# Social & Affective Neuroscience Society Annual Meeting 2014

# April 11-12, The Curtis

## Denver, Colorado

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# **Conference Schedule**

## Thursday April 10

Start	End	Session
6:00 PM	9:00 PM	Registration
6:30 PM	8:30 PM	Welcome Reception & Cash Bar
Friday Apr	il 11	
Start	End	Session
8:00 AM	8:50 AM	Continental Breakfast and Registration
8:50 AM	9:00 AM	Welcome
9:00 AM	10:15 AM	Symposium Session A: Intergroup Processes
10:15 AM	10:35 AM	Coffee Break
10:35 AM	11:50 AM	Symposium Session B: Clinical Neuroscience
11:50 AM	1:20 PM	Lunch Break
1:20 PM	2:35 PM	Symposium Session C: Social Affect
2:35 PM	3:50 PM	Poster Session D and Coffee Break
3:50 PM	5:05 PM	Symposium Session E: Developmental Neuroscience
5:05 PM	5:45 PM	Presidential Reception
5:45 PM	7:15 PM	Presidential Symposium: Advances in Fundamental
		Affective Neuroscience

## Saturday April 12

Start	End	Session
8:00 AM	9:00 AM	Continental Breakfast and Registration
9:00 AM	10:00 AM	Symposium Session F: Computation in Social Neuroscience
10:00 AM	10:25 AM	Coffee Break
10:25 AM	11:45 AM	Keynote Symposium: Perspectives from the "Parent"
		Disciplines of Social and Affective Neuroscience
11:45 PM	1:15 PM	Lunch Break
1:15 PM	2:30 PM	Distinguished Scholar Address: Elizabeth A. Phelps
2:30 PM	3:00 PM	Coffee Break
3:00 PM	4:15 PM	Symposium Session G: Basic Affective Processes
4:15 PM	5:30 PM	Poster Session H
5:30 PM	6:45 PM	Symposium Session I: Perceiving Others' Minds
6:45 PM	7:00 PM	Closing Remarks
7:00 PM	9:00 PM	Closing Reception & Cash Bar

# 2014 Awards

## **Distinguished Scholar Award**

Elizabeth A. Phelps, New York University

## **Innovation Award**

McKell R. Carter, Duke University "A distinct role of the temporal-parietal junction in predicting socially guided decisions"

## **SANS Poster Travel Awards**

Richard B. Lopez, Dartmouth College Matthew Brook O'Donnell, University of Pennsylvania Tyler Santander, University of Virginia

## **Symposia Presentations**

## Session A Intergroup Processes

Friday, April 11, 2014

9:00 - 10:15 AM

Chad Forbes, University of Delaware

Jonathan Freeman, Dartmouth College

Mariska Kret, University of Amsterdam

Tiffany Ito, University of Colorado

## ABSTRACTS

UNFORGETTABLE: STEREOTYPE THREAT ENDANGERS ENHANCED CODING OF **NEGATIVE FEEDBACK TO UNDERMINE PERFORMANCE** Chad E. Forbes, Kelly Jordan, Adam Magerman, and Jordan Leitner; University of Delaware – Stereotype threat, a situational pressure that stereotyped targets experience when they fear their actions may confirm a negative group stereotype, is known to engender negative emotions, physiological arousal and hypervigilance for errors. Research on mood congruent memory encoding suggests that situations like these can facilitate encoding of negative information specifically. Little is known, however, about how information, be it stereotype confirming or otherwise, is encoded and recalled under stereotype threat. Five studies examined the hypothesis that negative, stereotype confirming information presented under stereotype threat would be encoded more efficaciously than positive information. In Study 1, women completed a math test they thought was either diagnostic of their math intelligence (stereotype threat condition) or a problem solving task (control condition) while continuous EEG activity was recorded. Participants received meaningful feedback after each answer. Source localization and time-frequency analyses revealed that compared to women in the control condition, women under stereotype threat exhibited theta bursts in temporal gyrus (TG; a region integral for spatial working memory) and greater phase locking between the ACC and dorsolateral prefrontal cortex (DLPFC; regions also integral for working memory) in response to wrong compared to correct feedback. This pattern was reversed among women in the control condition. Furthermore, stereotype threatened women performed worse on the math test to the extent they elicited theta power in TG in response to wrong feedback. Study 2 extended these findings by examining whether women under stereotype threat encoded wrong feedback better than correct feedback. Women and men completed a math test framed as either diagnostic of their math intelligence or a problem solving task and received feedback after each problem. The feedback presented after each answer, however, was written in different fonts. A surprise memory test examined whether participants had seen the wrong or correct feedback (written in a specific font) during the math task. Stereotype threatened women encoded wrong fonts better than correct fonts and compared to men and women in the control condition. Men and women in the control condition exhibited no such bias. Study 3 replicated findings from Study 2 and provided evidence that even information presented in the periphery of negative feedback is encoded more efficaciously. Study 4 revealed that these effects persist up to one week after performance but only for women who are most identified with the math domain. Findings from Studies 2-4 indicated that stereotype threatened women underperformed on a follow-up difficult math test to the extent they encoded negative feedback on the previous math test. Finally, Study 5 revealed that stereotype threatened individuals predicted they performed much

worse than they actually did to the extent they exhibited decreased phase locking between regions in the default mode network before completing a supposed intelligence test. Consistent with the mood congruent/stress-induced memory literature, these findings suggest that stereotype threat renders negative feedback comparable to a physiological threat, enhancing attention to negative information very early in the information processing stream to facilitate encoding of negative information, negatively bias performance perceptions and undermine performance among the stigmatized accordingly.

#### PERSON PERCEPTION AT THE CROSSROADS OF SOCIAL CATEGORIZATION

*Jonathan B. Freeman; Dartmouth College –* On catching sight of other people, individuals spontaneously categorize along a number of social category dimensions, including gender, race, and emotion. Although often assumed to be independent, in this talk I will show that social category dimensions interact in meaningful ways to shape the basic way we see others' faces. I will present a number of neuroimaging and behavioral studies demonstrating that gender, race, and emotion categories mutually influence one another due to activated stereotypes (e.g., Black = hostile) that are incidentally shared across dimensions. Three studies made use of a novel paradigm in which fMRI was synchronized with a real-time mouse-tracking technique recording participants' hand movements en route to category responses on the screen. Results indicated that, depending on the strength of one's stereotypic associations, gender, race, and emotion categories became linked in basic visual perceptions. Due to stereotypes that male and Black individuals are likely to be aggressive and hostile, male and Black faces tended to spontaneously activate the angry category and appear angrier (even when they displayed no anger). Conversely, due to stereotypes that female and Asian individuals are likely to be docile and appeasing, female and Asian faces tended to spontaneously activate the happy category and appear happier (even when they displayed no joy). This was revealed by hand movements' incorrect, parallel attraction toward stereotype-associated category responses during early perceptual processing (e.g., toward angry response for a happy Black male face). Correlational analyses between synchronized neuroimaging and hand-movement data showed that the medial prefrontal cortex (mPFC) and dorsolateral prefrontal cortex (dlPFC) played dissociable roles in instantiating these social category interactions and subsequently inhibiting them, thereby allowing faces to be perceived accurately (e.g., to see a happy Black male face as indeed happy, rather than angry). Finally, multi-voxel pattern analyses (MVPA) characterized the inherent overlap of these different social category representations (e.g., male, Black, angry; female, Asian, happy) in lower-level fusiform regions involved in face perception vs. higherorder prefrontal regions involved in stereotype access and top-down visual predictions. Taken together, this research demonstrates that perceptions of social categories are not independent but rather systematically interact, and implicates both bottom-up and topdown processes in driving social category interactions. The findings bolster recent intersectional and dynamic-interactive frameworks for social categorization.

### TRUST DEPENDS ON CHANGES IN OTHERS' PUPIL SIZE VIA PUPIL

SYNCHRONIZATION Mariska E. Kret and A.H. Fischer, University of Amsterdam; T. Matsuzawa, Kyoto University; and C.K.W. de Dreu, University of Amsterdam – Humans cooperate with, and extend trust to both familiar and unfamiliar others, thus enabling ancestral groups and contemporary institutions to function and prosper. Yet to avoid betrayal, exploitation and subordination, humans must be prepared also to withhold cooperation and trust, and to punish those who betray and free-ride. Thus, whether recurrent or one-shot, humans need to assess whether partners are cooperators and worthy of one's trust, or instead untrustworthy and likely to exploit one's cooperative effort. Sometimes, such assessments can be based on deliberated and effortful considerations. Most often, however, decisions to trust are relatively fast and mostly intuitive, suggesting that humans have evolved the capacity to learn associations between tractable partner characteristics and their (un)trustworthiness, that in new interactions with unknown others operate as a heuristic device when deciding to cooperate and trust or, instead, to compete and withhold trust. During social interactions, humans attend to others' eyes, mimic expressions, follow gaze and there are indications that they synchronize pupil size. The communication of delicate eye signals must have become adaptive amongst individuals who trusted and not abused each other. Indeed, in an eye-tracking study including human and chimpanzee participants, we showed that humans specifically synchronize their pupilsize with the human and not with the chimpanzee eyes that were presented on a computer screen. A similar within-species effect was observed for chimpanzee subjects. Seeing a conspecifics' pupils dilate signals safety, permitting cooperation and trust; perceiving small pupils in contrast, inhibits pro-sociality. A possible mechanism is that the own pupils that synchronize with the partners' provides immediate neural feedback that the interaction environment is benign. To test the supposed relation between pupil synchronization and trust, we designed three experiments in which participants played trust-games with virtual trustees whose pupils contracted, remained static or dilated. We observed that trust and cooperation depend not only on emotion signals and group membership, but also on the partner's pupil size, with larger and dilating pupils triggering more trust and cooperation than smaller and contracting pupils. Participants' pupils synchronized with trustees' dilating pupils, especially when from the in-group (Caucasian) and expressing happiness. Participants' pupil-size decreased following trustees' contracting pupils, especially when anger was expressed by the out-group (Asian). Interestingly, the more participants synchronized with dilating pupils, the more they trusted. Thus, trust not only depended on characteristics of the partner, but also on participants' own reaction to that partner and more specifically on whether they synchronized or not.

A FACE BY ANY OTHER NAME: THE INFLUENCE OF SOCIAL CATEGORY ON FACE PERCEPTION *Tiffany Ito, University of Colorado* – While humans are generally expert with the category of faces, not all faces are processed the same. One consistent difference that has been observed occurs as a function of group membership, with ingroup faces typically processed in a more individuated manner and outgroup faces processed in a more categorybased way. While these differences are thought to produce important behavioral outcomes such as better memory for ingroup members, the engagement of qualitatively different processing is not invariant. This talk will review event-related brain potential data that helps first identify the typical stages of face perception, then illuminate how these differ or are as the same for ingroup and outgroup faces. Data will also be presented showing the impact of motivational factors, highlighting both invariant processes in the perception of ingroup and outgroup faces, as well as processes that are malleable. Implications will also be discussed for several behavioral phenomena such as the cross-race memory effect and implicit racial bias.

## Session B Clinical Neuroscience

Friday, April 11, 2014

10:35 - 11:50 AM

Dorien Enter, Radboud University Nijmegen

Abigail Marsh, Georgetown University

Nicole Giuliani, University of Oregon

Nouchine Hadjikhani, Massachusetts General Hospital

## ABSTRACTS

#### TESTOSTERONE ADMINISTRATION ALLEVIATES SUBMISSIVE GAZE

AVOIDANCE IN SOCIAL ANXIETY Dorien Enter, Radboud University of Nijmegen, Leiden University; David Terburg, Utrecht University, University of Cape Town; Anita Harrewijn, Leiden University; Phillip Spinhoven, Leiden University; and Karen Roelofs, Radboud University Nijmegen, Donders Centre for Cognitive Neuroimaging - Social anxiety may be based on a ubiquitous social hierarchy system, with patients showing an extreme form of social submissive behavior. Social anxiety disorder is associated with reduced endogenous testosterone levels and typical submissive behavior such as gaze avoidance in social encounters. Administration of testosterone has dominance-enhancing and social-anxiolytic effects, and has shown to enhance social dominant gaze behavior in healthy participants. Because avoidance behavior is the major maintaining factor in social anxiety disorder, it is relevant to test whether administration of testosterone can alleviate gaze avoidance from angry faces. In a double-blind, within-subject design, medication-free high socially anxious and healthy control participants received a single dose of 0.5mg testosterone and a matched placebo, at two separate days. On both days, their gaze behavior was recorded while they looked at angry, happy, and neutral facial expressions. In high socially anxious subjects testosterone reduced submissive gaze avoidance as indicated by an increase in first fixations to the eye region of angry faces. In contrast, in healthy controls testosterone diminished first fixations to the eye-region in a non-emotion-specific manner. These results suggest that although testosterone generally decreases social behavior in healthy participants, it promotes dominant gaze behavior, i.e. eye-contact with angry faces, in high socially anxious individuals. The findings support previous notions that the effects of testosterone on dominance seeking behavior are context dependent and may have implications for treatment studies aiming to boost therapy efficacy in social anxiety disorder.

EMPATHY ON A SLIDING SCALE - IS EXTRAORDINARY ALTRUISM THE INVERSE **OF PSYCHOPATHY?** Abigail Marsh, Kristin M. Brethel-Haurwitz, Sarah M. Stoycos, and Elise M. Cardinale, Georgetown University; Paul Robinson, University of Washington; and John W. VanMeter, Georgetown University - Altruistic kidney donors volunteer to undergo surgery so that one of their own healthy kidneys can be transplanted into a needy stranger. Such donations are relatively rare events and represent a costly, intentional behavior aimed at benefiting an anonymous, non-kin other, satisfying the most stringent definitions of altruism. Altruistic kidney donations cannot be readily explained by dominant self-serving explanations for altruistic behavior, including kin selection, reciprocity, or adherence to social norms. We hypothesize that extraordinary altruism can be conceptualized as the extreme end of an empathic continuum that is anchored at the low end by individuals with psychopathic personality traits. We used structural and functional magnetic resonance imaging and behavioral testing to assess how extraordinary altruists, all of whom volunteered to donate a kidney to a stranger, differ from healthy controls matched for age, sex, race and ethnicity, and cognitive intelligence. Previous investigations of psychopathy have consistently found that, relative to controls, individuals with psychopathic traits are less sensitive to cues indicating others' emotional distress (such as fearful facial expressions) both behaviorally and in terms of neural responsiveness, particularly in the amygdala.

Structural imaging studies have also found that psychopathic individuals possess smaller amygdalae than controls. We observed structural and functional differences in altruistic kidney donors consistent with the characterization of these individuals as "antipsychopaths": they exhibited heightened amygdala responses to fearful (but not angry) facial expressions, and this increased amygdala responsiveness appeared to be responsible for their greater sensitivity to the expressions; across the sample, amygdala responses to fearful expressions during the implicit processing task were positively correlated with the ability to recognize these expressions in a separate task conducted outside the scanner. In addition, group differences in amygdala volume were observed. After controlling for group differences in cerebral volume, altruists' right amygdalae were significantly larger than those of controls. We discuss our findings in light of observed differences and similarities in the moral judgments, economic decision-making, and personality structure of altruists and controls. These findings support the possibility of a neurobiological basis for extraordinary altruism, and indicate that extraordinary altruists exhibit structural and functional brain differences from controls that are consistent with altruism being a continuously distributed trait. These data may also be important for understanding empathic processes generally, in particular the role of nonverbal distress cues like fearful facial expressions in eliciting empathic and altruistic responses from observers.

ASSESSING REAL-WORLD BEHAVIORS IN THE LAB: INSIGHTS FROM EATING **REGULATION RESEARCH** – Nicole Giuliani, University of Oregon; Traci Mann, University of Minnesota; A. Janet Tomiyama, University of California, Los Angeles; and Elliot T. Berkman, University of Oregon - Neuroscientists carefully design protocols to isolate processes of interest, but by creating such tight control we might be missing how behaviors in the laboratory differ from behaviors in the real world. For example, people are not randomly assigned to situations but rather create idiosyncratic life structures consistent with our own abilities, preferences, and goals. This might be particularly true in the case of food choice and dieting. Here, we simulated the effect of the daily self-regulation involved in dieting by instructing half of a large sample (N=50) to restrict their consumption of a personally chosen energy-dense (ED) target food for two weeks. The other half monitored but did not restrict their consumption. Immediately before this, both groups completed a baseline scan in which they reappraised their craving for a personally relevant ED food (Giuliani et al., 2013). We then assessed real-world consumption of ED foods in the entire sample in two ways: selfreported everyday consumption of the target food via daily text messaging for two weeks after the scan ('in vivo'), and number of grams of ED food spontaneously consumed in the laboratory at the end of the two week period ('in lab'). The relationship between regulationrelated neural activation at baseline and subsequent consumption was different between the two groups (i.e., group-by-activation interactions) for both measures of consumption. For in vivo consumption (controlling for hunger), greater left inferior frontal gyrus activity during reappraisal predicted lower everyday consumption in the non-restrict group, but not in the restrict group. For in lab eating, the interaction revealed that greater activity in right dorsolateral prefrontal cortex during reappraisal predicted greater consumption in the restrict group, but less consumption in the non-restrict group. Together, greater regulationrelated brain activity predicted lower in vivo and in lab ED consumption among non-dieting participants, but higher in lab ED consumption among dieting participants. These results demonstrate the importance of assessing complex phenomena like eating in multiple contexts and the divergent predictive validity of initial neural activity.

#### EMOTIONAL CONTAGION IN AUTISM, AND SOME NEW HOPES IN AUTISM

**THERAPY** *Nouchine Hadjikhani, Massachusetts General Hospital* – A lack of empathy is often considered to be a hallmark of autism. Empathic concern consists of both emotional and cognitive processes. Cognitive processes associated with the perception of 'classical' facial expression are affected in autism, as has been shown in many studies. A lack of activation of mirror mechanisms has been reported in this type of paradigms, and some have hypothesized that a deficient mirror system may be underlying social difficulties in autism. Here, we used fMRI to examine the spontaneous reaction to the perception of facial expression of pain in 38 participants with autism and 35 matched controls. We observed no statistical differences between groups in activation of the areas involved in pain sharing, showing intact emotional contagion in autism. Our findings demonstrate that mirror mechanisms can be spontaneously elicited during the perception of pain in autism, and that

a 'broken mirror system' is probably not at the very basis of their difficulties. In addition, we found that at a more liberal threshold participants with autism had increased activation in areas involved in cognitive reappraisal. An imbalance between affective and cognitive processes, resulting in the need to increase reappraisal mechanisms in order to limit personal distress resulting from emotional contagion may be at the basis of the apparent lack of caring behavior in people with autism. There is no drug treatment available so far to improve social perception in autism. Three studies have recently shown that bumetanide, an 'old' molecule known for its diuretic effect, may be a new promising therapy in autism. Bumetanide reduces the level of chlorine in neurons, restoring the inhibitory effect of GABA that seems to be compromised in autism. I will present data from a proof-of-concept pilot study showing that 10 months of treatment with bumetanide improves perception of social facial expression in autism.

## Session C Social Affect

Friday, April 11, 2014 1:20 - 2:35 PM Andreas Olsson, Karolinska Institute

Janine Dutcher, University of California, Los Angeles

Cendri Hutcherson, California Institute of Technology

Jim Coan, University of Virginia

## ABSTRACTS

OTHERS AS MEANS TO A SAFE END: MECHANISMS OF VICARIOUS EXTINCTION LEARNING Andreas Olsson, Armita Golkar, Ida Selbing, Olof Hjort, and Vasco Castro; Karolinska Institute - Learning about what is safe and potentially dangerous in the environment through social means, such as observing others, can be both safer and more efficient than learning through individual trial and error. Recent research has contributed to a growing understanding of observational (vicarious) acquisition of fears, showing both similarities and differences as compared to directly experienced (Pavlovian) fear conditioning. However, little is known about the ways social observation can promote safety learning, and to what degree this form of vicarious learning is similar to traditional extinction learning. During traditional extinction, learned fear is diminished through repeated direct exposure to unreinforced presentations of the feared conditioned stimuli (CS). During vicarious extinction, learned fear is instead diminished by watching another individual ('demonstrator') acting non-fearfully to presentations of the CS. Here, we present three studies on vicarious extinction, examining (1) its effectiveness as compared to traditional extinction, (2) its underlying neural networks, and (3) its dependence on social cognition. Study 1 showed that, following fear conditioning, participants submitted to vicarious, as compared to traditional, extinction learning improved the extinction and effectively blocked the recovery of conditioned fear as measured by the skin conductance response (SCR). The presence of a demonstrator per se was not sufficient to demonstrate superior extinction learning. Instead, the superiority of vicarious extinction was dependent on the experience that the demonstrator was safe. Study 2 used a within-group paradigm to examine the neural mechanisms of vicarious extinction learning using fMRI. Following fear conditioning to two stimuli (CS+1 and CS+2), participants watched a demonstrator receiving shocks to the CS+1, but not to the CS+2 and a control stimulus (CS-). During the test-phase, all stimuli were again presented to the participants, this time without any shocks. Preliminary results support the strength of vicarious extinction and implicate a network of brain regions that has previously been associated with the expression of learned fear. Study 3 examined how the social (racial) group belonging of the demonstrator during vicarious extinction affected safety learning. Replicating Study 1, we showed that vicarious extinction effectively extinguished previously conditioned fear. Importantly, however, this was only the case when the demonstrator belonged to the same racial group as the learner, highlighting the dependence on social information during social safety learning. Taken together, our results provide important clues towards a better understanding of the social cognitive and affective processes underlying social safety learning with implications for real world applications.

ADMINISTRATION OF VASOPRESSIN INCREASES EMPATHY AND POSITIVE EMOTIONS WHILE RECALLING AN INSTANCE OF PROVIDING SUPPORT Janine M. Dutcher, Diana M. Wang, Benjamin Tabak, Meghan L. Meyer, Elizabeth Castle, Michael R. Irwin, Matthew D. Lieberman, and Naomi I. Eisenberger; University of California, Los Angeles - There has been increased interest in neuropeptides and their effect on social behavior. However, there have not been many vasopressin administration studies in humans that investigate the role vasopressin plays in social behavior. Animal work has found that vasopressin may be related to more male-specific behaviors, including aggression (Heinrichs, von Dawanes & Domes, 2009). Some recent work has found that vasopressin increases social recognition in male rats, as well as human males (For a Review see Zink & Meyer-Lindenberg, 2012). However, due to the small numbers of vasopressin administration studies with humans, it is unclear what effect vasopressin has on women. In addition, the effect of vasopressin in a positive social context is not yet known. Many animal studies inject vasopressin into the septal area of the brain, due to the number of vasopressin-specific receptors in this region. Interestingly, recent human neuroimaging work has indicated this region may be important in both prosocial behavior and empathy (Morelli, Rameson & Lieberman, 2012). Therefore, it is possible that vasopressin may lead to alterations in empathic and prosocial behavior. We conducted a (double-blind, intranasal) vasopressin administration study in which participants were asked to write about a recent time when they provided support to another person. Participants were prompted to write about their thoughts and feelings during this instance. Two trained coders, who were blind to participant condition, were then asked to code the essays for: 1) how empathic the author was towards the target of their support, and 2) to what extent the author expressed feeling good about helping the other person. The coders had good inter-rater reliability. Results indicate that vasopressin increases how empathic the author is towards the target of their support compared to placebo. In addition, vasopressin increases the extent to which the author describes feeling good about helping the target of their support. Specifically, results were the same for males and females. These findings suggest a novel role for vasopressin in human social behavior.

