revealed seven significant brain clusters of activation encompassing the medial frontal gyri, anterior cingulate cortex, middle temporal gyrus, precuneus and insula. Conclusions. Our analysis identifies the medial frontal gyrus and the anterior cingulate cortex as playing a central role in guilt processing, areas that are thought to be involved in abstract moral value processing and theory of mind. The study of guilt in pathological conditions should be now conducted.

C-49

THE MODULATION EFFECT OF MORALITY IN PERCEPTUAL MATCHING REVEALED BY EVENT-RELATED BRAIN POTENTIALS

Chuanpeng Hu - Tsinghua University; Kaiping Peng - Tsinghua University; Jie Sui - Tsinghua University – How the morality influence our perception is still unclear. In the present study, we assessed whether morality shape our perception processing, using a novel social learning paradigm which has shown a stable effect of social salience of stimuli on perception and attention. We had participants learnt the associations between people of different moral reputation (good, bad, or normal) and different geometric shapes (triangle, square, or circle). After learning instruction, they carried out a shape-moral matching task to judge whether a pair of sequentially presented person-shape matched. In Experiment 1, We found that compared to the normal person association (as a baseline), the response to good person association was faster and more accurate, but no effect of the bad person association was found. In Experiment 2, we recorded the EEG data while 8 participants finished the similar task as in experiment 1, to investigate the time course of effect of morality in the brain. The behavioral results replicated the pattern of Experiment 1. Moreover, the ERP results showed that the modulation effect of moral reputation occurred as early as approximately 100ms, with larger P1 for bad person association and smaller P1 for good person association. The results implied that morality could modulate perceptual processing in a very early stage.

C-50

ERPS REVEAL THE EARLY DETECTION OF SPEAKER BELIEVABILITY IN VOCAL

COMMUNICATION *Xiaoming Jiang - School of Communication Sciences and Disorders, McGill University; Marc D. Pell - School of Communication Sciences and Disorders, McGill University* – Dynamic formation of a speaker's credibility is crucial to interpersonal communication. Using ERPs, we explored when and how a speaker's voice-implied in-group or out-group status (i.e., accent information) affects listener's judgment of the speaker's believability in online vocal communication. English statements with no inherent truth value were produced by three groups of speakers (native dialect; regional dialect; foreign accent of English) in a confident, unconfident and neutral tone. Participants listened to each utterance and judged how much they believed the speaker on a scale from 1 to 5. ERPs time-locked to utterance onset revealed a larger N100 for the in-group than for the out-group voices. Moreover, an early differentiation between low and high level of believability was shown, with the least believable utterances eliciting a largest N1-P2 complex. Importantly, the early N1 differentiation only occurred in out-group voices (regional dialect and foreign accent) but not in in-group voices, while the P200 differentiation sustained for all voices. The N100 difference was modulated by whether participants held a positive social attitude towards the out-group speaker (perceived competence, intelligence, etc.). Although statements with higher mean f0, larger f0 variance and certain voice qualities generally sound less believable, this effect seems larger for the in-group than for the out-group voices. A lack of believability can be rapidly and reliably detected 200 ms after vocal information is encountered; moreover, the effect of a listener's stereotype towards an out-group member can be mediated by N100 response, which subserves an initial acoustic analysis preceding vocal judgments.

C-51

NEURAL SIGNALS UNDERLYING SELF-EVALUATION BIAS DURING DISHONEST DECISIONS

Eunbin S. Kim - Rutgers University; Megan E. Speer - Rutgers University; Mauricio R. Delgado - Rutgers University – Does the extent of individuals' own transgressions affect their judgments of the self-v.-others? Previous studies examining moral judgments and behaviors have found that biases exist in how people judge their own immoral