#### NEURAL CORRELATES OF EMOTIONAL AND UTILITARIAN CONSIDERATIONS

IN MORAL DECISION-MAKING Cendri Hutcherson\*, Leila Montaser-Kouhsari\*, and Antonio Rangel; California Institute of Technology - Current theories of moral decision-making posit that it results from the interaction between intuitive emotional responses to moral and immoral actions and deliberative consideration of the consequences of those acts. Based on neural activation during moral judgment, researchers have inferred the existence of distinct neural circuits related to these two aspects of judgment. Yet no study has directly examined the neural computations that support these different considerations, or how they are integrated into an overall judgment of moral appropriateness. To investigate this issue, we constructed a set of different harmful and beneficial scenarios (i.e. harm - Torture a captured terrorist; benefit - Save Los Angeles from nuclear attack) that could be viewed separately and recombined into different moral dilemmas. We then scanned participants using functional magnetic resonance imaging as they completed three tasks: 1) rating each individual harm and benefit for how good or bad it felt at an intuitive, emotional level (emotional ratings), 2) rating each harm and benefit for how good or bad its consequences were (utilitarian ratings) and 3) deciding the appropriateness of making different moral tradeoffs (a harm committed in order to achieve a benefit). Behaviorally, we observed that emotional and utilitarian ratings explained independent and equivalent portions of the variance in appropriateness judgments, but that benefits were weighed less than harms (i.e. a 'moral loss aversion' effect). Neurally, we observed distinct neural networks correlating with emotional and utilitarian ratings. Even though viewing the same scenarios, emotional ratings made during the emotional rating task correlated with activation in regions of insula, superior temporal gyrus, and rostral anterior cingulate cortex, while utilitarian ratings made during the utilitarian rating task correlated with regions of dorsomedial prefrontal cortex and temporoparietal junction. Using these regions as functionally defined ROIs, we showed that they continued to uniquely code emotional and utilitarian considerations respectively while participants made appropriateness judgments in the moral tradeoff task. Moreover, these regions demonstrated functional connectivity with a more anterior portion of medial prefrontal cortex whose activation correlated with the overall perceived appropriateness of the tradeoff (consistent with an integration function). Intriguingly, analysis of the temporal dynamics of activation in this integrative mPFC region indicated that harms were represented more quickly than benefits, providing a mechanistic explanation for the 'moral loss aversion' effect. Taken together, these results suggest that moral judgment may be the results of dynamically computed, weighted integration of emotional and utilitarian considerations. (\*co-first authors)

#### SOCIAL BASELINE THEORY: EMOTIONAL REGULATION AND RESPONDING

WHEN ME BECOMES WE Jim Coan, University of Virginia – Social proximity, peer bonding and soothing behaviors facilitate the development of non-anxious temperament, attenuate cardiovascular arousal, inhibit the release of stress hormones, reduce threat-related neural activation and may even extend the life-span. Conversely, social subordination, rejection and isolation are powerful sources of emotional stress. Data from our own laboratory suggests proximity familiar others – romantic partners, friends and relatives – attenuates both activating and regulatory neural responses to threats directed at the self. On the other hand, we have observed that threats directed at familiar others produce neural responses that are 1) very similar to those observed when threats are directed at the self, and 2) substantially different than those observed when threats are directed at strangers. Although many neural mechanisms of these and similar effects have been proposed, few (or none) have been unequivocally identified. Among the mechanisms considered for this talk concerns what Aron and colleagues have called the "inclusion of the other into the self". This talk will briefly review evidence from our laboratory that relationships imply an overlap between self and other that both increases the bioenergetic resources available to the self and extends the risk of losing bioenergetic resources to those we know and love. In reviewing this evidence, I will introduce Social Baseline Theory, a perspective that emphasizes the economy of action and perception/action links in integrating diverse literatures on the neural systems supporting attachment, empathy and emotion regulation.

## Session D Poster Presentations: Session 1

Friday, April 11, 2014

2:35 - 3:50 PM

See page 25 for abstracts

## Session E Developmental Neuroscience

Friday, April 11, 2014

3:50 – 5:05 PM

Bernd Figner, Radboud University Nijmegen

Berna Guroglu, Leiden University

Pilyoung Kim, University of Denver

Nim Tottenham, Columbia University

## ABSTRACTS

EXPECTED RISKS AND RETURNS IN CHILDRENS', ADOLESCENTS', AND ADULTS' DYNAMIC RISKY CHOICE: BEHAVIORAL EFFECTS AND NEURAL CORRELATES Bernd Figner\*, Radboud University Nijmegen, Columbia University; Anna C. van Duijvenvoorde\*, Leiden University, University of Amsterdam; Leah H. Somerville, Harvard University; Alisa Powers, Sackler Institute for Developmental Psychobiology, Cornell University; Isabel Woyke, Radboud University Nijmegen; Wouter Weeda, University of Amsterdam; Mauricio R. Delgado, Rutgers University; B.J. Casey, Sackler Institute for Developmental Psychobiology, Cornell University; Elke U. Weber, Columbia University; and Hilde M. Huizenga, University of Amsterdam – Many risky behaviors start and/or peak during adolescence and young adulthood, which has been explained by an imbalance between affective-motivational versus cognitive-control processes, caused by differential subcortical versus prefrontal maturational trajectories. Empirical support for this neurodevelopmental model based on a still small number of studies has been mixed, while there is a growing need to more thoroughly examine the psychological and neural mechanisms underlying adolescent risk taking. To investigate overt risk taking and its underlying processes, we decomposed risky choices into the theoretically meaningful components of the risk-return model, which describes risky choice as a function of expected returns (expected value; EV) and expected risks (outcome variability; here operationalized as SD) of the available choice options. In an fMRI-scanner, 23 children (M=9.6 years), 25 adolescents (M=17.3 years), and 24 adults (M=27.7 years) played an fMRI-adjusted version of a dynamic risky-choice task, the hot Columbia Card Task, previously shown to substantially involve affective processes, hypothesized to play a crucial role in adolescent risk taking. Behavioral data were analyzed with generalized linear mixed-models, with binary choices (take another card versus stop) as dependent variable and EV and SD as predictors of main interest. Higher EV increased the probability to take a card in all age groups, i.e., all ages liked greater returns. This "return sensitivity" increased linearly across age groups. Higher SD decreased the probability to take a card, i.e., all age groups disliked greater risk, exhibiting risk-aversion. However, this risk-aversion was virtually absent in children (indicating risk-insensitivity), but present in adolescents and adults, with adolescents showing substantial individual differences. fMRI analyses investigated age-independent effects of EV and SD in whole-brain analyses across all participants and age-differences in tracking risks and returns. Return-tracking was expected in regions previously shown to be sensitive to reward and value, including ventromedial prefrontal cortex (vmPFC), posterior cingulate cortex (PCC), and ventral striatum (VS). Regions such as the dorsal medial PFC, insula, and thalamus have been implicated in probability and risk. As expected, whole-brain analyses showed that increasing returns led to increased vmPFC, PCC, and VS activations. Increasing risk led, as expected, to increased activation in insula, dorsal medial PFC, thalamus, and striatal regions. Age-analyses showed that return-related vmPFC and VStr activations increased with age, whereas superior parietal regions showed a quadratic effect. For risk, quadratic age effects were observed in insula and dorsal medial PFC, indicating greatest risk-sensitivity in adolescents. In sum, return-sensitivity increased monotonically across age and was associated with activation in (cortical and subcortical) value-coding regions. Risk-sensitivity was absent in children, but increased steeply from childhood to adolescence. Risk-sensitivity was associated with activations in regions previously implicated in tracking probability and outcome variability and showed predominantly quadratic age effects. These results, together with the riskreturn tradeoff framework, substantially advance the field of developmental decision neuroscience, as such approaches allow for a more precise understanding and operationalization of the psychological and neural mechanisms underlying individual and age differences in overt risk-taking levels by decomposing them into meaningful components.

HOW CHILDHOOD PEER ACCEPTANCE AND REJECTION RELATE TO NEURAL **RESPONSES TO SOCIAL EXCLUSION DURING ADOLESCENCE Geert-Jan Will,** Leiden University, Leiden Institute for Brain and Cognition; Pol van Lier, VU University; Eveline A. Crone, Leiden University, Leiden Institute for Brain and Cognition, University of Amsterdam; Berna Güro lu, University of Amsterdam - Chronic rejection by peers has been linked to a variety of negative outcomes, including poor academic achievement and an increased incidence of depression, anxiety and aggressive behavior. Chronic exposure to negative treatment that accompanies a rejected status (e.g. being ignored, harassed or excluded) might alter subjective reactions to acute rejection experiences (e.g. social exclusion) and this could in turn influence the impact of those experiences on psychosocial adjustment. This functional Magnetic Resonance Imaging (fMRI) study investigated neural responses to social exclusion in adolescents (age 12-15) who either experienced chronic acceptance (n = 27) or rejection (n = 17) by their peers during childhood. After first being included and then excluded in a virtual ball-tossing game (Cyberball) by unfamiliar peers, participants reported feeling distressed, independent of long-term childhood acceptance or rejection. Neuroimaging results showed that across the sample social exclusion was associated with increased activity in brain regions associated with processing affect and emotion regulation, such as ventral anterior cingulate cortex (ACC), striatum and ventrolateral prefrontal cortex (PFC). Chronically rejected adolescents showed: 1) increased activity in the dorsal ACC during social exclusion and 2) increased activation in the presupplementary motor area/ACC and anterior PFC when they did not receive the ball during a social interaction in which they were included, suggesting a hypersensitivity to rejection. Taken together, our results show that a brief episode of social exclusion is highly distressing for adolescents and that childhood peer relations are associated with differential neural processing of social exclusion during adolescence.

HOW CHILDHOOD POVERTY IMPACTS ADULT NEURAL FUNCTIONS FOR

**EMOTION REGULATION** *Pilyoung Kim, Department of Psychology, University of Denver;* Gary W. Evans, Departments of Design and Environmental Analysis and of Human Development, Cornell University; Michael Angstadt, Shaun S. Ho, Chandra S. Sripada, James E. Swain, Israel Liberzon, Department of Psychiatry, University of Michigan; and K. Luan Phan, Department of Psychiatry, University of Illinois at Chicago - One fifth of America's children grow up in poverty. Childhood poverty has pervasive negative physical and psychological health sequelae among children. Furthermore, childhood poverty has long-term adverse effects on health because childhood poverty predicts adult morbidity irrespective of adult poverty. Exposure to chronic stressors may be one underlying mechanism for childhood poverty, health relations by influencing emotion regulatory systems. Although a wealth of literature suggests that chronic stress injures normal brain development, the prospective effects of childhood poverty on brain development have not been well understood. In this talk, I will present a longitudinal fMRI study investigating the relations between childhood poverty and neural coordinates of emotion regulation. In this longitudinal fMRI study of 49 young adult participants, we examined associations between childhood poverty at age 9 and adult neural circuitry activation during emotion regulation at age 24. To test developmental timing, concurrent, adult income was included as a covariate. Adults with lower family income at age 9 exhibited reduced ventrolateral and dorsolateral prefrontal cortex activity and failure to suppress amygdala activation during effortful regulation of negative emotion at age 24. In contrast to childhood income, concurrent adult income was not associated with neural activity during emotion regulation. Furthermore, chronic stressor exposure across childhood (at age 9, 13, and 17) mediated the relations between family income at age 9 and ventrolateral and dorsolateral prefrontal cortex activity at age 24. The findings demonstrate the significance of childhood chronic stress exposures in predicting neural outcomes during emotion regulation in adults who grew up in poverty. The information on the developmental timing of poverty effects and neural mechanisms may inform interventions aimed at reducing health disparities.

**HUMAN AMYGDALA - PFC CIRCUIT DEVELOPMENT** *Nim Tottenham, Columbia University* – Strong evidence indicates that reciprocal connections between the amygdala and medial prefrontal cortex (mPFC) support fundamental aspects of emotional behavior. Despite the central role that this circuitry plays in regulating emotions in adulthood, little is known regarding human amygdala-mPFC development. In this talk, I will present developmental functional magnetic resonance imaging data describing age-related changes in amygdala-mPFC circuitry throughout childhood and adolescence and how they relate to emergent emotion regulation. I will focus on both typical development as well as development following maternal deprivation (e.g., orphanage care), showing that early life stress may accelerate development of this circuitry. The findings presented are highly consistent with the animal literature showing both large changes in amygdala-mPFC circuitry throughout childhood/adolescence, as well as the large influence of maternal care in shaping this neural circuitry. These age-related changes will be discussed in terms of potential developmental sensitive periods for environmental influence.

## Presidential Symposium

Advances in fundamental affective neuroscience

Friday, April 11, 2014

5:45 – 7:15 PM

## Speakers: Suzanne Haber and Howard Fields

## ABSTRACT

Reward and pain are the fundamental affective forces that drive learning and behavior. They are the building blocks of emotion, social cognition, and decision-making, and we will not understand these complex human edifices without delving into the bedrock upon which they are built. Currently, we are undergoing a revolution in our understanding of the affective brain, fomented by methodological advances and rapidly developing models of cortical-subcortical circuits. This symposium features work at the forefront of these advances. The speakers describe parallel affective systems that span cortex, basal ganglia, and brainstem. These systems are increasingly anatomically differentiated, but their functions cut across domains, blurring the distinctions between affect and cognition and providing an increasingly integrated account of healthy and pathological behavior.

## Session F Computation in Social Neuroscience

Saturday, April 12, 2014

9:00 - 10:00 AM

Damian Stanley, California Institute of Technology

Luke Chang, University of Colorado

Damon Tomlin, Princeton University

## ABSTRACTS

#### **fMRI SIGNALS IN DIFFERENT 'SOCIAL BRAIN' REGIONS REFLECT DISTINCT COMPUTATIONS SPECIFIC TO LEARNING ABOUT PEOPLE** *Damian A. Stanley,*

Division of Humanities and Social Sciences, California Institute of Technology - Learning about other peoples' attributes, e.g. whether an individual is generous or selfish, is central to human social cognition. A sizable neuroimaging literature has shown that a network of regions, including the temporal parietal junction, the anterior temporal lobes, the precuneus and medial prefrontal cortex is reliably engaged when we think about other people. However, both the computational roles these regions play in learning about other people, and the extent to which these roles might be specific to social processing, remain poorly understood. We investigated this question using a task in which participants learned about other peoples' generosity by watching them make social decisions. In an event-related fMRI design, participants observed four 'Gifters' across many trials as they decided whether or not to share \$10 with 3rd party partners (whose identity varied across trials). In a computationally-matched, non-social control condition, participants learned the win/loss rates of four lotteries played by the same partners. Importantly, participants themselves received no rewards from the Gifters or lotteries. While fMRI activity in many regions reflected general learning computations for both Gifters and lotteries, signals in components of the social cognition network, notably the left temporal pole, and precuneus, reflected computations specific to learning about Gifters' generosity (and not lottery win/loss rates). Specifically, activity in the left temporal pole reflected participants' ongoing estimates of Gifter predictability, while activity in the precuneus reflected participants' prediction error (i.e. surprise) in response to Gifter decisions. Preliminary data from a second social learning paradigm investigated how social learning processes are impaired in high-functioning adults with autism spectrum disorder. These findings contribute to a larger body of research on person perception, providing a more nuanced understanding of the specific computations performed by regions of the 'social brain' when we learn about other people.

#### PICTURE INDUCED NEGATIVE EMOTION PATTERN DIFFERENTIATES AVERSIVE

EXPERIENCES Luke Chang, University of Colorado; Peter Gianaros, Steve Manuck, University of Pittsburgh; Anjali Krishnan, Tor D. Wager, University of Colorado - Emotions describe a class of internal motivational states that are critical to our survival. Emotional dysregulation is at the heart of much of psychopathology, and thus understanding the bio-psycho-social mechanisms underlying emotions is paramount to not only improving diagnoses and treatment for mental health issues, but also in addressing fundamental questions about the motivations underlying social behavior. Neuroscience promises to identify brain-based biomarkers that are endophenotypes of emotion and its dysregulation. These markers must be consistent across the population and specific to types of emotion and not other constructs. In this study we use computational machine learning methods to develop a multivariate pattern of brain weights that are predictive of affective ratings in response to viewing stimuli from the International Affective Picture System. We used penalized principal components regression to identify a distributed pattern of fMRI activity, which we term the Picture Induced Negative Emotion Signature (PINES), that increases with negative affective ratings in 100% of training sample (n=122) in cross-validated analysis. The PINES increased parametrically with negative affect across the entire range of ratings, and also increased with negative affect in 100% of test subjects (n=61) reserved as a separate holdout set. The PINES is uncorrelated with patterns related to pain (the Neurologic Pain Signature; Wager et al. 2013 NEJM) and other salient events (the ventral attention "salience" network; Yeo et al., 2011), which are unable to predict affective ratings. Moreover, the PINES appears to be a distributed representation of the affective experience and does not simply reflect average activation within affective ROIs: It is virtually orthogonal to the average ROI activity within important regions of interest (e.g., amygdala, insula, dorsal anterior cingulate). Finally, and importantly, the PINE pattern does not generalize to other aversive experiences such as experiencing thermal pain (n=28) suggesting that it may be specific to viewing negative affective images. This study provides the first candidate brain-based marker of emotion that is a) consistent across a large number of subjects (N = 183) and b) unrelated to general arousal or salience. This work provides a foundation to test the generality of this pattern across other types of induction methods and emotional experiences, leading towards a brain-based taxonomy of affective processes.

#### GROUP FORAGING TASK REVEALS NEURAL SUBSTRATES OF SOCIAL

INFLUENCE Damon Tomlin, Institute of Cognitive Science, University of Colorado; Andrea Nedic, Department of Electrical Engineering, Princeton University; Deborah Prentice, Department of Psychology, Princeton University; Phillip Holmes, Department of Electrical Engineering, Department of Applied Mathematics, Princeton Neuroscience Institute, Princeton University; and Jonathan D. Cohen, Department of Psychology, Princeton Neuroscience Institute, Princeton University - Conformity to group norms has been shown to perturb human judgment in many contexts. We used a multi-person foraging task to examine such phenomena and their relationship to underlying neural mechanisms. Groups of five participants earned monetary rewards by individually choosing between two options of unknown value while simultaneously undergoing functional brain imaging. In order to measure the impact of social information, participants were given information about the performance of the others as the task progressed. Several regions exhibited graded responses to misalignment with others in the group ('marginality'), whether in choices or payoffs. BOLD signals from one structure in particular, the bilateral insula, were found to predict choice behavior in relation to marginality. Our findings contribute to the growing body of evidence regarding the brain structures involved in the processing of social information, and demonstrate the utility of methods that may help enrich research in this area.

## Keynote Symposium

Perspectives from the "parent" disciplines of social and affective neuroscience

Saturday, April 12, 2014

10:25 – 11:45 AM

## Speakers: Lisa Feldman Barrett and John Gabrieli

## ABSTRACT

Social and affective neuroscience has, in a manner of speaking, reached adolescence, as an active research domain for well over a decade. At this stage, it is often easy to forget one's "parents," in this case the parent disciplines of social psychology and cognitive neuroscience from which our field was born. Nonetheless, these parent disciplines offer valuable perspective on the priorities, approaches, and techniques that might optimally support

social and affective neuroscientists in designing and implementing their research. In this Keynote Symposium, world-renowned scholars in cognitive neuroscience and social psychology — John Gabrieli (MIT) and Lisa Feldman Barrett (Northeastern) — will offer such perspective, and identify philosophical and practical lessons that social and affective neuroscientists can draw from the fields in which our work is rooted.

## **Distinguished Scholar Address**

From animal models to attitudes

Saturday, April 12, 2014

1:15 - 2:30 PM

## Speaker: Elizabeth A. Phelps

## ABSTRACT

Animal models of fear learning provide a basis for understanding human fears. This research has demonstrated that the amygdala is necessary for the acquisition, storage and expression of fear learning. This talk will explore how the neural mechanisms identified in animal models are consistent with human brain function and extend this research to the complex social situations typical of human experience. I will first describe how the mechanisms of fear in humans and may play a role in the expression of race attitudes. I will then focus on how fear, once acquired, can be diminished. Extinction and emotion regulation can be used to control fear via inhibitory signals from the prefrontal cortex to the amygdala. A similar circuitry has been implicated in the control of race attitudes. One drawback of these techniques is that fears are only inhibited and can return, with one factor being stress. A more lasting means to control fear may be to target the fear memory itself through influencing reconsolidation. I will present evidence suggesting that the behavioral interference of reconsolidation in humans persistently inhibits fear and diminishes involvement of the prefrontal cortex inhibitory circuitry.

## Session G Basic Affective Processes

Saturday, April 12, 2014

3:00 – 4:15 PM

Philip Kragel, Duke University

Harma Meffert, National Institutes of Health

Fiona Kumfor, Neuroscience Research Australia

Paul Whalen, Dartmouth College

ABSTRACTS

MULTIVARIATE REPRESENTATIONS OF DISCRETE EMOTIONS IN THE HUMAN BRAIN Philip A. Kragel and Kevin S. LaBar, Center for Cognitive Neuroscience, Department of Psychology and Neuroscience, Duke University - Understanding how neural activity signifies emotional states, either along continuous dimensions such as valence or arousal, or discrete categories such as fear and anger, is a fundamental question in affective neuroscience. Although neuroimaging studies have identified neural substrates consistently associated with emotion categories, little evidence supports emotion specificity within any single brain region. While this lack of specificity may be taken to refute discrete models, it may stem from inherent limitations of the univariate framework commonly used to identify biomarkers of emotion. An emerging body of work suggests that multivariate classification offers a more suitable framework for testing the predictions of theories of emotion and identifying specific markers of emotional states. Here we examine how distinct affective states are reflected in whole-brain patterns of central neural activation. During fMRI scanning, participants viewed cinematic films and music clips intended to elicit amusement, contentment, surprise, fear, anger, sadness, and neutral states. Following each induction, participants rated their experience of emotion using a self-report scale containing both categorical and dimensional items. Machine learning models were constructed to identify patterns of neural activation capable of specifying the emotional state of participants. Signal detection measures indicated classification performance was significantly above chance levels. Further, regression coefficients from machine learning models revealed distinct networks that reliably predicted the occurrence of each emotion. For example, instances of fear were associated with increased activation in a number of regions including amygdala, inferotemporal cortex, anterior cingulate, posterior cingulate, and right dorsolateral prefrontal cortex. Amusement, on the other hand, was predicted by clusters of activation in medial occipital cortex, bilateral superior temporal gyrus, thalamus, superior-, and middlefrontal cortex. Comparisons between errors in classifying patterns of neural activation indicate that fewer errors were committed on instances that were rated as most different on categorical measures of emotional experience, whereas instances that differed in terms of valence and arousal were associated with a greater number of errors. These findings suggest that unique components of emotional experience are grounded in distinct neural circuitry and demonstrate the efficacy of statistical learning methods in characterizing the nature of affect in the brain.