behaviors primarily through hypothetical scenarios (e.g., Manley et al., 2001). The present study investigated the neural correlates of active engagement in moral decisions and its relationship with self-v.-other evaluations. Participants played a game where they could win monetary rewards by correctly predicting whether a card's value was higher or lower than the number 5. Incorrect predictions, however, resulted in a monetary charity donation. Periodically throughout the task, participants had opportunities to cheat on incorrect trials to gain additional self-rewards (i.e., money intended for charity). Following the prediction task, participants made self-and-other evaluations on their moral behavior. In both a behavioral (N = 27) and preliminary fMRI sample (N = 9), we observed that individuals underestimated the extent of their own dishonest behavior. That is, participants believed to have cheated less frequently compared to their actual behavior, which was presented as the average cheating behavior of all participants. Interestingly, a preliminary fMRI analysis contrasting the period of opportunity v. no-opportunity to cheat showed greater activity in regions previously implicated in executive control (e.g., anterior cingulate), which may reflect conflict during the decision-making process. Consistent with this finding, participants deliberated longer on trials when given an opportunity to behave dishonestly. Future analyses will examine how neural activity during moral deliberation relates to the extent of biases in self-judgment.

C-52

HOW MORAL CHARACTER SHAPES MORAL JUDGEMENT

Jenifer Z. Siegel - University of Oxford; Molly J. Crockett - University of Oxford; Ray Dolan - University College London – Inferring the moral character of others is crucial for successful social interactions. Previous work suggests that we infer someone's character by judging the morality of their actions: moral judgments shape character assessments. Here, we examine the distinct but related question of whether character assessments, in turn, shape moral judgments. Subjects observed and judged sequences of decisions made by agents who were either selfish or kind. Each decision involved a tradeoff between personal profit and pain for a third-party victim. Across trials we manipulated the magnitude of profit and

pain resulting from the agent's decision, and whether the agent made an active or a passive response. We built and compared computational models to describe subjects' moral judgments and find that, in line with previous findings, moral judgments are sensitive to consequences, distinctions between actions and omissions, and to the presence of personal incentives. Furthermore, we show that the underlying character of the agent being judged – i.e., whether the agent is selfish or kind – exerts an independent effect on moral judgments and also moderates the influence of actions and incentives on judgments. We suggest these findings may result from interactions between Pavlovian and instrumental systems for reinforcement learning and decision-making.

C-53

NEURAL CORRELATES OF SELF-CONSCIOUS EMOTIONS

Michael Gilead - Columbia University; Maayan Katzir - Ben-Gurion University of the Negev; Tal Eyal - Ben-Gurion University of the Negev; Nira Libmeran - Tel-Aviv University – Self-conscious emotions are prevalent in our daily lives and play an important role in both normal and pathological behavior. Despite the immense significance of self-conscious emotions, relatively little is known regarding their neural basis. In light of this, we conducted an fMRI study in which participants thought of various personal events which elicited feelings of negative and positive self-conscious (i.e., guilt, pride) or basic (i.e., anger, joy) emotions. We performed a conjunction analysis to investigate the neural correlates associated with processing self-conscious vs. basic emotions, irrespective of valence. The results show that processing self-conscious emotions resulted in activation within frontal areas associated with abstract thought and self-control, namely, the mPFC extending to the ACC, and within the lateral-dorsal prefrontal cortex. Processing basic emotions resulted in activation throughout relatively phylogenetically-ancient regions of the cortex, namely in visual and tactile processing areas and the insular cortex. Furthermore, self-conscious emotions differentially activated the mPFC such that the negative self-conscious emotion (guilt) was associated with a more dorsal activation, and the positive self-conscious emotion (pride) was associated with a more ventral activation. We discuss how these results shed light on the nature of mental representations and neural

systems involved in self-reflective and affective processing.