### PREDICTION ERRORS TO EMOTIONAL EXPRESSIONS: THE ROLES OF THE

AMYGDALA IN SOCIAL REFERENCING Harma Meffert, Section of Affective and Cognitive Neuroscience, National Institutes of Health; Sarah J. Brislin, Clinical Psychology Program, Florida State University; Stuart F. White, Section of Affective and Cognitive Neuroscience, National Institutes of Health; James R. Blair, Section of Affective and Cognitive Neuroscience, National Institutes of Health - Social referencing paradigms in humans (Klinnert et al., 1986; Aktar et al., 2013) and observational learning paradigms in animals (Mineka and Cook, 1993) suggest that emotional expressions are important for communicating valence. It has been proposed that these expressions initiate stimulus-reinforcement learning (Blair, 2003). Relatively little is known about the role of emotional expressions in reinforcement learning, particularly in the context of social referencing. In this study, we examined object valence learning in the context of a social referencing paradigm. Participants viewed objects and faces that turned towards the objects and displayed a fearful, happy or neutral reaction to them, whilst judging the gender of these faces. Notably, amygdala activation was larger when the expressions following an object were less expected. Moreover, when asked, participants were both more likely to want to approach, and showed stronger amygdala responses to, objects associated with happy relative to objects associated with fearful expressions. This suggests that the amygdala plays two roles in social referencing: (i) initiating learning regarding the valence of an object as a function of prediction errors to expressions displayed towards this object; and (ii) orchestrating an emotional response to the object when value judgments are being made regarding this object.

#### EXPLORING THE EFFECT OF EMOTION ON MEMORY IN DEMENTIA SYNDROMES

Fiona Kumfor, Neuroscience Research Australia, School of Medical Sciences, University of New South Wales, ARC Centre of Excellence in Cognition and its Disorders, University of New South Wales; Muireann Irish, Neuroscience Research Australia, ARC Centre of Excellence in Cognition and its Disorders, University of New South Wales, School of Psychology, University of New South

Wales; John R. Hodges, and Olivier Piguet, Neuroscience Research Australia, School of Medical Sciences, University of New South Wales, ARC Centre of Excellence in Cognition and its Disorders, University of New South Wales - Events that are imbued with emotion are preferentially processed, resulting in these events being recalled more vividly and with greater confidence than non-emotional events. Converging evidence suggests that a trade-off for information central to an emotional event exists, with emotionally-salient central stimuli capturing attention and being remembered at the expense of peripheral information. Dementia syndromes offer a unique model to study the neurobiological basis of the interaction between emotion and memory and potential trade-off effects, given the differential impairment of memory and emotion across dementia syndromes. Alzheimer's disease (AD) affects the medial temporal and posterior cingulate cortices, manifesting as an early and profound deficit in episodic memory. In contrast, in frontotemporal dementia (FTD) the medial prefrontal and anterior temporal lobes are affected in the early stages, and clinically, patients show pervasive deficits in emotional functioning, behaviour and personality. We aimed to examine memory for emotional and neutral stories in these dementia syndromes and to determine how emotion influences memory for central and peripheral details across these patient groups. Fourteen AD, 13 FTD, and 12 controls viewed either an emotionally arousing or a closely matched emotionally neutral story. Multiple-choice recognition for total memory, central, and peripheral details was assessed after a 1-hour delay. Memory for the alternate story was assessed two weeks later. All participants underwent high-resolution structural brain magnetic resonance imaging. Both patient groups and controls subjectively rated the stories similarly for emotional content and level of understanding. Importantly, the impact of emotion on memory differed across groups. Although both AD and FTD patients remembered fewer details compared to controls, only the AD group showed emotional enhancement of total memory (p = .009). Notably, this effect was present for both central (p = .006) and peripheral (p = .027) details. FTD patients in contrast, showed similar memory for total, central and peripheral details, irrespective of the emotional content (all p values > .05). Voxel-based morphometry analyses revealed that the degree of emotional enhancement in AD was primarily associated with grey matter intensity in brain regions associated with memory including the hippocampus, posterior cingulate and left temporal regions. In contrast in FTD, emotional enhancement was associated with grey matter intensity in the right amygdala, insula and orbitofrontal cortex. Emotion has an enhancing effect on memory in AD, despite significant episodic memory impairment due to degeneration of core memory structures including the hippocampus and posterior cingulate. Surprisingly, the beneficial effect of emotion in AD occurs for both central and peripheral details. In contrast, memory in FTD is not enhanced by emotion, despite intact subjective ratings of the emotional content and understanding of events. Our results suggest that emotion does not necessarily cause a trade-off in performance and further reveal that the integrity of medial prefrontal emotion processing regions is integral to the preservation of emotional enhancement of memory, rather than traditional memory network structures. These data demonstrate the utility of studying dementia syndromes to improve our understanding of the interaction between emotion and memory.

## NEURAL RESPONSES TO THE MULTIPLE MEANINGS OF FEAR Paul Whalen,

*Dartmouth College* - Neural responses to fearful expressions can be interpreted as a response to the lack of predictive clarity associated with these expressions, in addition to a response to negative valence per se. This source ambiguity gives rise to numerous possible interpretations of a fearful expression observed in another person. For example, from the viewer's perspective, a fearful expression might mean that they themselves are in danger (anxious interpretation). Alternatively, this expression could be a call for help (empathic interpretation). Finally, the viewer may perceive that this expression is in response to their dominance in this situation (dominant interpretation). I'll describe behavioral and neuroimaging data addressing these multiple meanings of fear.

## Session H Poster Presentations: Session 2

Saturday, April 12, 2014

4:15 – 5:30 PM

See page 57 for abstracts

## Session I Perceiving Others' Minds

Saturday, April 12, 2014

5:30 – 6:45 PM

Diana Tamir, Harvard University

Meghan Meyer, University of California Los Angeles

Alexander Genevsky, Stanford University

Thalia Wheatley, Dartmouth College

## ABSTRACTS

**NEURAL AND PSYCHOLOICAL REPRESENTATION OF MENTAL STATES** *Diana I. Tamir, Mark A. Thornton, Harvard University; Juan Manuel Contreras, Walt Disney Corporation;*  Jason P. Mitchell, Harvard University - How do people understand the mental states of other individuals? Psychological researchers have posited a number of specific sets of dimensions along which people represent mental states, including agency and experience, emotion and reason, mind and body, uniquely human and shared, social and nonsocial, valence and arousal, or warmth and competence. Each of these models has offered considerable behavioral explanatory power for the ways in which people think about others' mental states. But to what extent do any of these models capture the manner in which we actually represents mental states? Research in social neuroscience has suggested that the neural network which includes the medial prefrontal cortex, temporoparietal junction, and lateral temporal lobes, plays a key role in our ability to think about the minds of other people, but it is unknown how these regions represent such social information. The present study used multivoxel pattern analysis of functional magnetic resonance imaging (fMRI) data to assess whether any of these psychologically viable theories actually capture the representations of mental states employed by our neural hardware. During fMRI scanning, on each trial participants thought about one mental state by judging which of two scenarios would better evoke that specific mental state in another person. Based on the patterns of activity evoked for each of the mental states, we generated a neural similarity matrix between all mental states within each voxel in the brain using a searchlight analysis. These neural similarity matrices were then compared to similarity matrices derived, based on pretesting, from the psychological models with the dimensions described above. This analysis revealed regions of the brain that represented mental states according to each of the psychological models. Results show that the models based on the valence and arousal, agency and experience, emotion and reason, mind and body, and warmth and competence dimensions all robustly captured the manner in which the brain represented mental states. In particular, regions specifically within the social brain network, including the dorsomedial prefrontal cortex, temporoparietal junction, and anterior temporal lobes represented mental states in line with these psychological theories. Other models, such as the models based on uniquely human and shared, and social and nonsocial dimensions failed to capture the way mental states were encoded in any neural regions. These findings suggest that the way our brain encodes others' mental states converges well with extant psychological theories of mental state representations.

#### SOCIAL WORKING MEMORY: 7 + OR - 2 IN THE MENTALIZING NETWORK?

Meghan L. Meyer and Matthew D. Lieberman, University of California Los Angeles - Whether keeping track of three friends' perspectives during a conversation, a roomful of colleagues beliefs during a conference, or the political ideology of someone we just met, we constantly juggle in mind social cognitive information or information about people's mental states, traits, and personalities. In psychology, managing information in mind is referred to as working memory. From the perspective of brain function, how we manage social cognitive information in working memory is mysterious. This is because the same neurocognitive network, often referred to as the 'mentalizing network,' that increases during social cognitive tasks without working memory demands is also known to decrease activation during traditional working memory tasks. In fact, failure to decrease mentalizing network activity during working memory tasks actually interferes with working memory task performance. Thus, it is unclear if the mentalizing network has the functional properties to support working memory for social cognition. Here, across three fMRI studies, we provide the first evidence that the mentalizing network uniquely supports social working memory. In Study 1, participants completed a social working memory task in which they ranked their friends along trait dimensions (e.g., funny) during a delay period. Importantly, across trials participants considered two, three, or four of their friends along the trait dimensions, which allowed us to examine parametric changes in brain activation as a function of social working memory load. Results showed that the mentalizing network linearly increased in activation as a function of the number of friends considered during the delay period, a response pattern characteristic of a working memory system. In another sample in Study 2, we directly compared linear increases across this social working memory task and a cognitive working memory task matched on performance (across trials, participants alphabetized two, three, or four friends' names during the delay period). Only the mentalizing network differentiated the two tasks by linearly increasing as a function of the number of friends

considered along trait dimensions during the delay period, while linearly decreasing as a function of the number of friends' names alphabetized during the delay period. To see if this pattern extends beyond social cognitive processing for people we already know, in Study 3, we used another social working memory paradigm in which participants first learned the relationships between characters (e.g., siblings, enemies, friends). Then, during social working memory trials participants considered how the characters would respond to events based on their relationships with one another and during cognitive working memory trials alphabetized characters names. Again, we observed linear increases in the mentalizing network as a function of the number of characters' reactions considered, but linear decreases as a function of the number of characters' names alphabetized. Thus, social working memory relies, at least partially, on domain-specific processing in the mentalizing network. Moreover, we are one step closer to understanding the functional properties of the mentalizing network: for the first time we know it systematically, and uniquely, supports social-cognitive processing load. Implications of these results and future directions for social working memory research will be discussed.

AFFECTIVE AND NEURAL BASES OF THE IDENTIFIABLE VICTIM EFFECT Alexander Genevsky, Stanford University; Daniel Vastfjall, Linkoping University; Paul Slovic, Decision Research; Brian Knutson, Stanford University - The identifiable victim effect describes the fact that people prefer to give to vivid identified victims than to anonymous victims of misfortune. Affect has been thought to contribute to this effect, but research has not yet established exactly which emotions matter and how. To further understand the role of affect in the identifiable victim effect we first ran a behavioral study to establish the effect withinsubjects and identify affective correlates. We than ran an FMRI on 22 individuals to explore the neural underpinnings of our observed behavioral effect. Prior to the study, subjects were given a monetary endowment from which they could choose to donate on each trial of the experiment (one of which would be randomly selected to count "for real"). During each trial subjects sequentially saw either a photograph or silhouette of an African orphan, an amount for the requested donation, and made a choice whether or not to donate. We found that just viewing a photograph increased peoples' willingness to donate (by about 50%). This increase in giving was associated with and statistically mediated by self-reported ratings of positive, rather than negative, arousal in response to the photographs. Further, in our imaging study we found that although a number of neural regions were responsive to the photograph vs. silhouette contrast, only the nucleus accumbens predicted eventual decisions to give. Current behavioral and neural findings suggest that the identifiable victim effect may be explained by positively aroused feelings and nucleus accumbens activation in response to affectively evocative identifiable information. This activity may compel people to give to others based on identifiable and affectively compelling characteristics, even in spite of costs to themselves.

**THE REPURPOSED MIND** *Thalia Wheatley, Dartmouth College* - Human beings are unlike other animals along two dimensions: innovation and sociality. We spend much of our lives imagining what is possible, leading to the rapid evolution of design for products, policies and art. We create vast and fluid social networks built on common interests and congregate en masse, often with strangers. How did we get here? Where did this capacity for innovation and connection come from? One theory is that the human brain re-purposes ancient neural computations for new domains: hardware that originally evolved to map the visible extended to map the invisible. I will present evidence from my own and other labs that supports this view and discuss how re-purposing provides a useful framework for understanding the structure, capacities, and limits of human thought and behavior.

## Poster Session D Friday, April 11, 2:35-3:50pm

D-01

### THE EFFECTS OF CORTISOL ON EXPLICIT VERSUS IMPLICIT PROCESSING OF SOCIAL THREAT: AN EVENT-RELATED POTENTIAL STUDY Jacobien van Peer, Behavioural Science Institute, Radboud University Nijmegen, Nijmegen, The Netherlands; Peter Putman, Institute of Psychology, Leiden University, Leiden, The Netherlands -The stress hormone cortisol is important for the regulation of social motivational processes. High cortisol levels have been associated with social fear and avoidance, which play an important role in social anxiety, as does hypervigilant processing of social threat. However, causal effects of cortisol on social threat processing remain unclear. Previous studies have shown both increases and decreases in social threat processing after cortisol administration. A review of these studies suggested that task or goal-relevance may be an important factor modulating the effects of cortisol on the processing of threat stimuli, consistent with the view, based on animal studies, that corticosteroids generally facilitate processing and adaptive behavior that is most relevant to the situation. Hence, we hypothesized that cortisol would increase threat processing when the stimuli are task-relevant, and inhibit threat processing when the stimuli are task irrelevant or distracting. In the present study we tested this hypothesis by directly comparing the effects of cortisol on task-relevant (explicit) versus task-irrelevant (implicit) processing of the same social affective stimuli. In an event-related potential (ERP) study we investigated the effects of oral administration of cortisol (40 mg hydrocortisone) on the processing of angry, fearful, happy, and neutral facial expressions in 24 healthy participants using a double-blind, within-subject, placebo-controlled design. Faces were presented at the center of a computer-screen for 300 ms, flanked by a pair of vertical lines (one on the left and one on the right side) with either the same or a different length. Emotional expression was varied across blocks, with angry, fearful, and happy faces shown in separate blocks, randomly intermixed with neutral faces (50% of trials). The experiment consisted of two conditions: In the face (emotion-relevant) condition, participants had to indicate with a button press on each trial whether the face showed an emotional or neutral expression, and ignore the lines. In the line (emotion-irrelevant) condition, participants had to indicate whether the two lines were of the same or a different length, and ignore the faces. The order of the conditions and the order of the blocks within each condition were randomized for each participant. Previous studies have shown similar tasks to be highly sensitive for capturing the effects of attention on the processing of emotional facial expressions. These studies demonstrated that the initial rapid stage of emotional expression processing (showing enhanced early positive potentials in response to emotional compared to neutral faces) is unaffected by attention, while later, more controlled stages of expression processing (reflected by positive potentials > 220 ms post-stimulus) are inhibited when

attention is directed away from the facial expressions (i.e., in the line condition). The results of the present study show how the effects of cortisol on social threat processing are modulated by these attention effects. These results will be discussed in light of the importance of motivational context (task-relevance) on the effects of cortisol on threat processing.

## D-02

SPEAKER-LISTENER PERSUASION: AN **fNIRS** STUDY OF MESSAGE PROPAGATION Kristin Shumaker, Matthew Brook O'Donnell, Nicolette Gregor, Emily B. Falk, Communication Neuroscience Lab, University of Pennsylvania - Successful message propagation depends on both the intention of a speaker to spread a message and their conception of how the message will be received by others. Previous fMRI studies collected neural data during an initial exposure to original content (i.e. pilot TV shows, novel products, mobile game applications), along with post-exposure ratings and video recommendations of the content. However, the fMRI environment limits the ability to capture neural activity in dynamic social interactions. By contrast, functional near-infrared spectroscopy (fNIRS) allows recording of neural activity in real time as participants complete tasks. With the ability to record time-locked audio and video, fNIRS also affords the potential to understand a wider range of communication signals than can be captured in an MRI environment. In this study, subjects (n=22) were asked to watch either seed videos, or the video recommendations recorded by other subjects, for 30 mobile game applications, while their neural activity was simultaneously recorded using fNIRS. Each subject was then subsequently video recorded discussing the ideas for the benefit of future participants as fNIRS recording continued. The initial seed videos were controlled for enthusiasm (high vs. low) and valence (positive vs. neutral vs. negative), allowing us to examine how such features elicited neural activity in an initial group of listeners, and how that neural activity then propagated from the initial group to subsequent idea recipients, along a chain formed by speaker-listener dyads. In other words, each dyad is structured as part of a propagation chain, such that the first-order subject in the chain watches the original, controlled content of the seed videos and the second-order subject watches the video recommendation recorded by the first. Using past fMRI research to define a priori regions of interest, we will present data on neural "intention effects" (neural activity associated with participants' initial intentions to share information), "salesperson effects" (individual differences in participants' success passing on their preferred ideas to the next listener), and their interactions with preceding message characteristics. Our analysis methods leverage the correspondence between neural activity as participants are exposed to ideas and then subsequently deliver those ideas, as well as analysis of correspondence in neural activity between speaker-listener dyads. Both behavioral and fNIRS data from the propagation chains will be reported, with a focus on how these results inform our understanding of the psychology of successful communication.

D-03

FUNCTIONAL CONNECTIVITY BETWEEN THE NUCLEUS ACCUMBENS AND ACTION **OBSERVATION NETWORK CORRELATES WITH** ADIPOSITY Jeremy F. Huckins (a,b,\*), Joshua S. Siegel (c), Fran M. Miezin (c), Rebecca S. Coalson (c), Babatunde Adeyemo(c), Todd F. Heatherton(a), Steven E. Petersen (c,d,e,f,g,h), William M. Kelley (a,b); a Department of Psychological and Brain Sciences, Dartmouth College, Hanover, NH, USA; b Program in Experimental and Molecular Medicine, Geisel School of Medicine at Dartmouth, Hanover, NH, USA; c Department of Neurology, Washington University School of Medicine, St. Louis, MO, USA; d Department of Radiology, Washington University School of Medicine, St. Louis, MO, USA; e Department of Anatomy and Neurobiology, Washington University School of Medicine, St. Louis, MO, USA; f Department of Biomedical Engineering, Washington University, St. Louis, MO, USA; g Department of Psychology, Washington University, St. Louis, MO, USA; h Department of Neurological Surgery, Washington University School of Medicine, St. Louis, MO, USA; \* Corresponding *author* - Obesity is a worldwide problem with outcomes related to morbidity, mortality, health care costs and impaired cognitive function. Body mass index (BMI) is a commonly used metric but has many confounds. Percentage body fat provides a more accurate estimate of an individual's fitness. Obesity rates tend to cluster within social groups suggesting a social or lifestyle factor. Recently our lab and others have shown that viewing reward cues or watching others receive rewards activates regions of the action observation network (AON) in addition to brain regions commonly associated with reward (e.g., nucleus accumbens [NAcc]). Here we examine whether resting-state functional connectivity (rsfc) between NAcc and the AON predicts individual differences in adiposity. Subjects (N = 260) participated in rsfcMRI, anatomical MRI, and had their body fat percentage measured via a bioelectrical impedance scale. Individual NAcc seeds were automatically parcellated from anatomical scans using FSL's FIRST. Functional connectivity data was analyzed using a standard processing stream (Power et al., 2013). NAcc seed maps were created by correlating the mean time-series from the individual seed region with each voxel. Maps were zscored and submitted to a regression analysis to identify differences across adiposity. Connectivity between NAcc and members of the action observation network were positively correlated with adiposity. Specifically, inferior parietal sulcus, inferior parietal lobule, posterior insula, and mouth and hand somatosensory cortex connectivity with NAcc was positively correlated with adiposity. These results suggest a functional relationship between reward-cue reactivity and action planning, the strength of which may give rise to unhealthy eating habits.

D-04

EYETRACKING AND NEUROIMAGING INVESTIGATIONS OF DIRECT FACE-TO-FACE INTERACTIONS L.A. Harrison, California Institute of

Technology, Computation and Neural Systems; M.L. Spezio, Scripps College, Psychology; J.M. Tyszka, California Institute of Technology, Biology and Biological Engineering; J. Elison, University of Minnesota, Psychology; R. Adolphs, California Institute of Technology, Humanities and Social Sciences; Biology.- Gaze is an important social communicative cue in primates. Individuals with deficits in social interaction, e.g. those with autism or amygdala damage, exhibit disturbances in gaze processing. While a large literature documents processing of faces and eye gaze, the vast majority of stimuli used in these studies have a series of shortcomings: they are pictures or videos, rather than people in the flesh. Yet, as our own experience and the growing literature on interactive social cognition argue, pictures and real people are processed in quite different ways, and ecological validity may significantly affect gaze behavior and processing. In two experiments, we employed a face-to-face paradigm to explore how gaze behavior and the neural processing of gaze are modulated by the live presence of another person. In this face-to-face paradigm, a participant directly interacts with a live actor; this interaction is contrasted with interaction through a video of the actor. In the first experiment, a headmounted eye-tracker allowed us to track a participant's gaze while they sat directly across from an actor and conducted a conversation. In this experiment, participants (n=27, 11 female) conversed with the actor in both an inperson face-to-face condition and in a live-video condition. In the former, both the actor and participant could see each others' gaze; we hypothesized that this would motivate the participant to socially modulate their gaze. In the latter case, the actor could not monitor the participant's gaze, which we therefore hypothesized would not be socially modulated to the same extent as the in-person gaze. These hypotheses were borne out in our findings: participants showed significant mouth gaze in the in-video compared to in-person condition (Chisquared (1,N=26) = 9.02, p<0.01). Following the finding that gaze behavior is indeed influenced by the direct presence of another person, we explored whether the neural response to gaze changes as a function of the presence of another person in a blocked design fMRI experiment. In a Live condition, participants (n=15, all male) monitored the gaze of a live actor sitting behind the bore of the magnet. Audio instructions delivered to the actor's headphones cued their gaze: actor conditions consisted of direct gaze, averted gaze, or eyes closed. In the Recorded condition, equivalent video recordings of the Live condition were used. Networks of activation revealed a set of partially distinct networks activated by direct Live gaze compared to Recorded gaze. The conditions were primarily differentiated by greater prefrontal and attentional activity in the Live but not Recorded condition. We demonstrate that gaze behavior and the neural response elicited by live gaze were distinct from those in response to video gaze. Thus, the presence of a real person, rather than a representation of them, appears to trigger distinct social processing. This face-toface approach will be important to understanding deficits in populations with impaired gaze behavior, such as individual with autism.

SOCIAL SUPPORT AS A PREPARED SAFETY STIMULUS: EXAMINING THE ROLE OF SOCIAL SUPPORT IN FEAR EXTINCTION Hornstein, Erica (UCLA); Eisenberger, Naomi (UCLA) - Research has consistently demonstrated that social support is linked with positive mental and physical health outcomes, but the mechanism underlying this beneficial relationship is not well understood. By combining social support research with well-established models of fear learning, we sought to examine whether social support figures act as 'prepared safety stimuli'--naturally signaling safety during times of threat. To the extent that social support figures act as prepared safety stimuli, they should both inhibit fear learning and enhance fear extinction, consequently reducing threat-related stress. In a previous study, we used a classic 'retardation' fear conditioning paradigm to demonstrate that social support reminders, in the form of images of close others, interfered with fear learning such that individuals less easily associated fear responding with their close others. In the current study, we used a classic 'summation' fear conditioning paradigm to investigate whether these social support reminders would help enhance the extinction of fear. In order to examine this, we designed a summation fear conditioning paradigm, in which we paired three neutral stimuli that had already been associated with fear with three different types of additional stimuli: social support stimuli (images of social support figures), stranger stimuli (images of strangers), and neutral stimuli (images of flowers). Hence, each subject was first conditioned to associate fear with three neutral images (a stool, a basket, and a clock), by presenting these images paired with a painful electric shock during a conditioning session, resulting in each image inducing a fear response when presented (increased galvanic skin response; GSR). Each of these now fearful neutral images was then paired with an additional image, a novel picture of either a social support figure, a stranger, or a flower, for a summation session during which there were four presentations of the paired images and no shock. In order to test whether the additional image affected the strength of the initial fear association, each fearful neutral image was presented again on its own. Results showed that while individuals showed equivalent initial fear learning for the three neutral images, fearful neutral images paired with the stranger or flower stimuli during the summation session induced a fear response when once again presented on their own, as measured by significant differences in GSR, whereas fearful neutral images paired with the social support stimuli during the summation session did not induce any fear response when once again presented on their own. These results show that social support figures weaken associations between fear and other stimuli, suggesting that social support figures act as prepared safety stimuli-inhibiting fear learning (as demonstrated in a previous study) and enhancing fear extinction (as demonstrated in the current study). By acting as prepared safety stimuli, social support figures may consequently reduce threat-related stress, offering insight into the links between social support and well-being.

#### D-06

EFFECTS OF SOCIAL SUPPORT ON BRAIN **RESPONSES TO PAINFUL STIMULATION IN ROMANTIC COUPLES** Marina Lopez-Sola, University of Colorado Boulder.; Luka Ruzic, University of Colorado Boulder.; Jason T. Buhle, Columbia University.; Jacob M. Parelman, University of Colorado Boulder.; Tor D. Wager, University of Colorado Boulder- Social attachment and romantic bonding are powerful reinforcers, associated with approach behaviors, openness and exploration, and increased wellbeing while reducing negative affect and arousal. Social support can have important effects on physical and emotional pain in real-life settings such as during childbirth, where it has shown to significantly reduce the duration of labor and the rates of labor-related complications and to significantly improve mother-infant bonding. However, the neural correlates of such distressalleviating effects during pain perception remain to be elucidated. This fMRI study assesses the effects of social support from the romantic partner on brain responses to acute thermal pain in healthy women (N=30), using a hand-holding paradigm. We compared pain-related responses during runs in which female participants held the hands of their romantic partner vs. runs in which they held a pneumatic squeezable device. Receiving social support from the romantic partner significantly reduced pain-related intensity and, to a greater extent, pain unpleasantness. Importantly, it also reduced anxiety associated with the pain anticipation cue while increasing perceived comfort during the pain experience. Preliminary fMRI results show significant reduction of acute pain responses during partner hand-holding in a number of pain-processing regions including somatosensory cortices, thalamus, insula/basal ganglia, and regions of the medial frontal cortex and anterior cingulate cortex. Overall, these results suggest that receiving social support from the romantic partner in a pain-related context exerts a protective effect both at the subjective and neural levels.

#### D-07

COMMON BUT DISTINCT CORTICAL RESPONSE TO SPONTANEOUS AND VOLUNTARY FACIAL MIMICRY Li-Fen Chen, Chiu-Jung Huang, Yong-Sheng Chen, Jen-Chuen Hsieh; Institute of Brain Science, National Yang-Ming University, Taipei, Taiwan; Integrated Brain Research Unit, Taipei Veterans General Hospital, Taipei, Taiwan; Department of Computer Science, National Chiao Tung University, Hsinchu, Taiwan; - Introduction: The ability of feeling what others feel is essential for social interaction. Embodying emotion, a model of emotion contagion, is proposed as a two-stage process, including facial mimicry and facial feedback. The present study aims at unraveling neural circuitry and its temporal scenario of embodied emotion by combining facial muscle recordings, magnetoencephalographic signals, and selfreport pleasantness rating. Materials and methods: Forty subjects (mean age 25.4±4.3 years old; 22 males) were recruited in the study. Each subject was instructed to passively view or voluntarily imitate the displayed video clips (2 min each) of smiling with different strengths (0%, 50%, 100%) and to report his/her pleasantness level at the end of each block (20 clips in each block). The electromyography (EMG) of the bilateral zygomaticus muscles and the whole-brain maior magnetoencephalography (MEG, Neuromag Vectorview system) were simultaneously recoded when they were exposed to smiling video clips. Spatiotemporal maps of brain activity for the event-related alpha-band MEG data were estimated using the beamforming method, followed by a paired t-test (contrast between100% and 0%, p<0.005, uncorrected; extended cluster size > 10) for each condition. Pearson correlation analyses were further employed to determine the relationships between pleasantness rating, EMG responses, and estimated brain activity within the clusters of interest in both conditions. Results: Significant bilateral EMG activations and elevated pleasantness levels were found in both viewing and imitating conditions. Similar but distinct activation of mirror neuron system (MNS), motor network and reward system were shown in these two conditions. The activity of the ventral premotor area was found only in the viewing condition, but not in the imitating condition. The activity of the pars triangularis (Brodmann area 45) and operculam ((Brodmann area 44) of inferior frontal gyrus (IFG) are positively correlated with EMG activity in the viewing and imitating conditions, respectively. Moreover, putamen was associated with biofeedback of automatic facial mimicry whereas caudate associated with that of the instructed (cognitively modulated) mimicry. Conclusions: Our results demonstrated different neural mechanisms underlying perceiving and imitating smiling faces. The MNS (IFG) and the orbitofrontal cortex link smile perception to motor simulation and emotion generation in both observation and imitation, with different temporal dynamics. These findings suggest that embodiment of emotional processing is dynamic and temporal properties of brain responses to emotional stimuli should be cautioned.

### D-08

AUDIENCES ENHANCE THE EXPRESSION BUT NOT **EXPERIENCE OF EMOTION** *W. Craig Williams; Stanford* University - The presence of others alters individuals' tendency to produce emotional facial expressions, but the source of this effect remains unclear. This is partially due to the contested relationship between expression and experience, another key channel of emotion. Traditional theoretical accounts consider expressions to be nearautomatic 'read-outs' of underlying experience. According to these models, socially-induced fluctuations in expression should reflect actual changes in experience. However, an alternative account treats expressions as efforts to communicate emotional experience to social others. This social communicative model suggests that the presence of others should modulate individuals' expression without altering their emotional experience. Critically, this theory also suggests that socially-driven changes in emotion expression should actually improve communication, for instance by increasing observers' accuracy about an individual's emotional state. The present study examined whether the mere presence of a close friend may indeed alter emotional expression

independent of experience. We additionally tested a core tenet of the social communicative account: that sociallyenhanced expression facilitates the communication of affect to others. Thirty-four pairs of close female friends were randomly assigned to either solo or presence conditions. Within dyads, each friend was also randomly assigned to either the 'target' or 'observer' role. Upon arrival at the lab, friend pairs were separated and informed that they would each be participating in two different studies. Targets completed two study phases in which they viewed and rated their emotional reactions to positive, neutral and negative images while their facial expressivity was recorded using electromyography (EMG). Meanwhile, observers monitored targets via video feed and rated their (targets') emotional experience using the same scale. Targets in both conditions completed the first phase in ostensible isolation. However, for the second phase only, targets in the presence condition believed their friends could see them (but crucially did not know that their reactions were being monitored). Targets in the solo condition meanwhile continued to believe they were alone throughout the second phase. This manipulation revealed the effects of targets' knowledge of their friends' presence on 1) targets' experience ratings, 2) targets' expressvity as measured by EMG, and 3) observers' accuracy in rating targets' affect.

### D-09

ALEXITHYMIA IS ASSOCIATED WITH BLUNTED ANTERIOR CINGULATE RESPONSE TO SOCIAL **REJECTION: IMPLICATIONS** FOR DAILY REJECTION AFFECTIVE RESPONSES TO THE ENVIRONMENT HELP US NAVIGATE OUR SOCIAL WORLD David S. Chester, University of Kentucky; Richard S. Pond, Jr., University of North Carolina - Wilmington; C. Nathan DeWall, University of Kentucky - Alexithymia, the inability to understand and identify affective states, is associated with poor social functioning. However, it remains unclear how alexithymia might influence individuals' likelihood of social rejection and the neural mechanism that might be involved. The dorsal anterior cingulate cortex (dACC) is a likely candidate given its role as an 'alarm system' that is attuned to social rejection. Using fMRI and a 7-day diary study, we found that the core feature of alexithymia, difficulty identifying affect, predicted both greater daily social rejection and a blunted dACC response to social rejection. Multilevel modeling revealed that the effect of deficits in affect identification on daily rejection was mediated and suppressed by dACC activation to rejection. Our findings emphasize the role that accurate affective understanding plays in maintaining social connections and implicate the dACC as a crucial mechanism in this process. The suppressing role of the dACC suggests future directions for clinical interventions on those with affective disorders.

### D-10

**RELATINGGRATITUDETOSOCIALEVALUATIONSANDGENEROSITY**ChristinaM.Karns, Ph.D., Dept of Psychology, University of Oregon -

Prosocial emotions, such as gratitude, might be thought of as a lens through which other events, experiences, and actions are magnified or filtered. Our working model of gratitude, similar to other views, posits that this emotional state consists of multiple affective and cognitive processing stages. First, a benefit is recognized through a rewarding emotion and a cognitive appreciation of the "gift." This is followed by a complex social evaluation of whether a social agent is responsible (a benefactor), the cost to the benefactor, the benefit to self, the cost-benefit of accepting, and inference about the intent of the benefactor (e.g., whether the gift is given freely or with "strings attached"). The outcome of this social evaluation could be gratitude, indebtedness, entitlement, or if social agency is minimal, simply appreciation of a "lucky break." An important outcome of gratitude is the motivation to reciprocate, to return the favor or deepen social ties to the benefactor. However, gratitude can also manifest as a prosocial desire to "give back" to others -- to be a benefactor or "pay it forward". To inform our in-progress neuroimaging studies, in a series of behavioral studies we examine the relationship of state and trait gratitude to two specific components of our working model, the evaluation of social agency, and the prosocial motivation to give, critical characteristics that may dissociate gratitude from related positive emotional states (e.g. relief, happiness, satisfaction, pleasure).

### D-11

SOCIAL EXCLUSION LEADS TO DECREASED RISK TAKING Vita Droutman, University of Southern California, Los Angeles; Feng Xue, University of Southern California, Los Angeles; Stephen Read, University of Southern California, Los Angeles - The role of insular cortex. This work examines the effect of social exclusion on risky decision making and explores neural components responsible for this effect. In particular, it investigates the role of the insular cortex in mediating between social deprivation and risk preference. The insular cortex is known to be sensitive to deprivation, including social deprivation. Numerous neuro-imaging studies (Aziz et al, 2000; Masten et al 2009) have shown elevated insular cortex activation during social exclusion. However, the insula has only recently been identified as a crucial component of the decision making circuitry. Specifically, increased insula activation immediately prior to decision making has been shown to be related to decreased preference for risk and vice versa (Kuchen & Knutson, 2005, Xue et al, 2010) We hypothesize that increased insular cortex activation due to social exclusion will be related to a preference for the safer choice. The research consists of a behavioral study and an fMRI pilot study. 133 university students participated in the behavioral study. The CyberBall task was used to induce social deprivation. In this task, participants start by playing a ball tossing game with 2 other players. At the end of the initial period, for Ss in the exclusion condition, the 2 other players start throwing the ball to each other only, thus excluding the participant. For participants in the control group, the game continues without change until the end. Following this social exclusion manipulation, risky decision making was assessed with the CUPS Task (a computer game in which participants

make a series of choices, each a selection of a gamble or a safe choice, for financial reward). To induce a social reward context, we told the participants that the final step of the experiment is a game to be played individually or with a group. In order to 'get into' the group game, they have to reach a certain threshold in their winnings in the CUPS task. We found that Ss in the exclusion condition had significantly lower preference for the risky choice (M = .5) than participants in the control group (M= .6), t (2, 133)=-3.14, p=.002. The fMRI pilot (11 participants) utilized a within subjects design: each subject performed 2 sets of CyberBall (once in the exclusion and once in the inclusion condition in counter-balanced order) followed by the CUPS task for each set. It confirmed that social exclusion incites insular cortex activation characteristic of deprivation states. Participants of this study had significantly higher activation in Anterior Insula and Anterior Cingulate Cortex while evaluating gambles in CUPS task immediately following Cyberball game played in excluded condition as compared to CUPS task following Cyberball inclusion condition. This research analyzes the neural mechanisms underlying the impact of social context on risky decision making and suggests that insular cortex may mediate the effect of social exclusion on decreased risk preference.

#### D-12

AUDIENCE IN RESONANCE: SHARED BRAIN **RESPONSES DURING LISTENING TO REAL-LIFE SPEECHES** Ralf Schmälzle - General and Biological Psychology, Department of Psychology, University of Konstanz, Germany; Frank Häcker - General and Biological Psychology, Department of Psychology, University of Konstanz, Germany; Christopher J. Honey - Department of Psychology, Princeton University, Princeton, USA; Uri Hasson - Department of Psychology, Princeton University, Princeton, USA; Harald T. Schupp - General and Biological Psychology, Department of Psychology, University of Konstanz, Germany - Powerful speeches have an enormous ability to draw in their listeners. Here we measured fMRI while participants listened to real-life speeches varying in rhetoric quality and assessed the emerging coupling between regional neural response profiles across listeners via inter-subject correlation (ISC) analysis. As expected, listening to real-life speeches evoked responses that were strongly correlated across listeners in widespread networks spanning across early auditory, linguistic (including superior temporal gyrus, angular gyrus, supramarginal gyrus, temporo-parietal junction, and the inferior frontal gyrus), and extralinguistic regions (including the precuneus, medial and dorsolateral prefrontal cortex). The main finding is that ISC effects were stronger for engaging vs. unengaging speeches, especially in bilateral superior temporal cortex. The enhanced inter-subjective coupling between listeners during engaging speeches suggests that they are more optimally tuned in to the time-varving speech signals, pointing to collectively increased attention, whereas unengaging speeches are processed more heterogeneously and attract less attention. These effects bear resemblance to metaphors of resonance, which are often invoked in discussions of speech impact and

suggest ISC as a potential measure for quantifying a given stimulus' power to attract collective attention. Taken together, the present results contribute to the emerging literature on auditory attention under natural circumstances and offer new possibilities for interdisciplinary research on the neural mechanisms mediating the reception of entertaining or persuasive messages.

### D-13

## **SOCIAL SOURCES OF RISK AND AMBIGUITY** Kim Fairley, Department of Economics, Radboud University

Nijmegen; Donders Institute for Brain, Cognition and Behaviour, Radboud University Nijmegen; Alan Sanfey, Donders Institute for Brain, Cognition and Behaviour, Radboud University Nijmegen ; Jana Vyrastekova, Department of Economics, Radboud University Nijmegen; Utz Weitzel, Department of Economics, Radboud University Nijmegen-Risk and ambiguity are respectively characterized by having probabilistic information concerning your choice options, or not. Studies on economic decision making under uncertainty have mainly focused on people's preferences' for risk and ambiguity in lottery setups. In these lottery contexts it is often found that people are ambiguity averse. They shy away from unknown uncertainty (ambiguity), more so than for known uncertainty (risk). Next to the distinction of the type of uncertainty, our study also emphasizes the importance of acknowledging the source of uncertainty. Real life cannot often be captured by a lottery like the flip of a coin or the roll of a die. People face uncertainty that directly stems from the conscious choice of (an)other person(s). This can be either anonymously in markets or more personal when having to decide if you lend money to your friend. In these situations, a person's outcome is dependent on another person's behavior, instead of the draw of a mechanistic lottery. In this study we investigate preferences for uncertainty in a social context and examine how these preferences differ compared to preferences measured by a standard lottery setup. This approach allows us to investigate if and by which mechanisms preferences for uncertainty are affected by its source. Twenty two adults participated in our fMRI study. While lying in the MRI scanner they had to indicate how many tokens (between 0-10) they wanted transfer to either a computerized lottery device (nonsocial conditions) or to a human receiver (social conditions). The transferred amount would then be multiplied by 3, before participants could receive back some proportion of their transferred amount. In the nonsocial case, this was randomly determined by the draw of a marble from a lottery, while in the social case these were the decisions of other participants who had decided in an earlier behavioral session to either keep the full amount or return back half of the tokens received. In both situations participants made transfer decisions either when probabilistic information was directly provided (risk), or it was not (ambiguity). Our behavioral results show that humans are ambiguity averse in both contexts. However this aversion is highest in the social context than when uncertainty stems from a lottery device. When comparing neural mechanisms underlying ambiguity in a social

context to ambiguity in a non-social context we found activation in the left and right fusiform gyrus, the right inferior parietal lobule and the right superior medial gyrus; areas that have been linked to interpretation of social information. These results indicate that people's preferences for uncertainty also depend on the underlying source. Our neuroimaging results suggest that social sources of uncertainty are characterized by emotional arousal and human beings uncertainty in their ability to mentalize and read other individuals intentions.

#### D-14

EXPERIMENTER PRESENCE **EFFECTS** ON **SUSTAINED ATTENTION** Wen Bu, University of Illinois College of Law; Jenny Porter, Columbia University; Kevin Ochsner, Columbia University - The accepted theory of social facilitation states that the presence of other people enhances "dominant" responses and inhibits "nondominant" responses and thus improves performance on easy or well-learned tasks and worsens performance on difficult or novel tasks. Some have suggested an attentional component to social facilitation such that the presence of others either narrows focus on the task or diverts it away from the task. We examined the potential attentional component of social facilitation by using two versions of a visual go/no-go task and varying the presence or absence of the experimenter in the room where the participant did the tasks. Because performance on go/no-go tasks has been associated with sustained attention to the task, we expected that differences in task speed and accuracy when the experimenter was present or absent would reflect differences in sustained attention. We found that experimenter presence slowed task performance, particularly on the more difficult task. This effect was particularly pronounced if the experimenter was present during earlier, rather than later, sets, suggesting that experimenter presence interferes with sustained attention at the point (early in the experiment) at which sustained attention would ordinarily be at its peak. Our results suggest that at least the performance decrement on difficult or novel tasks found in social facilitation studies may be partly explained by diversion of attention from the task at hand to the other person or people in the room.

## D-15

AN **EVENT-RELATED** POTENTIALS INVESTIGATION OF POLITICALLY-BASED SOCIAL EXPECTANCY VIOLATIONS DURING IMPRESSION FORMATION AND CATEGORIZATION Ivo Gyurovski (University of Chicago); Matthew Schafer (College of William and Mary); Cheryl Dickter (College of William and Mary); Jasmin Cloutier (University of Chicago) - Social expectations of individual or group behavior are an integral aspect of person perception (Jones, 1990; Macrae & Bodenhausen, 2000; Olson, Roese, & Zanna, 1996 ). When a group member displays stereotype-inconsistent behavior, the resulting violations of perceivers' social expectation can have many consequences. For example, they tend to experience greater affective arousal (Jussim, Coleman, & Lerch, 1987), form extreme evaluations of the targets

(Bettencourt, Dill, Greathouse, Charlton, & Mulholland, 1997), and recruit additional cognitive operations to process the violating information (e.g., Bartholow et al., 2001; Stangor & McMillan, 1992). Violations of social expectation also increase the likelihood that perceivers will individuate the target (Brewer, 1988; Fiske and Neuberg, 1990; Macrae et al., 1999;). Previous research examining the neural substrates of social expectancy violations found that brain regions involved in mentalizing (i.e., temporoparietal junction and medial prefrontal cortex) are preferentially recruited when perceiving targets violating social expectations (Cloutier et al., 2011; Todorov & Mende-Siedlecki, In press). Past research has also demonstrated that event-related potential (ERP) components can serve as indicators of the recruitment of processes responding to expectancy violation in regard to race (Bartholow et al., 2001; Dickter & Gyurovski; 2011;). The current study was designed to test whether the N2 and the P3 components of the ERP in response to the perception of targets paired with positions that represent either expectancy confirmations or violations of their political orientation, putatively reflecting early changes in attention and working memory updating respectively. Undergraduate participants read a statement conveying either a political statement that was typical of a Democrat or a Republican. They subsequently viewed the face of a politician that was identified as either a Democrat or a Republican, resulting in expectancy confirming or violating trials. ERPs were locked to the onset of each politician's image. Participants completed either an impression formation task (N=23) in which they were told to form an impression of each target, or a categorization task (N=20) in which they had to indicate whether the image was congruent or incongruent with the political information conveyed. Results revealed a sentence by image interaction such that higher N2 amplitudes were observed in response to expectancy confirming (e.g., Democrat Sentence - Democrat Image) relative to expectancy violating trials (e.g., Democrat Sentence - Republican Image). For the P3 component, however, a significant sentence by image interaction indicated that higher amplitudes were observed in response to expectancy violating relative to expectancy confirming trials. Furthermore, the data revealed a significant task by image interaction, such that higher P3 amplitudes were observed in response to Republicans, relative to Democrats during categorization, whereas no differences were observed during impression formation. These results provide a better understanding of the impact that expectancy violations and confirmations have on social cognition and help further our knowledge of the neural correlates of person perception. In particular, these findings arguably reflect differential effects of violating and confirming information on working memory updating and attention.

## D-16

#### ONLINE WORD-OF-MOUTH: HOW GROUP RECOMMENDATIONS INFLUENCE NEURAL PROCESSING OF SUBSEQUENT RECOMMENDATIONS Christopher N. Cascio, University of Pennsylvania ; Matthew Brook O'Donnell, University of

Pennsylvania; Joseph Bayer, University of Michigan ; Frank Tinney, Jr., University of Michigan; Emily B. Falk, University of Pennsylvania- Sharing ideas and information is an essential aspect of communication and has substantial impact on human preferences and behaviors. People frequently make recommendations about products and services, willingly sharing their experiences and opinions with others. This phenomenon is particularly highlighted in the new media environment, where people can instantly share with a wide range of others online, accounting for more than twice the sales of paid advertisements. However, little is known about the neural processes through which social information impacts recommendations. The present study seeks to understand the neurocognitive processes underlying what makes some people readily and dynamically update their recommendations in the face of peer group feedback when others do not. This study addresses the intersection of social influence and social sharing in adolescents in a task that involves recording recommendations of real mobile game apps. We focus on adolescents given that strong preferences and ways of processing social information are learned during this developmental period and adolescents have a high level of engagement with the new media environment. We hypothesized that increased activity in neural systems that help individuals track social cues (i.e., the mentalizing system, the social pain and reward systems) will be associated with changing recommendations. Sixty-five adolescent males were recruited and completed two rounds of the App Rating Task-a task that captures neural processes associated with making recommendations on one's own and in response to manipulated peer recommendations. During the initial pre-scan rating session participants were asked to give their preliminary opinions on 80 previously unknown mobile game apps based on exposure to the game title, logo, and brief description. During the fMRI session participants were told that they would be re-rating the same 80 mobile game apps. In the scanner, they were shown manipulated information about whether their peers in the study were more likely, less likely, or equally likely to recommend the games to others, or for some games, told that no peer recommendation information was available. Increased activity in a priori hypothesized mentalizing and social pain regions during peer feedback susceptibility to tracked social influence on recommendations. For example, activity in an anatomically defined rTPJ ROI across all feedback conditions predicted how often participants changed their recommendation (r = .292, p = .019). This effect was strongest when participants were told that peers were less likely to recommend the app to others (r = .293, p = .018). Parallel results were observed in affective processing systems relevant to processing social cues. Overall, our results demonstrate that increased activity in brain systems associated with understanding the mental states of others and maintaining social ties significantly predicted changing recommendations in the face of group feedback that peers were less likely to recommend the app to others. These findings may help explain the power of negative reviews in the new media environment, lend insight into the psychological and neurocognitive processes underlying recommendations, and speak to

important basic psychological forces that help humans share ideas and maintain group harmony.