C-54

STRESS EXPOSURE DECREASES COOPERATIVE DECISION-MAKING BEHAVIOR

Candace Raio - New York University; Oriel FeldmanHall - New York University; Mrunalini Gaikwad - New York University; Frederico DePauli - Cornell University; Jeni Kubota - University of Chicago; Elizabeth Phelps - New York University – Previous research has shown that cooperation is a common phenomenon across species, despite being immediately disadvantageous to personal gain. This form of prosocial behavior has been widely examined in the context of economic decision-making, but it is unknown how aversive emotional states encountered in everyday life, such as those induced by stress, influence such behavior. Since stress has been shown to engender reliance on habitual forms of behavior it is possible that stress may enhance cooperation, which has been described as an automatic or intuitive response. Alternately, the aversive nature of stress exposure may enhance individuals' propensity to behave selfishly in order to secure additional resources. Here, we sought to distinguish these possibilities by combining a well-characterized, classic behavioral economic game that measures cooperative decision-making behavior with an acute stress manipulation known to reliably engage sympathetic and neuroendocrine responses to stress. Participants underwent a stress induction task (i.e., cold pressor task) or control task before playing either the Prisoner's Dilemma game, in which participants could either cooperate with a partner for a lower monetary reward, or betray them for higher monetary gain, or a matched non-social lottery game. Our data reveal that stress exposure reduced prosocial behavior by decreasing cooperation and increasing individuals' propensity to betray their partners for more money. By studying the effect of an ecologically valid stress induction on cooperative decision-making, this work promises to situate our understanding of prosociality in a broader framework that reflects the influence of real-world conditions of stress exposure.

C-55

THE ROLE OF THEORY OF MIND REGIONS IN COOPERATIVE VERSUS COMPETITIVE INTERACTIONS

Lily Tsoi - Boston College; James Dungan - Boston College; Adam Waytz - Northwestern University; Liane Young - Boston College – Our capacity to consider people's mental states (i.e., theory of mind; ToM) is crucial for social interaction with close others in the case of affiliation or cooperation and enemies in strategic interactions or competition. In an fMRI study involving a game variant of "Rock, Paper, Scissors", we investigated whether cooperative versus competitive interactions differentially recruit brain regions for ToM, such as the right and left temporoparietal junction (TPJ), precuneus, and dorsomedial prefrontal cortex (dmPFC). In this game variant, players (the participant and a confederate posing as another player) chose between two shapes (circle or square) in each trial. In cooperate trials, both players shared the same goal (e.g., to guess the same shape); in compete trials, players had opposing goals (e.g., one player was told to guess the same shape while the other was told to guess the opposite shape). Univariate region of interest (ROI) analyses reveal that ToM regions are similarly recruited for cooperate and compete trials. However, ROI-based multivariate pattern analyses (MVPA) reveal different spatial patterns of neural activity in these ToM regions for cooperate and compete trials. These MVPA results did not extend to cooperate and compete trials in a control condition in which players were unable to choose their shape (players were told that the computer made the choices). These results suggest that while ToM regions are similarly recruited for cooperative and competitive interactions, these regions encode the representational content underlying cooperative and competitive interactions that specifically involve choices and decisions made by people.

C-56

SANS Poster Award winner

THE SOCIAL VALUE OF SHARING EXPERIENCES

Eshin Jolly - Dartmouth College; Diana I. Tamir - Stanford University; Jason P. Mitchell - Harvard University – Social experiences can be rich sources of happiness, and previous work has demonstrated that reminiscing about or anticipating these experiences is

highly rewarding. However, research has yet to fully explain the immediate social value associated with sharing experiences with others. In this study we used a novel experience-sharing and decision-making paradigm and functional MRI to understand this social value. In five behavioral studies, participants chose between watching a video by themselves or with a study partner. Each option was paired with a variable monetary reward. Consistent with the hypothesis that individuals value social experiences, participants consistently gave up money to watch a video with another person. Remarkably, they did so despite consistent evidence that they did not find experiences any more enjoyable when shared. In a subsequent fMRI experiment, individuals passively viewed a video with (share) or without (solo) a study partner. Trials were separable across an anticipation phase and an experience phase. Analyses were performed on the contrast of shared > solo in brain regions associated with motivation, reward and mentalizing. Ventral striatum was observed across both phases, suggesting increased subjective value for the shared experience. Dorsomedial prefrontal cortex emerged during the experience phase suggesting participants were actively considering their study partner's thoughts and feelings during the video. Activity during the anticipation phase in these regions positively correlated with how close individuals felt to their study partners. These results suggest that participants value sharing experiences with others, but that doing so does not increase enjoyment of the experiences themselves.