## D-17

ACTIVATION AND DEACTIVATION OF THE SOCIAL BRAIN: A BRAINMAP META-ANALYSIS Jennifer L. Robinson, Ph.D. & Jessica Busler; Auburn University, Department of Psychology - Social cognition plays an undeniable role in everyday behaviors. Advances in functional neuroimaging have afforded the scientific community an opportunity to understand the neural correlates of such complex processes. However, single studies can differ across a number of parameters, thus limiting their potential to generate robust models of neural network involvement. Here, we capitalize on the structure of the BrainMap database to identify a wholebrain social cognition network encompassing over 58 studies and inclusive of 1,111 subjects. Activation likelihood estimation results revealed 18 clusters consistently activated by tasks that are taxonomically considered 'social cognition' by the BrainMap ontology. Clusters included portions of the inferior (BA9/BA44), medial (BA9/BA10), and superior frontal gyri (BA6/BA9), the anterior cingulate (BA32), superior temporal gyri (BA 39), inferior parietal lobules (BA 40), the insula, the posterior cingulate (BA31), the caudate, the hippocampi (BA37), and the amygdalae. Additionally, we sought to determine which brain regions were deactivated during social cognition. To this end, we found regions of deactivation in the right amygdala, anterior cingulate (BA32), right medial frontal gyrus (BA10), and portions of the parietal lobe. These data present a model for future investigations of functional or effective connectivity in social cognitive paradigms by providing network nodes for consideration when analyzing singlestudy functional neuroimaging data. Doing so may elucidate the neural mechanisms underlying social cognitive phenomenon.

## D-18

BEYOND THE LAB: PREDICTING DAILY SOCIAL INTERACTION QUALITY FROM PERFORMANCE ON EMOTION REGULATION AND EMPATHIC **ACCURACY TASKS** Jenny Porter, Columbia University; Jennifer Silvers, Columbia University; Erik C. Nook, Stanford University; Jamil Zaki, Stanford University; Kevin Ochsner, Columbia University - As thinking, feeling, humans we are constantly appraising and reappraising emotional cues in our environment. Furthermore, we often try to infer the emotional appraisals of those around us. Both emotion regulation and empathic accuracy are thought have profound consequences for our personal and interpersonal well-being. However, no prior work has investigated the relationship between these skills. In a novel study, 43 adult participants (23 female, M= 20.8, SD= 2.72) completed an emotion reappraisal task (Silvers et al., 2012) and an empathic accuracy task (Zaki et al., 2008) in counterbalanced order. Preliminary findings revealed no significant relationship between empathic accuracy and emotion reappraisal; however, individuals higher in empathic accuracy for negative experiences reported feeling less negative after viewing aversive images than those lower in empathic accuracy (t = -2.74, p < 0.05). Here, we attempt to bridge the gap between labbased measures of emotional skills and real life social interaction quality by presenting new findings on the relationship between emotion regulation, empathic accuracy (from our sample mentioned above) and daily measures of social interaction quality collected from the aforementioned sample during a 15-day daily diary study.

## D-19

PLACEBO TREATMENT REDUCES SOCIAL **REJECTION-RELATED PAIN VIA ACTIVATION OF** THE DORSOLATERAL PREFRONTAL CORTEX AND THE PERIAQUEDUCTAL GRAY Leonie Koban, University of Colorado Boulder; Ethan Kross, University of Michigan; Choong-Wan Woo, University of Colorado Boulder; Luka Ruzic, University of Colorado Boulder ; Tor Wager, University of Colorado Boulder - Placebo analgesia (PA) refers to a reduced experience of pain caused by belief in a medical treatment. PA has been mainly studied in somatic pain, but placebo effects may extend to social 'pain' and other forms of distress as well. Placebo effects on somatic pain are thought to involve prefrontal cortex and subcortical regions that contribute to the opioidergic descending pain modulatory system, particularly the periaqueductal gray (PAG). The corresponding mechanisms of placebo effects on social pain are unknown, but several recent studies suggest opioidergic circuits in the PAG and forebrain may be involved. Here, we used fMRI to investigate whether placebo treatment can reduce the social 'pain' caused by re-experiencing a recent romantic rejection. N=40 participants were presented with pictures of their ex-partners and of friends (control condition), during a baseline period, as well as after a randomly assigned placebo or control intervention. Behavioral ratings showed a significant reduction in negative affect following the placebo but not the control intervention, indicating that expectations can regulate psychological pain. Further, a multilevel mediation analysis revealed that placebo effects on social pain ratings were mediated by increased fMRI activity in the right dorsolateral prefrontal cortex and PAG. These findings imply that prefrontal-PAG interactions may also be crucial for the relief of affective and social distress, and suggest a possible mechanistic basis for non-specific treatment effects in a wide range of affective disorders.

### D-20

WATCH WHAT I DO, NOT WHAT I SAY I DO: COMPUTER-BASED "AVATARS" TO ASSESS BEHAVIORAL INHIBITION, A VULNERABILITY FACTOR FOR ANXIETY Catherine E. Myers(1,2), John A. Kostek(1,2), Barbara Ekeh(3), Rosanna Sanchez(3), Annie Krusznis(2), Noah Weinflash(2), Richard J. Servatius(1,2); 1. VA New Jersey Health Care System, East Orange NJ; 2. Stress and Motivated Behavior Institute, Department of Neurology and Neurosciences, Rutgers-New Jersey Medical School, Newark NJ; 3. Honors College, Rutgers University, Newark NJ - Individual differences in personality can affect not only how we behave in daily social and non-social interactions, but also determine vulnerability to various psychiatric disorders such as anxiety disorders and post-traumatic stress disorder (PTSD). Various biological, genetic, and psychological/cognitive risk factors have been identified, including behavioral inhibition (BI), a temperamental tendency to avoid or withdraw from novel situations. BI is believed to be a relatively stable personality trait that is evident from early childhood. Children and adults with high BI are at increased risk for later development of anxiety disorders and PTSD. BI can be assessed through direct observation of behavior in children; in adults, the assessment of BI is usually based on self-report, e.g. questionnaires such as the Adult Measure of Behavioral Inhibition (AMBI), which presents a series of behaviors and attitudes that represent inhibited and non-inhibited responses, and asks the degree to which each statement accurately describes the respondent's typical behavior. While such questionnaires are useful, they are subject to all the limitations of self-report, including demand characteristics and individual differences in selfawareness of one's own behaviors. As an alternative method for assessing BI, we have developed a computerbased task, in which the participant creates and manipulates an "avatar" through a series of scenarios, in which the avatar can meet and interact socially with different characters. At each choice point, the participant is presented with three alternative actions that the avatar can take; some of these are simply "distractor" questions related to the scenario (e.g. a choice between several possible food items for lunch) and some ask questions specifically adapted from items on the AMBI (e.g. a choice between approaching and interacting with a stranger vs. keeping to oneself). Participants are requested to choose the behavior that they themselves would be most likely to make, if confronted with such a situation. Responses at the choice points are scored similarly to the AMBI, with 2 points for each "inhibited" response, 0 points for the "noninhibited" response, and 1 point for a "neutral" response. In preliminary work, we have collected data on the avatar game from a sample of healthy young adults (n=57 college undergraduates), who were also administered the AMBI, with task order counterbalanced across subjects. In this initial sample, there was a very strong positive correlation between BI as assessed by the avatar game and by the AMBI self-report questionnaire (Pearson's r>0.800, p<0.001). This suggests that the avatar format is an effective way to assess BI in a healthy population. Future work will examine this task in additional populations, including those who express PTSD symptoms, to determine whether this format may be a more accurate way of assessing BI, and PTSD vulnerability, than self-report questionnaire.

#### D-21

**SEX DIFFERENCES IN TRADITIONAL AND NON-TRADITIONAL ANTIDEPRESSANTS IN RATS** Michelle Lerner, BS, Temple University; Yushi Kawasumi, BA, Temple University Graduate Student; Brittany Wicks, BS, Research Assistant, Temple University; Sabina Khantsis, Undergraduate Research Assistant, Temple University; Debra Bangasser, PhD, Principal Investigator, Temple University - Affective disorders impact many people and have high societal costs; therefore treatments for these disorders should be a research priority. Women are twice as likely as men to receive a diagnosis of one of these disorders. Although there is debate over the underlying factors contributing to this disparity, substantial evidence indicates that there is a biological component. Treatments also show different efficacies between the sexes. For example, drugs operating primarily through the noradrenergic system often have better efficacy in men, while drugs acting on the serotonergic system tend to work better in woman. In addition, the non-traditional treatment scopolamine, an anticholinergic with rapid antidepressant action, has a stronger effect in women. As we approach an era of personalized medicine, understanding the biology underlying these sex differences will be crucial for the effective treatment of affective disorders. In the present study, we sought to determine whether a common preclinical test of antidepressant efficacy, the forced swim test, is sensitive to sex differences, not only with traditional antidepressants, but also with non-traditional pharmacotherapies. To this end, we used the standard forced swim test (two swim sessions in two consecutive days) with male and female Sprague-Dawley rats receiving three injections of desipramine (10 mg/kg, s.c.), a tricyclic antidepressant that works mainly through the noradrenergic system, scopolamine (20 µg/mL or 8 µg/mL, i.p.), a non-selective muscarinic antagonist, or vehicle, between the two sessions. An anti-depressant effect on this test is typically defined as a decrease in passive behaviors (floating) and an increase in active behaviors (climbing and swimming) during the second swim session. In addition, the active behaviors, climbing and swimming, are believed to reflect noradrenergic and serotonergic activity, respectively. Using this procedure we found that desipramine increased climbing in both male and female rats, consist with its modulation of the noradrenergic system. While floating was decreased more in males than females, this result did not reach significance. The high dose of scopolamine (20  $\times^{\circ}g/kg$ ) caused a decrease in floating in female, but not male rats. Together these results suggest that the forced swim test appears to be sensitive to sex differences in both traditional as well as non-traditional antidepressant treatments. As this test is a widely used tool for the study of antidepressant efficacy, establishing its utility in the detection of sex differences further proves its usefulness in preclinical research. It also suggests that the forced swim task will be a valuable tool to further investigate the physiology of sex differences as well as a first step in tailoring drug interventions to the specific needs of different patient populations.

#### D-22

**TESTOSTERONE AND REDUCED PREFRONTAL CONTROL OF EMOTIONAL ACTIONS IN CRIMINAL PSYCHOPATHS** Inge Volman (1,2), Katinka von Borries (1,2,3,4), Erik Bulten (4), Robbert Jan Verkes (2,3,4), Ivan Toni (2), Karin Roelofs (1,2); 1. Radboud University Nijmegen, Behavioural Science Institute (BSI), Nijmegen, The Netherlands; 2. Radboud University Nijmegen, Donders Institute for Brain, Cognition and Behavior, The Netherlands; 3. UMC Sint Radboud, Department of Psychiatry, Nijmegen, The Netherlands; 4. Pompestichting, Nijmegen, The Netherlands - Psychopaths are known for their well-controlled goal-directed behaviour. Yet, during social challenges, they often show uncontrolled emotional behaviour. Previous studies in healthy participants showed that the anterior prefrontal cortex (aPFC) is crucial for successful control of social emotional behaviour. Connectivity analyses, including dynamic causal modelling, suggested that down-regulation of the amygdala by the aPFC is critical in overriding automatic emotional action-tendencies during control of emotional behaviour, with testosterone modulating the strength of the connectivity between the aPFC and amygdala. This study tests whether alterations in this neuro-endocrine mechanism underlie the paradoxical lack of emotional control observed in psychopathic offenders. Control of emotional behaviour was operationalised with an fMRIadapted approach-avoidance (AA) task requiring ruledriven control over rapid emotional responses. Fifteen psychopathic offenders (no drugs, medication or psychiatric comorbidity except antisocial personality disorder; PCL-R > 26) and 19 matched healthy controls made approaching and avoiding movements in response to emotional faces. Control of social emotional behaviour was required during affect-incongruent trials, when participants had to override affect-congruent, automatic action tendencies (approach-happy, avoid-angry) and select the opposite response (approach-angry, avoidhappy). Psychopathic offenders showed less controlrelated aPFC activity and aPFC-amygdala coupling during trials requiring control of social emotional actions, when compared to healthy controls. This pattern was particularly pronounced in psychopaths with high endogenous testosterone levels. These findings suggest that reduced prefrontal coordination underlies reduced behavioural control in criminal psychopaths during emotionally provoking situations. The modulatory role of endogenous testosterone on the aPFC-amvgdala circuit provides a neurobiological mechanism of individual differences, relevant for advancement of treatment and reduction of recidivism.

### D-23

### THE EFFECTS OF LONG-TERM rTMS ON NEURONAL PLASTICITY USING EVENT-RELATED POTENTIAL IN PATIENTS WITH DEPRESSION

Kyung Mook Choi 1,2,3, Kyoung-Mi Jang 4, Kuk In Jang 3, Myung-Sun Kim 4, Jeong-Ho Chae 1,2,3\*; 1 Department of Biomedical Science, 2 Department of Psychiatry, Seoul St. Mary's Hospital, 3 Institute of Biomedical Industry, The Catholic University of Korea, College of Medicine, Seoul, South Korea, 4 Department of Psychology, Sungshin Women's University, Seoul, South Korea - Previous studies have reported that the repetitive transcranial magnetic stimulation (rTMS) could induce neuronal plasticity in the brain. However, the effects of long-term rTMS on neuronal plasticity are incompletely understood, and an event-related potential (ERP) study on long-term rTMS in patients with medication-resistant major depression has been absent. Therefore, we hypothesized that long-term

rTMS treatment would induce changes in brain function of patients with medication-resistant major depression and the changes in brain function would correlate with changes in rating scales. Eighteen patients with medication-resistant major depression (five males and thirteen females) participated in this study. Their mean age was 34.9 years old (SD 14.5, range 19~67). Seventeen patients participated in 3-weeks and 6-weeks follow-ups and one patient could not participate in 6-weeks followup. All patients received rTMS treatment for three weeks. All patients completed self-rated scales including Hamilton Depression Rating Scale (HAM-D), Hamilton Anxiety Scale (HAM-A), Beck Depression Inventory (BDI), State-Trait Anxiety Inventory (SAI, TAI), Korean-Ruminative Response Scale (K-RRS), Emotion Regulation Questionnaire (ERQ), and Cognitive Emotion Regulation Questionnaire (CERQ), and electrophysiological assessment such as ERP auditory oddball task, at their first visit, 3-weeks, and 6-weeks visit. In rating scales, there were main effects for time of measure in HAMD (F = 7.83, p < .005), BDI (F = 13.17, p < .0001), HAMA (F = 10.1, p <. 0005), SAI (F = 4.96, p < .05), and 'blaming others' scale of CERQ (F = 3.49, p < .05). In ERP auditory oddball task, when amplitudes of FP1, FP2, FZ, FCZ, CZ, and PZ channels were analyzed, P200 component showed a main effect for time of measure (F = 4.28, p < .05). Symptoms improved and ERP amplitude increased after long-term rTMS treatment. The P200 amplitudes of the channels were positively correlated with the reappraisal scores of ERQ and the positive reappraisal scores of CERQ when the changes between the baseline and 3weeks follow-up were analyzed (.581< r < .767, p < .05). The results of this study suggest that long-term rTMS treatment induces changes of brain function in patients with medication-resistant major depression and the changes of brain function were correlated with those of reappraisal in them.

### D-24

DEPRESSIVE SYMPTOMS AND EVENT-RELATED POTENTIALS TO IMPLICIT AND EXPLICIT PROCESSING OF EMOTIONAL EXPRESSIONS Stephanie Bastidas, Jacob T. Braunwalder, Nicholas M. Terry, Lucy J. Troup; Colorado State University - Depressive disorders have been associated with altered patterns of emotion processing, reflected across all stages of information processing. Event-related potential (ERP) experiments have established distinct patterns of ERP components' amplitude and latency, mostly a slowed and reduced P3 component for happy stimuli and a slowed P3 component for negative stimuli. It is still unclear, however, whether these differences occur independently from intentionality during emotion processing; that is, whether directing attention toward the emotional versus non-emotional aspects of emotional stimuli affect ERPs to these stimuli. The current study aimed to examine the effect of implicit and explicit processing on the relationship between depressive symptoms experienced in the week prior and event-related brain potentials to emotional facial expressions. Electroencephalogram was recorded from 19 electrodes (10-20 International System) while participants performed sex discrimination (implicit)

and emotion discrimination (explicit) judgments of faces showing happy, sad, and neutral expressions in fullyrandomized blocks. Explicit processing was associated with greater mean P1 (80-140ms) and N170 (140-200ms) amplitudes for sad and neutral than happy faces in depressed but not in control individuals. These differences were also reflected as greater P1 and N170 amplitude to happy faces in controls than in depressed individuals. No effects of group or emotion were found during implicit processing or for P3 and late positive potential (LPP) latency and amplitude in either condition. Results suggest depressive mood is associated with early differences in processing of happy facial expressions when attention is directed to emotional features of the stimuli but not during incidental processing of facial expression.

### D-25

THE IMPACT OF PREFRONTAL CORTEX "WARM UP" ON IMMEDIATE COGNITIVE REAPPRAISAL ABILITY IN OLDER ADOLESCENTS WITH ELEVATED SYMPTOMS OF DEPRESSION Emma L. Peterson, M.A. (University of Denver); Stephen R. Shirk, Ph.D. (University of Denver) - Cognitive Reappraisal (CR) is a central component of Cognitive Behavioral Therapy (CBT) for adolescent depression (Weersing, Rozenman, & Gonzalez, 2009). Yet, previous work has failed to identify the specific impact of CR training on symptom reduction. Additional work also demonstrates that a brain region highly associated with successful CR in adults, the Prefrontal Cortex (PFC), is under-developed in adolescents (Steinberg, 2005). It has been suggested that CR capacity develops over the course of adolescence in conjunction with the maturation of the PFC (Garnefski, Boon, & Kraaij, 2003). Given evidence that adolescents report using cognitive coping strategies, including CR, less than adults (Garnefski, Legerstee, Kraaij, Van Den Kommer, & Teerds, 2002) there has been growing concern that CBT interventions directed at building CR abilities in depressed teens might be constrained by PFC immaturity (Shirk, 2010). Insofar as CR is useful for managing negative emotion (Gross & John, 2003), finding a way to improve CR ability in adolescents could improve outcomes for adolescent depression and other disorders. The primary aim of the current study is to incorporate research findings from affective neuroscience literature with treatment development research. Specifically, the study, will evaluate the impact of PFC "warm up" on immediate CR ability (which is defined as the successful reduction of negative affect in the face of negative stimuli). Pilot data from the initial phase of the study will be presented. Participants include 8 older adolescents (aged 18-19 years-old) with moderately elevated symptoms of depression. First, participants watched a sad film clip and complete self-report and behavioral measures of mood to establish a baseline level of negative affect. To obtain self-report measures of mood, participants completed the Positive and Negative Affect Scale (PANAS; Watson, Clark, & Tellegen, 1988). The behavioral measure of mood, the Facial Emotional Expression Stimuli Test (FEEST; Young et al., 2002), required participants to view happy and sad facial

expressions morphed to express 25, 50, and 75% of the full happy or sad expressions and indicate whether the facial expression was positive or negative. Individuals with a negative bias, which would be consistent with sad mood, demonstrate higher recognition rates for negative faces than positive ones. Next, participants completed a modified Reading Span (Rspan) task designed and previously used by Bomyea & Amir (2011). The Rpsan is a working memory task, which has previously been shown to activate the PFC and improve performance on subsequent affect related tasks. Participants were then given CR instructions (following Troy et al., 2010) before watching a second sad film clip and completing mood measures. Changes in negative affect (both mood and behavioral measures) were compared between both film Results indicate that on average, sadness ratings clips. on the PANAS decreased by 0.8 (sd=2.0) and happiness ratings increased by 1.1 (sd=2.4) following the working memory task and CR instructions. On the FEEST, the percent of positive stimuli identified increased by 2.8 (sd=8.5). This pilot data indicates that the working memory task followed by CR instructions has, on average, had the intended effect on participants' moods. D-26

WHITE MATTER INTEGRITY AS A PREDICTOR OF SOCIAL ANHEDONIA IN YOUTH AT ULTRA HIGH-**RISK FOR PSYCHOSIS** Andrea Pelletier-Baldelli and Vijav A. Mittal; Department of Psychology and Neuroscience; University of Colorado Boulder, Boulder, CO, USA; - Social anhedonia refers to a limited capacity to find interest or pleasure in initiating and/or engaging in social interactions. Social anhedonia is often present in youth at clinical high-risk for psychosis (i.e. individuals who are clinically identified as being at risk for developing a formal psychotic disorder such as schizophrenia). This population is referred to as ultra high risk (UHR) due to the attenuated psychotic symptoms and deteriorating occupational and social functioning they tend to experience. Current clinical assessment allows for a limited ability in identifying UHR individuals; therefore, there is a need for developing further means of detecting psychosis risk. In addition to increased levels of social anhedonia, there is some evidence that abnormal brain development may be a key feature for this UHR group. Normal brain development involves a gradual increase in myelination, allowing for heightened efficiency in white matter tracts and overall brain circuitry. Research suggests that this myelination process can be deficient in UHR individuals. One way to assess for myelination and white matter integrity is by looking at fractional anisotropy (FA) through diffusion tensor imaging (DTI). In brief, higher FA values correspond to higher fiber integrity in white matter. Based on the available literature, both social anhedonia and abnormal maturational processes in UHR individuals allow for a potential opportunity to identify vulnerability markers of risk for psychosis. The present study assessed 15 UHR individuals (aged 16-21) at an initial time point using diffusion tensor imaging to evaluate white matter integrity in the uncinate fasciculus (a tract implicated in schizophrenia and social behavior). These 15 UHR youth were then assessed 12 months later for social anhedonia.
This is the first study in UHR youth to utilize multiple levels of analysis to determine whether uncinate integrity can be a viable predictor of social anhedonia and risk for psychosis. Controlling for age, uncinate FA values were significantly predictive of social anhedonia 12 months later (F=3.06, p=.004). Specifically, lower FA values corresponded to increased anhedonia. Results show that lower white matter integrity in the uncinate may be a biomarker for social anhedoina in UHR youth and provide an additional means of identifying risk for psychosis. These findings are consistent with the larger brain development literature, which highlights deficient myelination as a feature of psychosis risk. Study results also provide further insight into the developmental trajectory of schizophrenia, suggesting a link between fiber integrity in the uncinate fasciculus and social functioning.

# D-27

Α CEREBELLAR ROLE IN ANXIETY VULNERABILITY: INDIVIDUAL DIFFERENCES IN FUNCTIONAL CONNECTIVITY WITH EXECUTIVE **CONTROL NETWORKS** Meghan D. Caulfield - Stress & Motivated Behavior Institute Rutgers Graduate School of Biomedical Sciences, Newark, NJ. ; J. Devin McAuley - 1) Stress & Motivated Behavior Institute Department of Psychology, Michigan State University; David C. Zhu -Department of Psychology, Michigan State University Department of Radiology, Michigan State University; Richard I. Servatius - Stress & Motivated Behavior Institute-Behavioral inhibition (BI) is a risk factor linked to the development of anxiety disorders that is typified by extreme withdrawal when facing novel social and nonsocial challenges. Previous research has revealed that individuals scoring high on measures of anxiety vulnerability show faster acquisition of cerebellardependent learning tasks, such as eyeblink classical conditioning. Here, we assess individual differences of cerebellar reactivity to stimuli and connectivity with executive control networks using functional magnetic resonance imaging (fMRI). Twenty-six college students (M = 20.7 years of age, 27% male) were separated into high and low scoring groups based on responses on the Adult Measure of Behavioural Inhibition (AMBI). Participants were familiarized to 96 faces and scenes on day one and then underwent fMRI on day two while making 'old' vs. 'new' recognition judgments about familiarized and novel faces and scenes. A 7-minute resting state scan followed the task-based functional imaging. For the resting state analysis, spherical seed regions with radii of 6mm were placed at the left and right dorsolateral prefrontal cortex (DLPFC) for each participant. Between-group t-tests showed significantly stronger structural connections of the right cerebellum Crus I with the right DLPFC for the high AMBI group compared to the low AMBI group, (p<.005). The right cerebellum Crus I region was then used as a region of interest to extract percent signal change for each of the stimulus categories (familiar face, familiar scene, novel

face, novel scene) for each participant. A 2 (face/scene) x 2 (familiar/novel) x 2 (high AMBI/low AMBI) mixed measures ANOVA indicates a main effect of familiar stimuli, p<.05, as well as a trend for increased reactivity of the high AMBI group to novel stimuli, especially novel faces. Combined, these findings suggest a promising role for the cerebellum as a neural substrate underlying risk for anxiety. Supported by the SMBI, GSBS Foundation of Research Scholars, and Michigan State University Psychology.

# D-28

BOLD ACTIVITY IN RESPONSE TO EMOTIONAL DOMINANCE RELATED TO A MEASURE OF PSYCHOPATHY IN HEALTHY CONTROLS Matthew Jerram, Ph.D., Suffolk University; Alyson Negreira, M.A., Suffolk University; David Gansler, Ph.D., Suffolk University -Emotion is a dimensional construct, comprised of valence, arousal, and dominance. Emotional dominance is understood as the sense of agency one has in response to an emotional stimulus- the best exemplar is the contrast of anger (high dominance) and fear (low dominance). In terms of understanding psychopathy, an understanding of emotional dominance is necessary as abnormally high levels of emotional dominance are a likely correlate of psychopathic behavior. The most widely used model of psychopathy postulates that psychopathic behavior is either a function of primary psychopathy, characterized by callousness and instrumental aggression, or secondary psychopathy, characterized by emotion dysregulation and While most neuroimaging studies of impulsivity. emotion have primarily studied the neural correlates of valence and arousal, recent work in our lab has demonstrated regions associated with the processing of emotional dominance. These areas include the insula, visual association cortex, premotor area, and fusiform gyrus for high levels of perceived dominance and the precuneus for low levels of perceived dominance. In the current study, it was hypothesized that brain activity in a high perceived dominance condition would be positively correlated with a measure of primary psychopathy. Seventeen male participants viewed images from the International Affective Picture System (IAPS); two conditions were created using IAPS normative ratings: high emotional dominance and low emotional dominance (both with low valence). Participants passively viewed the stimuli in a block design while undergoing functional MRI. fMRI data were analyzed using the standard SPM8 processing stream and contrasts for high>low dominance and low>high dominance were created. Analysis of these contrasts identified clusters of significant activity in the regions mentioned above. Participants also completed several self-report measures outside the scanner, including the Self-Report Psychopathy Scale (SRPS). The SRPS provides two scales - a primary psychopathy scale (PPS) and secondary psychopathy scale (SPS). Signal change values were extracted from significant clusters of the high>low and low>high contrasts using the Rex toolbox and these values were correlated with PPS and SPS scores. As expected, PPS correlated moderately to strongly with activity in the left insula (L Ins: r = 0.58), while SPS scores were weakly correlated (L Ins: r = 0.08).

This pattern was also present in right insula, the premotor cortex, and visual association cortex, though the correlations were weaker, but was not observed in the fusiform gyrus. Of interest, the precuneus, which was the only active region for the low>high contrast, correlated moderately with both the PPS (r = -0.39) and SPS (r = -0.25). The results indicate that emotional dominance plays a role in the normal variance of psychopathic traits in the population and is relevant to understanding the neural correlates of psychopathy

#### D-29

AUTISM SPECTRUM DISORDER, BUT NOT AMYGDALA LESIONS, **IMPAIRS** SOCIAL ATTENTION IN VISUAL SEARCH Shuo Wang1, Juan Xu2, Qi Zhao2, and Ralph Adolphs1,3; Computation and Neural Systems, California Institute of Technology, Pasadena, CA, USA ; Department of Electrical and Computer Engineering, National University of Singapore, Singapore.; Humanities and Social Sciences, California Institute of Technology, Pasadena, CA, USA; - People with autism spectrum disorder (ASD) have pervasive impairments in social interactions, a diagnostic component that may have its roots in atypical social motivation and attention (Chevallier et al. 2012). Although there is evidence for global dysfunction in autism at the level of the whole brain, several studies emphasize abnormalities in the amygdala. To further characterize the impairment of people with autism in processing socially relevant information and to elucidate the possible role of the amygdala, we employed a visual search task with both social (faces and people with different postures, emotions, ages, and genders) and non-social targets (e.g., electronics, food, utensils), which participants were asked to find in an array of 24 objects. We defined targetrelevant effects as the difference in the percentage of fixations that fell on target-congruent versus targetincongruent objects in the array. In Experiment 1, we tested 10 high-functioning autism subjects, 3 patients with focal bilateral amygdala lesions, and 19 controls. Controls rapidly oriented to target-congruent objects and showed a strong and sustained preference for fixating them. Strikingly, people with autism oriented significantly more slowly to target-congruent objects, an effect driven primarily by reduced orientation towards social objects. By contrast, patients with amygdala lesions performed indistinguishably from controls. In Experiment 2, we recruited a different sample of 16 people with autism and 8 autism-matched controls, and tested them on the same search arrays but all stimuli equated for low-level saliency (Itti-Koch saliency, size, distance to center). The results replicated Experiment 1 and we still found impaired target-relevant effect in the autism group. In Experiment 3, we recruited 17 people with autism, 8 autism-matched controls, 3 amygdala lesion patients and another group of 11 controls and tested them on a simpler array with only

12 array objects. We did not observe reduced target relevant effect in autism anymore and all four subject groups showed similar target-relevant effects. These findings argue that the attentional deficit in autism is specific to social stimuli, cannot be explained by low-level visual properties of the stimuli, and only emerges with high task demands. Furthermore, this deficit appears to be independent of the amygdala. Supported by grants from NSF, the Pfeiffer Family Foundation, the Simons Foundation, and NIMH Conte Center, and Singapore MoE AcRF Tier 1.

#### D-30

ANXIETY VULNERABLE INDIVIDUALS EXHIBIT ENHANCED ACOUISITION OF CONDITIONED **EYEBLINKS:** SUPPORT FOR A LEARNING DIATHESIS MODEL OF ANXIETY DISORDERS Todd Allen, University of Northern Colorado; Stress and Motivated Behavior Institute; Jacqueline Holloway, Stress and Motivated Behavior Institute; Catherine E. Myers, Stress and Motivated Behavior Institute, Dept. of Veterans Affairs, New Jersey Hlth. Care Syst.; Richard J. Servatius, Stress and Motivated Behavior Institute, Dept. of Veterans Affairs, New Jersey Hlth. Care *Syst.*- The manner in which individuals acquire predictive relationships and express avoidance may represent a diathesis for anxiety disorders like post traumatic stress disorder (PTSD). We tested this theory with individuals self-reporting behavioral inhibition (BI), which has been proposed as a risk factor for the development of anxiety disorders (Fincham et al. 2008; Hirshfeld et al. 1992; Kashdan et al. 2009). Two hundred and twenty nine undergraduates completed the Adult and Retrospective Measures of Behavioural Inhibition (AMBI and RMBI, Gladstone & Parker, 2005) and received 3 US alone trials, 60 acquisition trials, and 20 CS-alone extinction trials presented in one session. Conditioning stimuli were a 500 ms tone conditioned stimulus (CS) and a 50-ms air puff unconditional stimulus (US). Participants were randomly assigned to receive delay, omission, or voked training. Delay training consisted of paired presentations of a CS tone and co-terminating US air puff. Omission training included the imposition of an omission contingency in which the presence of a conditioned response (CR) during the CS prevented US delivery. Yoked training consisted of an identical schedule of CS and US delivery as the group with the omission contingency, but CR presence did not affect US delivery. For yoked training, subjects were matched on total AMBI and RMBI scores to a corresponding omission subject. There were no differences in UR amplitude between the high and low BI Anxiety vulnerable individuals exhibited groups. facilitated acquisition as compared to non-vulnerable individuals. This facilitation was greatest in the omission and yoked condition. There were no significant differences in extinction between the three groups. Comparisons of omission and yoked individuals did not reveal avoidance learning but were consistent with a partial reinforcement effect. We then tested the effects of explicitly partial reinforcement schedules in which half of

the acquisition trials were CS-US paired trials and half of the trials were either CS alone or US alone trials. Anxiety vulnerable individuals exhibited facilitated acquisition as compared to non-vulnerable individuals in both partial reinforcement protocols. CS alone partial reinforcement produced a partial reinforcement extinction effect (i.e., PREE) but only in the anxiety vulnerable individuals. To test the possibility of the partial reinforcement effects being due to the increased time between paired CS-US trials, we inter-mixed blank trials with no stimuli between the CS-US paired trials is the same trail pattern as the partial reinforcement schedules. Only high AMBI individuals exhibited facilitated learning to the spaced trials with a variable inter-trial interval ranging from 25 to 123 s. Overall, enhanced sensitivity to forming stimulus associations in anxiety vulnerable individuals is most evident when the predictive relationship between the CS and US is less than optimal such as in the case of omission/yoked and partial reinforcement schedules. Also, classic learning phenomena like PREE and the spacing effect were only evident in anxiety vulnerable individuals. These findings support a learning diathesis model for anxiety disorders in which anxiety vulnerable individuals learn associations more rapidly especially when there is some uncertainty about trial type and trial timing.

# D-31

**STUDIES** NICOTINE NEUROIMAGING OF ADDICTION AND APPROACH BEHAVIORS Vlad B. Papa, Kevin E. Ruprecht, Laura E. Martin; University of Kansas Medical Center - Tobacco use is one of the top preventable causes of death in the United States, with about 20 percent of the US population currently smoking. Previous studies demonstrate that smokers are more impulsive compared to nonsmokers. Impulsivity is a multidimensional personality characteristic associated with increased reward sensitivity and increased approach behaviors. One way to look at approach behaviors is through the Behavioral Activation Scales (BAS) fun seeking sub-scale, because fun seeking measures spontaneous approach of potential rewards, and a desire for new rewards (Carver and White 1998). The current study used functional magnetic resonance imaging (fMRI) to examine associations between approach behaviors and the neural systems of reward during passive viewing of smoking images. Participants (n=28) were scanned while viewing images of smoking and nonsmoking cues, at least 4 hours following their last cigarette. Brain data was correlated with approach behaviors measured by the Behavioral Activation Scales (BAS; Carver and White, 1998). The medial prefrontal cortex (MPFC), bilateral insula and lateral PFC showed increased activation to smoking images as BAS Fun-Seeking scores decreased. A possible explanation for this may be that as the inclination to seek out new rewards is increasing, the response to smoking images is decreasing because the images are not rewarding enough. Overall, these results provide more insight as to the motivations people have for smoking, and may have implications for the development of future health interventions. For example, some smoking cessation programs encourage individuals to engage in

rewarding activities that are incompatible with smoking. However, if other activities do not provide a reward to some smokers, these types of programs may be less effective than others, such as pharmacotherapy. But by determining the fun seeking levels of smokers attempting to quit, smoking cessation programs can be tailor made for each individual.

# D-32

ASSOCIATIONS BETWEEN COPING STRATEGIES AND ANXIETY: NEURAL MECHANISMS OF **EMOTION REGULATION** Hannah C. Bianco, Pilyoung Kim; Gary Evans; L. Phan; I. Liberzon; J. Swain; University of Denver; Cornell University; University of Illinois at Chicago; University of Michigan - Introduction: A major component of cognitive-behavioral therapy interventions aimed at the treatment of anxiety is the acquisition and use of adaptive coping strategies. While adaptive coping strategies, such as active coping, are consistently related to reductions in anxiety, maladaptive coping strategies, such as behavioral disengagement, are related to increases in anxiety. Active coping involves effortful attempts to change a situation or remove a stressor by taking direct action to address the problem. Behavioral disengagement is characterized by a decrease in effort or even a giving up of attempts to change a problematic situation. Both of these coping strategies reflect cognitive engagement with or disengagement from the stressor or situation. However, little is known about the neural mechanisms involved in such differential coping strategies. The ventrolateral prefrontal cortex (PFC) and anterior cingulate cortex (ACC) are involved in cognitive down regulation of negative emotions and in turn may underlie behavioral coping strategies. Using neuroimaging and self-report data, the current study examines the associations between use of adaptive (i.e. active coping) and maladaptive (i.e. behavioral disengagement) coping strategies, neural functioning involved in emotion regulation, and trait anxiety in young adults. Methods: Self-report of trait anxiety (State-Trait Anxiety Inventory; Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983) and use of coping strategies (COPE inventory; Carver, Scheier, & Weintraub, 1989) as well as neuroimaging data were collected from a total of 48 participants (22 female, age M = 23.60, SD = 1.32). fMRI scanning took place in a 3.0 Tesla Philips magnet scanner. Neural activity was recorded while participants engaged in an emotion regulation fMRI paradigm. During the Reappraisal condition, participants effortfully decreased the intensity of their negative affect in response to aversive images by using the cognitive strategy of reappraisal. During the Maintain condition participants naturally experienced their emotional state in reaction to aversive images. The contrast of Reappraisal and Maintain conditions was used to represent neural functioning while engaging in emotion regulation. Results: In the behavioral analyses, the use of active coping was significantly correlated with lower anxiety, r(46) = -.336, p = .019 and the use of

behavioral disengagement coping was significantly correlated with higher anxiety, r(46) = 458, p = .01. In the fMRI analyses, active coping was associated with activity in the left medial PFC/ACC, p < .005, uncorrected, voxel > 20. Behavioral disengagement coping was negatively associated with activity in the dorsal ACC and bilateral ventrolateral PFC/inferior frontal gyrus, p < .005, uncorrected, voxel > 20. Conclusions: The results suggest that activity of the PFC and ACC during emotion regulation is associated with more use of adaptive coping strategies and less use of maladaptive coping strategies for regulating anxiety. The understanding of such neural mechanisms may help to inform future practice by identifying individuals who may benefit most from psychotherapeutic interventions aimed at enhancing coping ability to reduce anxiety.

# D-33

CORTICAL AND SUBCORTICAL CONTRIBUTIONS TO DECODING EMOTIONAL SIGNALS: EVIDENCE FROM CORTICOBASAL **SYNDROME** AND ALZHEIMER'S DISEASE Fiona Kumfor (1,2,3), Laurie-Anne Sapey-Triomphe (1), Cristian Leyton (1,2,3), John R. Hodges (1,2,3) & Olivier Piguet (1,2,3); 1 Neuroscience Research Australia, Sydney, Australia; 2 School of Medical Sciences, the University of New South Wales, Sydney, Australia; 3 ARC Centre of Excellence in Cognition and its Disorders, the University of New South Wales, Sydney, Australia - Background: The ability to decipher cues from static and dynamic facial expressions requires a complex set of skills including basic visuoperception, face perception, emotion detection and evaluation of higherlevel social cues. Although functional imaging will identify the regions that activate during a given task, it cannot determine which of these regions are necessary for its successful completion. Clinical investigations, in contrast, provide a complementary model within which to study the neurobiological substrates of complex human behaviours. Corticobasal syndrome (CBS) is an atypical Parkinsonian presentation characterised by changes in motor functioning, cognition and behaviour. CBS is associated with changes in a network of brain regions, such as the frontoparietal cortices and the basal ganglia, regions which are posited to be involved in emotional functioning. Anecdotal evidence indicates the presence of emotional processing disturbance in CBS. Emotional functioning, however, has not been comprehensively studied in this syndrome to date. The aims of this study were twofold: first, to establish the pattern and severity of emotion processing disturbance in CBS, and second, to determine the role of cortical and subcortical regions in face and emotion processing by comparing CBS with Alzheimer's disease, a dementia in which the medial temporal lobes and posterior cingulate are the earliest regions affected, and changes in emotional functioning are relatively mild. Methods: Sixteen CBS, 18 Alzheimer's disease and 22 controls were assessed on a comprehensive battery of in-house face and emotion processing tasks, the Ekman 60, and the Awareness of Social Inference Test (TASIT). All participants underwent high-resolution structural brain magnetic resonance imaging. Results: CBS patients were impaired on tasks of basic facial

perception and higher-level emotion processing. Importantly, performance remained impaired even after covarying for their face perception deficits. In contrast, the Alzheimer's disease group showed only mild impairments on the higher-level emotion processing tasks (Ekman 60, TASIT). Neuroimaging analyses using Freesurfer revealed that cortical thinning in the occipital lobe, fusiform face area and ventral visual stream was associated with basic face processing, whereas performance on emotion processing tasks was associated with cortical thinning in the anterior cingulate, insula and superior frontal cortex in all patients combined. Correlations between behavioural performance and subcortical volumes revealed distinct associations according to patient group. Impaired performance was associated with volume loss in the basal ganglia in CBS, whereas hippocampal, amygdala and nucleus accumbens atrophy was implicated in Alzheimer's disease. Conclusions: These results are the first to demonstrate widespread deficits in emotion processing in CBS, which are related to neuronal atrophy in cortical and subcortical regions involved in emotion decoding and emotional responding. The results provide a potential mechanism for the evolution of the psychiatric and behavioural symptoms reported in this syndrome. Importantly, these results also offer new insights into the network of cortical and subcortical regions involved in the complex ability of decoding emotional expressions.

# D-34

NEURAL INDICATORS OF INCREASED EMPATHIC **CONCERN IN ANTISOCIAL INDIVIDUALS** Nathan L. Arbuckle, University of Ontario Institute of Technology; Matthew S. Shane, University of Ontario Institute of Technology - Antisociality implies a reduced concern for others - and indeed, reduced empathy has been consistently linked to increased antisociality. For example, antisocial individuals, such as those high in psychopathic traits, violent offenders, and parents who abuse children, are characterized by limited empathic concern. This limited empathic concern has been reflected in the differential neural reactivity of antisocial individuals to images of others in pain. That is, there is a general tendency for people to display increased activity in the anterior cingulate cortex (ACC) and insula when viewing others in pain, but antisocial individuals fail to demonstrate this pattern of responding. Limited empathy for others could be due to either a lack of ability to care about others, or a lack of motivation to do so. In two studies, we examined whether antisocial individuals possess the emotional capabilities to allow for an empathic response. This was done using a directed emotion regulation paradigm, asking antisocial participants to modify their reactions to images of others in pain. All participants were recruited through New Mexico probation/parole. We found that although these participants showed little neural activity to images of others in pain during passive viewing, they showed increased neural activity in the ACC and insula to images of others in pain when they were directed to increase their concern for the person in pain. Further, the most severely antisocial individuals, those high in psychopathic traits,

were just as likely to show increased neural activity as those low in psychopathic traits. Together, these studies suggest that antisocial individuals are capable of controlling their empathic responses, and raise the question of why they fail to display empathy under normal circumstances.

#### D-35

**TESTOSTERONE ADMINISTRATION ALLEVIATES** SUBMISSIVE GAZE AVOIDANCE IN SOCIAL ANXIETY Dorien Enter, Radboud University Nijmegen, Leiden University; David Terburg, Utrecht University, University of Cape Town; Anita Harrewijn, Leiden University; Philip Spinhoven, Leiden University; Karin Roelofs, Radboud University Nijmegen, Donders Centre for Cognitive NeuroImaging- I Social anxiety may be based on a ubiquitous social hierarchy system, with patients showing an extreme form of social submissive behavior. Social anxiety disorder is associated with reduced endogenous testosterone levels and typical submissive behavior such as gaze avoidance in social encounters. Administration of testosterone has dominance-enhancing and socialanxiolytic effects, and has shown to enhance social dominant gaze behavior in healthy participants. Because avoidance behavior is the major maintaining factor in social anxiety disorder, it is relevant to test whether administration of testosterone can alleviate gaze avoidance from angry faces. In a double-blind, withinsubject design, medication-free high socially anxious and healthy control participants received a single dose of 0.5mg testosterone and a matched placebo, at two separate days. On both days, their gaze behavior was recorded while they looked at angry, happy, and neutral facial expressions. In high socially anxious subjects testosterone reduced submissive gaze avoidance as indicated by an increase in first fixations to the eve region of angry faces. In contrast, in healthy controls testosterone diminished first fixations to the eye-region in a nonemotion-specific manner. These results suggest that although testosterone generally decreases social behavior in healthy participants, it promotes dominant gaze behavior, i.e. eye-contact with angry faces, in high socially anxious individuals. The findings support previous notions that the effects of testosterone on dominance seeking behavior are context dependent and may have implications for treatment studies aiming to boost therapy efficacy in social anxiety disorder.