C-57

THE INFLUENCE OF GENDERED CHARACTERISTICS ON INTERPERSONAL SYNCHRONY

Rachel G. Pizzie - Dartmouth College; Eric Hehman - New York University; Jonathan B. Freeman - New York University – In even brief interactions, we perceive a multitude of information about other individuals. Prior research has examined how gender influences dyadic interactions, but it is less understood how these interactions may be shaped by interaction partners' gender stereotypes, as well as their own adherence to those stereotypes. The current work examined how the interplay of gender and stereotypes would influence behavioral synchrony. Increased behavioral synchrony is typically associated with affiliation and liking,

and often operates outside of conscious control. Participants were video-recorded while participating in a brief conversation in same-sex dyads (N = 96, 20 female dyads, 18 male dyads). Individual differences in gender stereotypes (Ambivalent Sexism Inventory; ASI) and self-reported behavioral adherence to those stereotypes (Bem Sex Role Inventory; BSRI) were assessed following the interaction. Frame differencing measures were used to sensitively measure behavioral synchrony during the interaction. We found that synchrony was associated with ASI and BSRI scores, but these relationships were moderated by gender. Specifically, greater ASI scores were associated with increased behavioral synchrony for male-male dyads (specifically the benevolent sexism subcomponent), whereas this was not true for female-female dyads. Conversely, for female-female dyads, greater scores on the BSRI (feminine subscale) were associated with an increased level of synchrony, whereas for male-male dyads they were associated with decreased synchrony. Taken together, individual differences in gender stereotypes and adherence to those stereotypes differentially predicted behavioral synchrony in brief interactions. These findings suggest that dissociable stereotype-related processes function differently for men and women to drive synchrony in real-world interactions.

C-58

INTER-SUBJECT PHASE SYNCHRONIZATION OF HEART RATE VARIABILITY DURING COOPERATIVE VIDEO GAME PLAYING

Sotaro Shimada - Meiji University; Tomomasa Sakano - Meiji University; Yumie Ono - Meiji University – Cooperative multi-player video games provide a promising research platform to investigate human social behavior and its neural underpinnings. In this study, we measured heart rate variability (HRV) of two players cooperating in a simple puzzle game (Tetris) and examined whether the HRV signals showed inter-subject synchronization during the play. Sixteen male subject pairs (aged 21.8 ± 0.4 years) were participated in the experiment. The subject pair performed independent (but simultaneous) single-player gameplays and cooperative two-player gameplays alternately, repeating 6 times. In the two-player mode, two Tetris blocks in a single game screen were separately operated by the two players to erase the blocks in a

cooperative fashion. The length of each gameplay was 1 min with inter-trial interval of 1 min. In order to examine how the autonomic nerves of two players were intertwined, we calculated phase synchrony index (PSI) of HRV time-frequency data. We found that PSI was significantly higher in the cooperative gameplay than in the single-mode gameplay both in the low-frequency (LF: 0.04-0.15 Hz; $P < 0.001$) and the high-frequency (HF: 0.15-0.4 Hz; $p < 0.005$) HRV bands. Most interestingly, when the data was time-locked to the event that the two falling Tetris blocks accidentally collided with each other, PSI in LF decreased significantly in the successive period of 3-11 s after the collision ($P < 0.05$, t -test). These results suggest that inter-subject HRV coupling during cooperative gameplay, which could be interrupted by the erroneous play, can be used as a physiological measure to evaluate the ongoing inter-subject interaction.