# D-36

DECREASED RESPONSE IN EMOTION AND EXECUTIVE NETWORKS IN ADOLESCENTS SUFFERING FROM EMOTIONAL, ATTENTIONAL, AND BEHAVIORAL DISORDERS Andrea T. Shafer 1, Anthony Singhal 1,2, Vivian Chan 2, Jessica Van Vliet 3, Sunita Vohra 4, Lihong Wang 5, & Florin Dolcos 2,6; 1 Centre for Neuroscience, University of Alberta; 2 Department of Psychology, University of Alberta; 3 Department of Educational Psychology, University of Alberta; 5 Department of Psychiatry, Duke University; 6 Department of Psychology, Neuroscience Program, and Beckman Institute, University of Illinois at Urbana-Champaign - Understanding alterations in

emotion-cognition interactions associated with psychopathology in youth is of paramount importance, as psychopathologies with a childhood onset are associated with a high incidence of relapse and heightened resistance to therapy, along with other long-term health problems. Emotion processing (EP) and attentional control (AC) are sub-served by two separate, but integrated neural networks, with EP being associated with more ventral structures (e.g. amygdala-AMY, ventrolateral prefrontal cortex-vlPFC) and AC with more dorsal structures (e.g. dorsolateral prefrontal cortex-dlPFC, lateral parietal cortex-LPC). Notably, AC is involved in both goalrelevant processing and inhibition of emotional distraction. While EP and AC have been investigated separately in healthy youth and clinical adults, little is known about EP and AC in clinical youth suffering from emotional, attentional, and behavioral disorders. Abundant behavioral evidence points to problems in this population with emotion regulation and attentional impulsivity, but the neural correlates underlying these maladaptive alterations in EP and AC remain unclear. The present study investigated this issue in a group of 35 clinical adolescents (CA group) and a group of 18 healthy controls (HC group), using an emotional oddball task with infrequent task-irrelevant distracters [negative (fearful and sad), neutral images] and task-relevant targets presented amongst frequent phase-scrambled images, while fMRI data were recorded. Importantly, this task allows for the assessment of emotion processing, goal-oriented/attentional control processing, and the interaction between them. Preliminary analysis of behavioral and brain imaging showed altered emotion and executive functioning in the CA compared to the HC group. First, behavioral data showed that CA subjects perceived the negative images as less negative than the controls. Paralleling the behavioral data, brain imaging data showed less activation throughout the emotion network (in AMY, vlPFC, temporal-occipital cortex -TOC) for the CA group, but this dampening of activity was specific only to the fearful stimuli. Second, the CA participants had increased errors in target detection compared to controls, and this impairment was associated with decreased activation in the cingulate gyrus and temporal-parietal junction during target processing. Lastly, behavioral data points to differences between CAs and controls in how the emotion and executive networks interact. Individual variance in reaction time to targets was found to differ as a function of the preceding type of emotional distracter and group. Specifically, the CA group had greater individual reaction time variance for targets following fear compared to controls and had greater variance for targets that followed neutral images compared to targets following other targets, whereas the HC subjects had decreased reaction time variance for targets following fear compared to targets following other targets. Taken together, these data provide clinically important and novel evidence of alterations in the neural mechanisms underlying emotion and executive processing in youth with psychopathologies. These findings will also be discussed in the context of results from analyses of brain imaging data investigating variability in the BOLD response linked to the differences in variance seen in the reaction time data.

#### D-37

PROBABILISTIC LEARNING: A SCENARIO WHEN ADULTS INFLUENCE ADOLESCENT BEHAVIOR MORE THAN PEERS Frederico Lourenco\*, Catherine Hartley\*, Johannes Decker, Andrew Drysdale, BJ Casey; Sackler Institute for Developmental Psychobiology, Weill Cornell Medical College, New York, NY; \*Authors contributed equally to this study - We all learn from trial-and-error which actions are likely to be rewarded, a process commonly modeled using error-driven reinforcementlearning algorithms. While experiential learning is critical for adaptive function, exclusive reliance upon one's experience would be inefficient and potentially dangerous. We also depend upon the instructions or advice of others to guide our actions. When explicit information about action outcomes is available, trial-anderror learning may be de-prioritized, likely reflecting prefrontal cortical modulation of striatal-dependent experiential learning. During adolescence, peer influence is thought to contribute to suboptimal decision-making and increased risky behavior. Thus, we wondered whether the social source of instructions might modulate the effect of explicit information on experiential learning. To test this, we assessed how instructions given by a similarly-aged peer and an older adult influence experiential learning and bias choices during a probabilistic learning task. Participants saw four stimuli pairs: one pair consisted of a stimulus that would yield a reward in 80% of trials versus another that was rewarded the remaining 20% of trials. The other three pairs had similarly skewed reward contingencies (70% versus 30%), however for two of these pairs, a peer and an older advisor, introduced as previous study participants, each incorrectly recommended one of the lesser rewarded stimuli as having a high reward probability. During the training phase, participants received choice feedback, and thus could potentially learn through experience that the advice was inaccurate. In a subsequent test phase, all possible pair combinations were presented and participants received no feedback. This test phase enabled us to gauge the degree to which individuals learned the stimuli reward value, or whether inaccurate instructions impeded experiential value learning. We hypothesized that adults, with stronger PFC-striatal connectivity, would be more influenced by instruction (perform more poorly) than adolescents whereas adolescents might have an upper-hand by relying more on subcortically-driven experiential learning. Moreover, we hypothesized that adolescents would show a stronger effect of peer advice versus older adult advice on their choices. During the test phase, choices in both age groups revealed a small instruction-consistent bias. Surprisingly, whereas the inaccurate advice from an older adult "expert" significantly reduced choice accuracy in both age groups, the peer advice showed no effect. These data suggest that peer influence in adolescence may be diminished in the absence of a socially charged context. In fact, both adolescents and adults appeared to be more influenced by advice provided by an older adult, suggesting both groups found those instructions to be more credible. In sum, we show evidence that peer influence upon behavioral choices is context dependent. When extrinsic non-social rewards are at stake, teens appear to be just as influenced as adults by the advice of an older adult, even when this advice is contradicted by their own experience.

#### D-38

INCREASED FEELINGS OF DOCTOR-PATIENT SIMILARITY PREDICT REDUCED PAIN RATING DURING SIMULATED CLINICAL INTERACTIONS Elizabeth Reynolds Losin, Luke J. Chang, Tor D. Wager; University of Colorado, Boulder - Individuals from ethnic minorities are most often treated by doctors of an ethnicity different from their own. This ethnic discordance has been linked to lower patient satisfaction and is thought to be mediated in part by reduced feelings of personal belief similarity between ethnically discordant patients and doctors. Here we tested whether feelings of similarity between doctors and patients (independent of ethnicity) influenced pain perception during medical care. A mixed-ethnicity group of 80 participants (4 per session) was divided into two groups based on the similarity of their self-reported political, religious, and gender beliefs, and randomly assigned to the role of doctor or patient. Each participant took part in two simulated clinical interactions--one with an ingroup member and one with an outgroup member--in which patients rated pain from noxious thermal stimulation delivered by the doctor. We found that patients reported feeling more similar to ingroup doctors than outgroup doctors, and that the more similar to their doctors the patients felt, the less pain they reported. These findings suggest that interventions aimed at increasing patients' feelings of similarity to their doctors may decrease patient pain during medical care regardless of ethnic concordance. Such interventions may help mitigate the negative impact of the high prevalence of ethnically discordant doctors on minority populations.

# D-39

DISSOCIATED EFFECTS OF TEMPORAL AND PREFRONTAL LESIONS ON IMPLICIT BIAS CHANGE Jennifer T. Kubota (1), Rachel Mojdehbakhsh (1), Jessica Dalymple (1), Karen Blackmon (1), Mahzarin R. Banaji (2), & Elizabeth A. Phelps (1); (1) New York University, (2) Harvard University - Previous research finds that exposure to counterstereotypes decreases implicit racial bias. This is thought to occur either by forming new salient counterstereotypic associations, by increasing executive control over implicit associations, or some combination of the two factors. Research on race processing implicates the prefrontal cortex (PFC) in the regulation of implicit racial bias. To assess the role of the PFC in implicit racial bias and diminishing implicit racial bias via exposure to counterstereotypes, patients with PFC lesions and temporal lesions completed an implicit association test (IAT), measuring the degree of association between Black and White faces and pleasant and unpleasant words. Following the IAT, patients read a counterstereotypic story about a White assailant and a Black rescuer and then again, immediately following, completed the IAT. Although patients with temporal lesions had significant implicit bias on the initial IAT, patients with PFC lesions had even greater implicit bias. Patients with PFC lesions had greater implicit bias than control participants. Following the counterstereoytpic story, patients with PFC lesions and control participants had significantly reduced and eliminated implicit bias whereas patients with temporal lesions implicit bias did not differ from the first IAT to the second. Additionally, a subset of patients with PFC lesions read a control story. Implicit bias pre versus post the control story did not differ for these patients. These results indicate that the temporal lobe and PFC are not critical for implicit race bias, but implicit bias increases when the PFC is impaired. Patients with PFC lesions and control participants can overcome implicit bias via exposure to counterstereotypes. Moreover, decreases in implicit bias after exposure to counterstereotypes relies in part on an intact temporal lobe, suggesting that malleability of implicit bias after exposure to counterstereotypes may occur because of the formation of new salient counterstereotypic associations.

# D-40

CAN SOCIAL CATEGORIES BE MANIPULATED? EXPLORING THE IN-GROUP BIAS IN FACIAL RECOGNITION USING A MINIMAL GROUP **PROCEDURE** Maia T. Nguyen\* and Lucy J. Troup\*; \*Department of Psychology, Colorado State University; -Social categorization has been found to influence intergroup behavior, especially in the realm of facial recognition. Participants asked to view faces grouped by own university affiliation demonstrated greater recognition performance for individuals associated with their own university, regardless of the race of the face presented. In other words, the own-race bias, or the superior recognition of faces of one's own race, was effectively suppressed for faces that were labeled as being affiliated with one's own university. This suggests that social categorization-university ties in this case-is a driving factor in recognition accuracy. Minimal group procedures have also been used as manipulations of social categorization to create experimentally-induced social ties. Several techniques have been used to separate individuals into 'minimal groups' and induce the experience of group membership, such as faux personality guizzes and art ratings. Individuals that have been categorized as either 'red' or 'green' based on artificial tests have demonstrated a bias toward their ingroup members, based on facial recognition scores. The act of studying names related to one's in-group is a robust method of inducing minimal group categorization. This study examined the effect of social categorization, using a minimal group procedure, on facial recognition. Participants were randomly assigned to an experimental group, reading a list of names associated with their group (red or green), or a control group, who did not read a list of names and were not assigned to a group. This was followed by a study phase in which participants studied 16 female and 16 male Caucasian faces. A final recognition test was then conducted during which participants were presented with 64 faces. Of these faces, half were old and half were new; the old faces were different photos of the same individuals seen in the study phase. There were also an equal number of male and female faces as well as in-group and out-group faces. Results suggest evidence for a social-cognitive model of facial recognition with an emphasis on the effects of social categorization.

# D-41

CULTURAL IDENTITY SHAPES NEURAL **REACTIVITY TO PROSOCIAL DECISIONS** Nicholas T. Ichien, Yang Qu, Eva H. Telzer; University of Illinois at Urbana-Champaign - Intergroup biases have a pervasive impact on social perception and decision making; people tend to show preference toward members of their own social group (i.e. ingroup members) and occasional derogation toward members not in their social group (i.e. outgroup members). One specific case of this tendency manifests through prosocial decision making as people are more willing to share more resources with ingroup members than with outgroup members. An effective means of promoting group cohesion and prosperity, this bias may serve an evolutionary adaptation; the more cohesive and prosperous a social group is, the more likely its members are to receive valuable social and physical support and benefit from increased survival rates. The mechanisms by which individuals choose to be more prosocial towards ingroup members are unknown. Functional MRI research has identified several brain regions involved in prosocial behavior. In particular, the ventral striatum, a brain region involved in reward processing, tends to be as active or even more active during prosocial rewards than personal rewards, suggesting that helping others is intrinsically rewarding. Additionally, brain regions involved in mentalizing (e.g., dorsomedial prefrontal cortex) are more active when making prosocial decisions, suggesting that taking another's perspective facilitates prosocial behavior. Building upon prior neuroimaging work, we sought to examine whether cultural group membership affects neural processing during prosocial decisions to in- and out-group members. Twenty-six participants (13 American-born and 13 Chinese-born) completed a decision-making task adapted from Zaki and Mitchell (2011) during a functional brain scan. Prior to the scan, participants interacted with two confederates who were ostensibly completing a related task. One confederate was American and the other was Chinese. To make cultural group membership salient, the participant and confederates played an icebreaker during which they answered questions about themselves (e.g., favorite band; favorite actor; favorite food). The confederates provided answers that emphasized their group membership (e.g., favorite food: American=hamburger, Chinese=lo mein). During the scan, participants were presented with a series of financial offers. During each offer, participants saw a picture of themselves and one other confederate with a financial value above each picture; they had to decide to either keep an amount of money for themselves (e.g., \$2.00) or donate a different amount of money to the confederate (e.g., \$3.00). Prosocial decisions occurred when participants donated money to a confederate at a

cost to themselves. In addition, pure rewards trials did not entail a possible donation to the confederate. All participants made decisions regarding both the American and Chinese confederates. Results indicate that prosocial decisions to donate money to ingroup members were associated with greater activity in the ventral striatum and DMPFC than decisions to donate to outgroup members. Importantly, prosocial decisions toward ingroup members activated the ventral striatum more so than when receiving pure monetary rewards. Thus, helping members of one's own group is fundamentally rewarding and may facilitate cohesion and support of the ingroup. While prior research has found similar effects when helping one's own kin, these findings extend to one's broader cultural group.

#### D-42

THE EFFECT OF RACE & RACE BIAS ON MOTOR **IMITATION** Troy C. Dildine, University of Colorado, Boulder; Catherine J. Norris, Swarthmore College - Previous research has shown that imitation promotes social behaviors (Chartrand & Bargh, 1999; van Baaren, Holland, Kawakami, & van Knippenberg, 2004) and is increased toward ingroup members (Yabar, Johnston, Miles, & Peace, 2006). The current study sought to examine whether White individuals exhibit decreased imitation of Black targets using a basic motor imitation task (Bertenthal, Longo, & Kosobud, 2006). While event related brain potentials (ERPs) were collected, White participants viewed Black and White hands and made button presses in response to either an observed finger movement (finger cue) or to the appearance of a symbol (symbolic cue). Some trials included both cues to examine whether finger movements facilitated (when congruent with symbolic cues) or interfered (when incongruent) with responses, a pattern consistent with automatic motor imitation. Reaction times indicated that White participants exhibited greater automatic motor imitation to White targets than to Black targets, as evidenced by greater facilitation for congruent cues and greater interference for incongruent cues. Furthermore, Black targets elicited larger N1 and P2 amplitudes as compared to White targets, indicating greater attentional resources were deployed toward outgroup stimuli. Implications for empathy and intergroup interactions are discussed. Keywords: imitation, facilitation, interference, ingroup, outgroup, N1, P2

#### D-43

**STEREOTYPE THREAT AFFECTS WOMEN'S PERFORMANCE ON ATTENTIONAL BLINK TASK** *Kelly A. Jordan; Adam Magerman; Eric Splan; Chad E. Forbes; Psychology Department of University of Delaware -* There is little doubt that despite dramatic advancements in racial and gender equality over the past 30 years, stigmatized minorities and women still face an uphill battle when they progress into the upper echelon of academia and math related domains respectively. Past research indicates that the negative stereotypes that target these groups have particularly pervasive, detrimental effects on minorities' and women's performance on high stakes tests like the SAT and GRE, and possibly class tests in general. Repeated exposure to situations that contribute to underperformance, termed stereotype threat, may ultimately undermine the extent to which minorities and women identify and remain engaged with the academic or math and science related (STEM) domains respectively. Prior research has demonstrated reduced performance by women under stereotype threat, in that, they underperform on math tasks compared to men and women who are not under stereotype threat. It is unknown what the cognitive mechanisms behind these findings are, one theory is that STEM related stimuli (i.e. math problems) are threatening and holds attention thus placing the women under cognitive load which in turn affects their performance. The present research examined the effects of stereotype threat on attention directly, by employing an attentional blink (AB) paradigm that utilized threatening (STEM related pictures with males in them) and non-threatening stimuli (non-STEM academic pictures with females in them). Participants were White males and females. In study 1, we initially measured participant's implicit math attitudes, all participants were then placed under stereotype threat and performed the AB task, a filler math task, manipulation check, attitudes of self-enhancement, math-enhancement, and selfcompassion were measured (the questionnaires were counterbalanced across participants). Results of study 1 provided partial support for our hypothesis in that, women were less likely to report the stimuli at time point 2 (a nature scene) as visible following threatening stimuli at time point 1 then men. There was a marginal relationship between the individual difference between self-enhancement and performance on the attentional blink task, such that those with higher self-enhancement scores performed better on the attentional blink task. ; Study 2 examined the neural correlates underlying these behaviors. Continuous EEG activity was recorded while White male and female participants completed the tasks described in study 1. Results revealed interesting interactions between brain regions important for selfperception and attention orientation. Together these findings indicate that STEM related stimuli can be considered threatening to women and affect their encoding and processing of novel information in situations of stereotype threat. This effect may be attenuated by individual differences in self-enhancement, which in moderate levels, may act as a buffer, shielding women from the negative cognitive effects of stereotype threat

# D-44

THE NEURAL BASIS OF INHIBITING IRRELEVANT STEREOTYPICAL ASSOCIATIONS IN PERSON PERCEPTION Eric Hehman, Dartmouth College; Jonathan B. Freeman, Dartmouth College - Individuals belong to numerous social groups. To effectively navigate a complex social world, previous theoretical and behavioral work has demonstrated that individuals focus on a salient social identity when perceiving others, inhibiting all other associations. However, the neural basis of how these additional identities are inhibited has been relatively unexplored. Thus, the current research focused on how irrelevant associations with a target were suppressed during person perception. Perceivers extract multiple social dimensions from another's face (e.g., race, emotion), and these dimensions can become linked due to stereotype knowledge (e.g., Black individuals, angry). Individuals who are counter to these stereotypes are frequently encountered (e.g., happy Blacks), of course. During these encounters, top-down stereotypes and bottom-up perceptions conflict, and irrelevant stereotypic associations (e.g., Black individuals, angry) must be resolved to perceive such targets accurately. Using functional magnetic resonance imaging (fMRI), the current research examined how the brain resolves these conflicts between facial cues and stereotype knowledge in person perception. Participants (n=23) passively viewed faces varying in race (e.g., Black, White) and emotion (e.g., angry, happy) while neural activity was measured using fMRI. Following scanning, participants categorized these same targets by race and emotional expression while hand movements en route to responses were recorded using real-time hand-tracking. Conceptually replicating previous research, across all participants, results revealed that the medial prefrontal cortex and anterior cingulate cortex exhibited linearly increasing responses as race and emotion became stereotypically more incongruent. Most importantly, participants who had a stronger behavioral tendency to link race and emotion stereotypically during categorization, as indexed by subtle hand-movements, demonstrated greater dorsolateral prefrontal cortex (dlPFC) activation to targets incongruent with stereotypes (all p's <.05 corrected). Because the dIPFC has been linked with the suppression of prepotent responses, these results suggest that individuals with stronger behavioral tendencies to perceive targets stereotypically exert greater neural resources to inhibit inaccurate stereotypical links in order to perceive others accurately. This research is the first to link fMRI with real-time measurement of behavioral tendencies to stereotype, and helps reveal the neural basis of how conflicting stereotypes at the nexus of multiple social dimensions are resolved.

#### D-45

**THE IMPACT OF TARGET RACE ON NEURAL RESPONSES DURING THREAT DETECTION** *Keith B. Senholzi, University of Colorado Boulder, Department of Psychology and Neuroscience; Brendan E. Depue, University of Colorado Boulder, Department of Psychology and Neuroscience, University of Colorado Boulder, The Institute of Cognitive Science; Marie T. Banich, University of Colorado Boulder, Department of Psychology and Neuroscience, University of Colorado Boulder, Department of Psychology and Neuroscience, University of Colorado Boulder, The Institute of Cognitive* 

Science; Tiffany A. Ito, University of Colorado Boulder, Department of Psychology and Neuroscience-This study examined the neural mechanisms underlying threat detection to targets of different races. During fMRI, participants determined whether Black and White individuals held weapons. Participants were faster to "shoot" armed Blacks than armed Whites, but faster to "not shoot" unarmed Whites than unarmed Blacks. Brain activity in parietal and visual cortical regions was preferentially heightened for armed Blacks than armed Whites, suggesting heightened visual attention and processing to more stereotypically threatening targets. Increased anterior cingulate cortex activation occurred for unarmed Whites than unarmed Blacks, suggesting greater response conflict and increased cognitive control was elicited by unarmed Whites. Seed-based functional connectivity of the amygdala revealed greater coherence with both parietal and visual cortices for armed Blacks vs. armed Whites than any other contrast. Furthermore, greater implicit Black-danger associations were associated with increased amygdala activation to armed Blacks, as compared to armed Whites. Our findings indicate that the neural mechanisms underlying target race differences in threat detection involving decisions to shoot and not shoot are dissociable, and further that race information and implicit biases influence how people perceive and process threat information.

#### D-46

ARE OTHER-RACE EFFECTS OF EMOTION **VIEWPOINT SENSITIVE?** Christopher D'Lauro and Juli Nokleberg; Department for Behavioral Sciences and Leadership; US Air Force Academy - How do specific viewpoints of faces reflect the brain's perceptual representations of race and emotion? Recent evidence shows that contrary to prior beliefs, people have more difficulty identifying certain facial expressions in other race faces than in same race faces (Jack, Caldara, & Schyns, 2012). The current study uses behavioral data to assess the degree to which the facial representations for race and emotional expressions overlap and interfere with each other in a viewpoint-sensitive manner. Prior studies demonstrated that prolonged viewing of a face turned to one viewpoint (e.g. turned 30 degrees right) will make subsequently viewed frontal faces appear to be turned in the opposite direction (i.e. slightly to the left). This viewpoint aftereffect of repetition adaptation may then be used to discern the similarity of faces' neural representations with more similar faces showing greater transference of viewpoint aftereffects (Fang, Ijichi, & He, 2007). This current work employs the repetition adaptation paradigm to show the view-sensitivity of the other race effect in identifying facial expressions. In each experimental trial, participants first adapt to a face (facing 30 degrees, left or right) for 4 seconds, then view a brief mask (150-300ms), followed by the test face turned 3 degrees to the left or right, or presented frontally (400ms). Participants respond by indicating whether the test face is turned to the left or right. The test faces may differ from the adapting faces in terms of race or facial expression. Diminished viewpoint aftereffects for other race faces or different facial expressions point to greater separation in their underlying

# D-47

THE EFFECT OF ETHNICITY ON NEURAL CORRELATES OF **EVALUATING** SOCIAL **INTERACTIONS** Yuta Katsumi, Suhkyung Kim, Keen Sung, & Sanda Dolcos; University of Illinois at Urbana-Champaign; University of Massachusetts Amherst - Being able to accurately understand and evaluate others' intentions and actions plays an important role in successful social interactions. Individuals typically rely not only on what they hear in conversations, but also a range of non-verbal cues, including facial expressions and body language, in order to form impressions of and further evaluate others. Moreover, such evaluative judgments may also be influenced by whether or not individuals identify with their interaction partners in terms of social characteristics such as ethnicity. Previous investigations have revealed the role of ethnicity on how individuals process and incorporate such information in their decision-making. However, little is known about the extent to which perception of ethnicity may be linked to evaluative judgments in a social context, and about its neural correlates. In the present study, 20 Caucasian participants (10 females) viewed and rated a series of movies illustrating non-verbal guest-host interactions in a business setting, while fMRI data were recorded. Ethnicity of the hosts was separated into 50% Caucasian (in-group) and 50% Non-Caucasian (out-group) trials. The hosts displayed behaviors that either encouraged (Approach condition) or discouraged (Avoid condition) further social interaction. Behavioral analysis yielded a significant difference, such that participants rated Avoidance behaviors displayed by out-group hosts lower than those displayed by in-group hosts. Brain imaging analysis identified specific regions showing common and dissociable activity in response to avoidance behaviors displayed by in-group and out-group hosts. Common regions included a host of areas from the social cognition network, including the posterior superior temporal sulcus, inferior parietal lobule, and lateral prefrontal cortex. Further analyses revealed that the in-group/Avoid relative to out-group/Avoid condition was associated with increased activity in the posterior insula, precuneus, and middle temporal gyrus, while the out-group/Avoid relative to in-group/Avoid condition was associated with increased activity in a broader network of regions, including the dorsomedial prefrontal cortex, inferior frontal gyrus, anterior insula, temporo-parietal junction, and bilateral fusiform gyrus. Interestingly, insula showed dissociable responses to the hosts' ethnicity, such that its posterior region showed increased activity for avoidance behaviors displayed by in-group hosts, whereas the anterior region showed increased activity for those displayed by out-group hosts. Overall, these findings provide evidence for both common and dissociable responses in the social cognition network to avoidance behaviors displayed by in-group and out-group members, and point to dissociable patterns of response in the insula indexing opposing sensitivity to ethnicity-related ingroup and out-group members.