C-59

TELL ME ANOTHER ONE: AN fNIRS STUDY OF NEURAL COUPLING IN NATURAL STORYTELLING

Kristin Shumaker - University of Pennsylvania; **Matthew B. O'Donnell** - University of Pennsylvania; **Nichollette Gregor** - University of Michigan; **Lynda Lin** - University of Pennsylvania; **Emily B. Falk** - University of Pennsylvania – Successful communication depends upon the ability of speakers and listeners to align during the processing of common messages (e.g. persuasive messages or everyday stories). Previous fMRI studies of narrative transmission suggest that neural coupling between speakers and listeners underlies successful social interactions (Hasson et al., 2012; Stephens, Silbert, & Hasson, 2010). Other fMRI studies have highlighted the role of the mentalizing system, particularly the TPJ, in predicting which speakers are more likely to effectively transmit ideas to their listeners (Falk, Morelli, Welborn, Dambacher, & Lieberman, 2013). However, the fMRI environment limits the ability to capture neural activity in dynamic social interactions. With the ability to record continuous neural activity with time-locked video viewing and recording during naturalistic conversation, functional near-infrared spectroscopy (fNIRS) affords the potential to increase the ecological validity of communication tasks. Here, we examine speaker-listener coupling in the mentalizing system (TPJ and DMPFC) while subjects engage in narrative transmission. Participants

(target $n=60$; data collection in progress) record videos telling stories (5-7 minutes) of memorable, real-life occurrences while undergoing fNIRS. They also listen to a story told by another participant, adopt that story and retell it in the first person. Previously, we have found that mentalizing in speakers during persuasive message propagation predicts the mentalizing activity in listeners during listening to a message (Shumaker, O'Donnell, Gregor, Lin & Falk, in prep). Using intersubject correlation, we will examine neural coupling between TPJ, DMPFC and MPFC, occurring during the telling and retelling of authentic and adopted personal narratives.

C-60

PRE-RESPONSE NEURAL SYNCHRONY BETWEEN REGIONS INTEGRAL FOR AFFECTIVE AND SELF REGULATORY PROCESSES PREDICT DECISIONS TO TRUST OTHERS

Eric D. Splan - University of Delaware; **Adam B. Magerman** - University of Delaware; **Chad E. Forbes** - University of Delaware – This study examined the neural biomarkers that immediately precede decisions to trust (or distrust) novel others. To examine trust related processes, White participants completed a coin flip game with either a White or Black confederate who reported the outcome of a simulated coin flip. Participants were told that at various points throughout the game the reporter would be motivated to lie. For each flip, participants decided whether or not to trust the confederate's response while continuous EEG activity was recorded. Using a data driven approach, we probed for neural biomarkers elicited during time intervals immediately before players decided to trust reporters. Source localization models conducted on 750 ms and 250 ms pre-decision yielded sources in the insula, inferior frontal gyrus, medial frontal gyrus, and the anterior cingulate cortex. Time frequency analyses conducted in these sources revealed increased communication (defined as increased phase-locking in the theta and alpha frequency bands) between the insula, inferior frontal gyrus and medial frontal gyrus for distrusting trials compared to trusting trials. These neural patterns were evident regardless of the confederate's race. Findings provide evidence that increased communication between a general neural network of regions involved in affective

processing and self-regulation in ambiguous situations bias individuals towards decisions to distrust novel others.

C-61

PUPILLARY SYNCHRONY EMERGES ACROSS DYADS AS A FUNCTION OF SHARED ATTENTION

Olivia Kang - Dartmouth College; Thalia Wheatley - Dartmouth College – Everyone wants to be understood, to connect at a deep level with other people. Forging these connections requires joint attention: we must be able to understand and share others' thoughts and feelings. As demonstrated by Zaki and colleagues (2008), this ability is dependent on others making their perspectives easy to infer (expressivity), as well as our own empathy. On the basis of these findings and research demonstrating that the pupillary response sensitively indexes dynamic attention (Wierda et al., 2012), we hypothesized that shared attention would yield shared patterns of pupil dilation (i.e., synchrony) across individuals. Moreover, we predicted that the degree of pupillary synchrony between a speaker-listener dyad would vary as a function of expressivity and empathy. We video-taped and eye-tracked "Speakers" as they relayed positive and negative emotional memories, and then eye-tracked an independent group of "Listeners" as they passively watched these videos (adapting Zaki et al's empathic accuracy paradigm, 2008). Speakers were either high- or low-expressive (scoring in the outer quartiles of the Berkeley Expressivity Questionnaire; Gross, 2000) and listeners' cognitive empathy was measured using the perspective-taking scale of the Interpersonal Reactivity Index (Davis, 1983). Pupillary synchrony emerged as a function of the interaction between speakers' expressivity and listeners' cognitive empathy, such that greatest synchrony was found in high-expressive, high-empathic pairs. These findings suggest that shared attention is interpersonal (dependent on listener's empathy and speakers' expressivity) and manifested by pupillary synchrony across a dyad.

C-62

THE GEOMETRY OF AFFECTIVE SPACE: A REVISED FRAMEWORK FOR REPRESENTING THE RELATIONSHIP BETWEEN AROUSAL AND VALENCE

Alison M. Mattek -

Dartmouth College; George L. Wolford - Dartmouth College; Paul J. Whalen - Dartmouth College – The literature contains notable disagreements concerning the relationship between the dimensions of arousal and valence. Some theories emphasize the fact that arousal and valence are independent, while positive and negative evaluations are dependent (i.e., anti-correlated; Russell 1980). Others depict arousal and valence as dependent (i.e., correlated), while positive and negative evaluations are independent (Cacioppo & Berntson, 1994; Lang 1995). Here, we offer a revised geometric framework that identifies the conditions under which these affective dimensions co-vary or vary independently, using data from 133 subjects across 4 datasets, providing ratings of emotional faces, vocalizations, music, visual scenes, sentences, and words. First, the data define an empirical boundary reflecting the dependence of valence and arousal ratings, which takes mathematical form as a nonlinear inequality ($a \geq |v|$)*. However, they also show that independent positive and negative dimensions do not sufficiently account for the arousal dimension. These seemingly opposing findings are reconciled with a triangular affective space anchored by three mutually exclusive categories (i.e., positive, negative, and neutral). In this space, arousal and valence are dependent upon each other on the edges of the space where clearly valenced positive/negative stimuli reside, but these dimensions vary independently in the central aspects of the space inhabited by ambiguously valenced stimuli. Conversely, positive and negative evaluations are dependent upon each other in the central ambiguously valenced aspects of the space, but vary independently along the clearly valenced edges of the space. These findings reveal that the relationship between affective dimensions depends on the presence of ambiguity.

* a = arousal; $|v|$ = the absolute value of valence

C-63

I FEEL THE SAME WAY: NEURAL MECHANISMS UNDERLYING SOCIAL INFLUENCES ON EMOTION

Rebecca E. Martin - Columbia University; Kevin N. Ochsner - Columbia University – Emotions, though generated individually, are strongly influenced by other people. The goal of this study was to examine how other people

shape our emotions. We scanned participants (N=24) while they viewed and rated pictures of positive, negative, and neutral scenes on a 1 to 7 scale indicating how bad or good the scene made them feel. Following their rating participants were shown what they believed to be a group rating from a sample of approximately 100 peers. After a rest period, participants then rerated the scenes a second time, this time without seeing peer ratings. We found a strong main effect of peer ratings such that participants changed their second ratings of the scenes to conform to those of their peers. This effect was strongest for negatively valenced scenes. At the neural level, our findings replicated previous studies (e.g.,

Klucharev et al., 2009; Izuma & Adolphs, 2013) demonstrating activation of the rostral cingulate during peer conflict (when peers rated items higher or lower than participants), and this activation was modulated by the magnitude of conflict. We also found activity in lateral prefrontal regions while viewing peer ratings. Additionally, we found that amygdala activation for negative scenes was either enhanced or dampened depending on whether peers rated scenes as more or less negative. Future directions include using connectivity and mediation analyses to explore the functional relationship between networks associated with social influence and emotional reactivity.

Notes