#### D-48

AGENDA-BASED REGULATION IN THE OWN-RACE BIAS: EXAMINING THE ROLE PLAYED BY **AROUSAL** Hillary Wehe - Colorado State University; Sarah DeLozier - Colorado State University- Learners show better recognition for faces of their own race, compared to faces of other-race individuals, a finding termed the own-race bias (ORB). One account for this phenomena, socialcategorization, suggests this decreased recognition may be due to a lack of motivation to differentiate between other-race faces. In support of this model, current research (DeLozier & Rhodes, 2013) has given learners an agenda-based goal of achieving a high total point score by correctly recognizing high- and low-value own-and other race faces. Results showed that point value could be used as a motivator to increase recognition for high-value ownrace faces. Under some circumstances, point value also increased recognition for high-value other-race faces, reducing the ORB and providing some support for socialcategorization. As such, it is possible that other factors besides motivation may contribute to the ORB. In the current series of experiments, we investigated the effect of arousal as a possible moderator of the ORB. Experiment 1 used a between-subjects design, with a control group receiving the standard point value instructions, and the experimental group receiving an "Asian disease" survival scenario with this same point-value agenda. Learners were told that the point-values presented with each face represented the number of times that individual had been exposed to the deadly Asian disease. Therefore, learners were told, it was very important to recognize high-value faces in order to decrease their chances of catching this disease. Of primary interest, we collected pre- and posttest ratings of arousal and valence. Data collection is ongoing, with preliminary analyses showing increased recognition for high-value faces.

# D-49

SHARED BELIEFS ENHANCE SHARED FEELINGS: **RELIGIOUS/IRRELIGIOUS IDENTIFICATIONS** MODULATE EMPATHIC NEURAL RESPONSES Shihui Han, Siyuan Huang; Department of Psychology; PKU-IDG/McGovern Institute for Brain Research; Peking University, Beijing, China; - Recent research has revealed stronger empathic neural responses to same-race compared to other-race individuals. Is this in-group favoritism in empathy specific to race identification or a more general effect of social identification - including that based on religious/irreligious beliefs? The present study investigated whether and how intergroup relationship based on religious/irreligious identifications modulates empathic neural responses to others' pain. We recorded event related brain potentials (ERPs) from Christian and atheist participants to perceived pain or neutral expressions of faces that were marked as being Christians or atheists. We found that both Christian and atheist participants showed greater neural activity to pain (vs. neutral) expressions at 132-168 and 200-320 ms over the frontal region to those with the same (vs. different) religious/irreligious beliefs. In-group favoritism in

empathic neural responses was also evident at a later time window (412-612 ms) over the central/parietal regions in Christian but not in atheist participants. Our results indicate that intergroup relationships based on shared beliefs, either religious or irreligious, produces in-group favoritism in empathy for others' suffering.

# D-50

#### EMPATHIC NEURAL RESPONSES DIFFERENTIALLY PREDICT HELPING BEHAVIOR DURING THE TRANSITION ТО ADOLESCENCE: Α LONGITUDINAL FMRI STUDY John C. Flournoy, Allison Tackman, William E. Moore III, John C. Mazziotta, Marco Iacoboni , Mirella Dapretto, Jennifer Pfeifer; Department of Psychology, University of Oregon; Ahmanson-Lovelace Brain Mapping Center; UCLA-FPR Center for Culture, Brain, & Development- Background: Though much literature in psychology has explored empathy as a possible motivator of prosocial behavior, results have been mixed, and authors have suggested that this may be due to differences in paradigms and definitions (Eisenberg and Miller, 1987). Recent neuroimaging work seeks to address definitional issues by measuring trait empathy as brain activity during performance of empathy related tasks. For example, neural activity during a perspective-taking sympathy task correlated with self-reported empathy and predicted real-world prosocial behavior in adults (Rameson et al., 2011). Other research, probing the shared experiencing aspect of empathy known as affective resonance has found brain regions that are active during both experience and observation of pain, and that this activity relates to differences in self-report empathy (Singer et al., 2004). However, no research has investigated whether differences in affective resonance neural activity motivate prosocial behavior, and very little is known about the development of these brain networks. What little is known suggests that affective resonance may either increase or decrease prosocial behavior, depending on other factors such as stage of development. In an analysis of a subset of the data employed in the present research, in 10-year-olds, brain activity from regions involved in both observation and imitation of emotional faces was positively related to both self-report empathic concern and personal distress (Pfeifer et al., 2008). While self-report empathy is positively related to helping behavior during pre- and early-adolescence, personal distress is associated with less helping (Eisenberg et al., 1991). Because emotional reactivity outpaces development of regulation during the transition between childhood and adolescence, affective resonance may be expected to hinder prosocial behavior, at least for some part of this developmental period. We examine affective resonance as a motivator of prosocial behavior during the transition between childhood and adolescence. Methods: Participants visited the lab on two occasions, first at age 10 (N=90) and again at age 13 (N=57). A subset (N=55) provided good fMRI data at both timepoints. fMRI Task: Participants observed and imitated emotional expressions (happy, neutral, scared, angry, and sad). Regions of interest were defined by assessing the conjunction of voxels significantly more active during

imitation of negative affect than during rest, and

significantly more active during observation of negative affect than during rest. The conjunction analysis attempted to reject the conjunction null at p < .005, k > 10. Self-report measures: Real-world prosocial behavior is measured as the number of hours per week spent "helping other people without getting paid...to make your city a better place." Other scales measured empathy, prosocial intentions, and child perceptions of parents' helping behavior. Preliminary Results: For boys only, activity in regions involved in both imitation and observation positively predict hours volunteered at age 10, and negatively predict volunteering at age 13

# D-51

INFANT ATTACHMENT PREDICTS BODILY FREEZE **IN ADOLESCENCE** Hannah C.M. Niermann 1,2, Verena Ly 1,2, Sanny Smeekens1, Bernd Figner 1,2, J. Marianne Riksen-Walraven 1, Karin Roelofs 1,2; Affiliations: ; 1 Behavioural Science Institute (BSI), Radboud University Nijmegen, The Netherlands; 2 Donders Institute for Brain, Cognition and Behaviour, Radboud University Nijmegen, The Netherlands-Freezing is a major defensive stress-response in animals. It is characterized by reduced body motion and decreased heart rate. Amplified freeze-reactions have been observed in both animals and humans with a history of anxiety and traumatization and enhance the chance of later psychopathology. Studies in rodents and primates have shown that the experience of early life-stressors, particularly maternal deprivation, is associated with longlasting deviations in primary defensive stress-responses, such as enhanced freeze-reactions. In humans, the relationship between infant-parent attachment and defensive freeze-reactions remains unstudied. Understanding this relationship in humans is critical to advance our knowledge of the development of primary defensive stress-reactions in humans and is important for translational research in animals and humans. Therefore, this prospective longitudinal study investigated whether insecure (compared to secure) attachment in human infants-reflecting a history of low quality parental responsiveness and sensitivity to the infants' needs-is related to increased freeze-reactions to social threat in adolescents. By means of a stabilometric force platform, we measured reductions in body sway (freeze) in response to angry, neutral, and happy faces in 79 14-yearold adolescents from the Nijmegen Longitudinal Study. Infant-parent attachment security of these participants had been classified at 15 months of age using the Strange Situation Procedure (Ainsworth et al., 1978). A repeatedmeasures ANOVA with body-sway as dependent variable, Emotion (angry, happy, neutral) as withinsubject factor, and Attachment (secure, insecure) as between-subject factor showed the expected significant Emotion x Attachment interaction (F(2, 76) = 3.23, p = .045,  $\mathbb{E}\Sigma^2 = .08$ ). Follow-up analyses indicated that only the Emotion contrast of angry versus neutral demonstrated a significant interaction with Attachment  $(F(1, 77) = 6.52, p = .013, \times \Sigma^2 = .08)$ , which was specific for the insecurely attached participants (F(1, 22) = 9.16, p = .006,  $\times \Sigma^2$  = .29) but not for their securely attached counterparts (F(1, 55) = 0.20, p = .661,  $\times \Sigma^2$  = .00). In conclusion, the results of this prospective longitudinal study suggest that insecure infant-parent attachment is associated with adolescents' enhanced freeze-reactions to socially threatening relative to neutral faces. These results suggest that the effects of early negative caregiving experiences on the human stress-system extend to very basic defensive freeze-reactions, which are objectively detectable during adolescence. This research opens venues to start exploring the role of freeze in the development of human psychopathology.

#### D-52

# WHAT THE BRAIN "LIKES:" NEURAL CORRELATESOFSOCIALMEDIAENGAGEMENTINADOLESCENCELauren E. Sherman; Patricia M. Greenfield;Jessica J. Chiang; Leanna M. Hernandez; Devora Beck-Pancer;MirellaDapretto - University of California, Los Angeles -

Mirella Dapretto - University of California, Los Angeles -Social media plays an important role in peer interaction during adolescence and young adulthood, and many of the socioemotional processes enacted online actually parallel those in youths' offline lives. It is likely that simple, quantifiable indices of online social endorsemente.g., "likes"-serve as powerful motivators in adolescence, a developmental period characterized by heightened sensitivity to peer influence. This hypothesis, however, has yet to be empirically examined. Neurotypical adolescents (age range 15-18 years) underwent functional magnetic resonance imaging (fMRI) while completing a task that mimics the popular social photo-sharing application Instagram. Participants viewed a feed of photographs ostensibly submitted by peers and decided whether to press one of two buttons: "Like" indicated that they "liked" the image, whereas "Next" indicated that they wished to move forward without "liking" the image. Furthermore, participants submitted their own photographs for inclusion in the feed, and received feedback on how many peers had ostensibly "liked" their images. Using region of interest analyses in the ventral striatum (VS) and orbitofrontal cortex (OFC), we tested the hypothesis that reward circuitry would be recruited to a greater extent when participants a) chose "Like" (versus "Next") and b) received many "likes" (versus few) on their own images. In addition to our a priori ROI analyses, we also performed whole-brain analyses to examine how other brain areas, if any, might be implicated. As predicted, during trials in which participants pressed "Like" (versus "Next), the bilateral VS (peak MNI coordinates x =12, y = 10, z = -2) and the bilateral OFC (peak MNI coordinates x = -34, y = 28, z= 10) were significantly activated. Whole-brain analyses revealed that significant activation was not limited to the reward circuit, but included the dorsal striatum, the cingulate and paracingulate cortices, and regions of the posterior parietal cortex implicated in the central executive network. The reverse contrast (i.e., "Next" greater than "Like") yielded no areas of significant activation. Viewing one's own photographs with many likes from peers (vs. few likes) also activated the VS (peak MNI coordinates x =-4, y = 4, z = 2) and OFC (peak MNI coordinates x = 28, y= 14, z = -16). Whole-brain analyses revealed that receiving many likes was also associated with activation in the thalamus, insula, and regions of the default mode network (e.g., precuneous, medial prefrontal cortex). The reverse contrast (i.e., receiving few versus many "likes") yielded no significant activation. Our results suggest that reward circuitry may play an important role in social networking when it comes to both providing and receiving feedback. In both cases, the provision or receipt of positive feedback elicited greater neural responses not only in reward circuitry but across several other regions as well. These findings support the hypothesis that adolescents are avid users of social media because they find the nature of social interaction afforded by these tools to be motivating. Indeed, the very fact that "likes" are straightforward, immediate, and quantifiable may contribute to their appeal and enhance reward-learning processes that occur on social media.

# D-53

THE NEURO-ENDOCRINE CONTROL OF SOCIO-EMOTIONAL ACTIONS IN ADOLESCENCE Anna Tyborowska [1,2], Inge Volman [1,2], Sanny Smeekens [1], Ivan Toni [2], Karin Roelofs [1,2]; [1] Radboud University Nijmegen, Behavioural Science Institute, Nijmegen, The Netherlands; [2] Radboud University Nijmegen, Donders Institute for Brain, Cognition and Behaviour, Nijmegen, The Netherlands; - When frontal control of socio-emotional behavior fails, people fall back on automatic action tendencies to either approach or avoid social stimuli. Chronic failure of this control has been observed in social anxiety as well as aggression-related disorders. The anterior prefrontal cortex (aPFC) has been shown to be crucial for controlling these automatic action tendencies. These observations are particularly relevant for neurobiological models of adolescent development. During adolescence, social-affective processes undergo important changes on both the behavioral and neural level. Crucially, there is an imbalance between already developed limbic/striatal structures and a still maturing prefrontal cortex, likely resulting in less top-down control of emotional tendencies. Interestingly, pubertal stage and the accompanying hormonal changes have been shown to modulate the processing of socio-emotional stimuli in these neural networks. With the development of many emotional disorders peaking during adolescence, it is essential to understand the neurobiological mechanisms underlying control of automatic action tendencies during this age. Using an fMRI adapted social Approach-Avoidance (AA) Task, we assessed the behavioral and neural properties of emotional action control during a critical transition phase in adolescence. A total of 47 adolescents (21 males) were tested at 14 years of age. Salivary testosterone measurements were collected and served as an indicator of pubertal development. Behavioral and fMRI analysis were controlled for gender effects. During the AA-Task, participants had to evaluate the emotional expression (happy, angry) of faces and respond by either pulling a joystick toward (approach) or away (avoidance) from themselves. Affect-congruent conditions involved intuitive stimulus-response mappings (i.e. approach-happy and avoid-angry faces). In contrast, affect-incongruent conditions required participants to override these automatic action tendencies in order to meet task demands (i.e. approach-angry and avoid-happy faces). As has been shown in previous adult

studies, participants have faster affect-congruent responses than affect-incongruent responses due to the increased demands of the latter, when automatic tendencies need to be controlled. In the current adolescent sample this behavioral congruency effect (affect-incongruent vs. affect-congruent) was significantly replicated. fMRI analysis further revealed a significant congruency effect in frontal and striatal regions that was differently modulated by testosterone levels. High testosterone individuals showed greater aPFC activity when controlling their automatic action tendencies, while low testosterone individuals showed greater subcortical (thalamus and caudate) activity. Moreover, behavioral performance was not affected by testosterone levels, suggesting that the recruitment of different neural systems does not immediately affect task performance. These results suggest that in early puberty, the more mature subcortical structures (compared to prefrontal) are recruited for controlling automatic action tendencies. With increased pubertal development, there is a transition to maturing prefrontal control systems. This developmental switch is most likely the result of ongoing neural reorganization and hormonal changes that take place during this period.

# D-54

CHILDREN ARE LESS WILLING TO DELAY GRATIFICATION WITH AN UNTRUSTWORTHY **EXPERIMENTER** Laura Michaelson\*, Rachel Lahoda, Anjela Sargent, Yuko Munakata; University of Colorado Boulder-Early indices of willingness to wait for delayed rewards show remarkable stability across the lifespan. In the classic delay of gratification task, the number of seconds a preschooler waits for two marshmallows, rather than choosing to eat one marshmallow immediately, predicts academic achievement, social competence, and physical health later in life (Ayduk et al., 2000; Mischel et al., 1989; Shoda et al., 1990). Theories of delaying gratification largely focus on reward sensitivity and self-control, and associated neural regions in the ventral striatum, nucleus accumbens, and prefrontal cortex (e.g., Casey et al., 2011). Despite a growing literature demonstrating the role of social factors in cognitive processes, social influences in delaying gratification have been largely overlooked. The present work tests whether social trust might play a central role in children's willingness to delay gratification. Children may only opt to delay gratification in trustworthy social contexts, when they are confident that delayed rewards will actually be delivered. Social trust influences delaying gratification in adults (Michaelson, de la Vega, Chatham, & Munakata, 2013). However, it is unclear whether social trust plays a role in childhood, and might contribute to the stability of self-control across the lifespan. Decreasing trust by failing to deliver a promised reward increases preschoolers' preferences for immediate gratification (Kidd, Palmeri, & Aslin, 2012; Mahrer, 1956); however, because trust is confounded with rewards in such studies, such manipulations could influence delay choices via the effects of rewards on factors such as selfcontrol and mood, which are known to affect delay of gratification. Moreover, social trust could play less of a role in delaying gratification early in development, when

children's notable limitations in self-control could be more of a determining factor. The present study thus manipulated social trust in preschoolers in the absence of rewards, to test effects on delaying gratification. Thirty-four preschoolers were assigned to one of two conditions. In the trustworthy condition, the experimenter accidentally damaged a confederate's art projects and was honest about it; in the untrustworthy condition, the experimenter intentionally damaged the art projects and lied about it. The experimenter then administered the classic marshmallow task. With a trustworthy experimenter, children waited almost twice as long without eating the marshmallow (M = 10.99 min) compared to an untrustworthy experimenter (M = 5.79min), W = 212, p = .02, and were also more likely to wait the full 15 min delay period (71% versus 18%, X2 = 7.64, p = .006). Conditions did not differ terms of mood, suggesting effects on delay of gratification were specific to differences in social trust. This work complements existing evidence using hypothetical manipulations and rewards in adults, and highlights the importance of social trust in early willingness to delay rewards. Given that early delay abilities can be diagnostic of important later life outcomes, incorporating the trust factor is broadly relevant, both in terms of an improved understanding of failures to delay, and for expanding existing neural profiles to incorporate regions associated with social trust, such as the caudate nucleus (King-Casas et al., 2005).

# D-55

HEIGHTENED INFLUENCE OF UNPREDICTABILITY ON EMOTIONAL INTERFERENCE AND STRIATAL RESPONSE TO POSITIVE STIMULI IN **ADOLESCENTS** Catherine Insel, Alea C. Skwara, Stephanie F. Sasse, Erik K. Kastman, Leah H. Somerville; Harvard University, Department of Psychology Prior work has demonstrated that adolescents are especially sensitive to rewards and appetitive emotional cues, and rewardrelated responses have been shown to interfere with cognitive processes. Though uncertainty potentiates affective responding and is a key feature in models of reinforcement learning, it is not clear whether predictability is a key mediating variable on a) adolescent reward sensitivity, and b) the capacity for affective cues to disrupt cognitive processes. In this study, participants aged 9-22 completed an emotion-interference task in which predictability and valence were manipulated while undergoing fMRI scanning. Participants viewed blocks of positive, neutral, and negative scenes and were asked to complete a concurrent task (determining whether it was an indoor or outdoor scene). For some blocks of images, temporal predictability cues were provided so that participants were aware of the timing of the forthcoming image, and for others the timing was unpredictable, with a random sequence of numbers. Overall, response times were slower for the unpredictably relative to the predictably timed images. There was also a main effect of

valence, whereby participants were slowest to respond to negative images, intermediate for positive images, and fastest for neutral images. These findings suggest that both positive and negative emotional cues result in increased emotional interference on concurrent task performance. Comparing adolescents to adults revealed maximal interference for unpredictable positive events in early adolescence, as measured by reaction time differences for unpredictable relative to predictable positive events. FMRI results revealed that adolescents showed heightened responses in the ventral striatum for positive relative to neutral images relative to adults. Further, these effects were driven by increased sensitivity to unpredictable positive events in adolescents. Ongoing analyses are examining the effects of predictability on subjective ratings of image valence and arousal. In addition, we are investigating the trial-by-trial effects of unpredictability and self-reported valence and intensity to reveal parametric effects on emotional responses and interference resolution. Overall, these findings suggest that uncertainty is a critical mediating factor of adolescent sensitivity to affectively positive cues.

# D-56

ON THE REWARDING PROSPECT OF BECOMING ONESELF: SOCIAL INFLUENCES ON REWARD ACTIVITY DURING ADOLESCENCE Will Moore, University of Oregon; Jennifer Pfeifer, University of Oregon

- The notion that self and reward are related at a fundamental neural level has recently garnered considerable empirical attention (Northoff & Haves, 2011), and the developmental trajectories for shared networks that mediate these processes have even been preliminarily studied in the context of aging (Grady, Grigg, & Ng, 2012). However, the younger end of the developmental spectrum has yet to be explored in this regard. Over time, socially rewarding actions shape not only an individual's noetic sense of self-concept, but also pre-potent behavioral tendencies in interpersonal contexts. As such, acknowledging that self and reward are deeply intertwined (if not inextricable) concepts is likely to yield a fruitful approach for designing robust empirical investigations of brain and behavior across development. Adolescence is an ideal developmental epoch for investigating the emerging self in the context of reward learning, in part because during this time social influences become increasingly evident in decisions about "who we are" and "what we do" (Blakemore & Robbins, 2012; Pfeifer & Peake, 2011). We know that adolescents make more risky decisions than adults or children (Burnett, Bault, Coricelli, & Blakemore, 2010), particularly in the presence of peers (Chein et al., 2011; Steinberg, 2008), a context which heightens their preferences for immediate rewards (O'Brien et al., 2011). Such social influences on decision-making might be partially mediated via the impact of rewarding peer interactions on self-perceptions. For example, adolescents and young adults exhibit activity in reward networks in response to favorable peer evaluations of the self (Davey, Allen, Harrison, Dwyer, & Yücel, 2009), and both neural and behavioral indicators of "value" are triggered when adults disclose information about themselves to others (Tamir & Mitchell, 2012). At a

more basic level, several investigations have reported overlapping patterns of striatal activity for rewarding and self-relevant stimuli (Ersner-Hershfield, Wimmer, & Knutson, 2009; Fliessbach et al., 2007), and a specific region of the medial prefrontal cortex (mPFC) known as the perigenual anterior cingulate cortex (pACC) has been directly implicated in carrying out both personally relevant and reward-related cognition (Enzi et al., 2009). Yet pACC responses are also modulated by context, as recently demonstrated by its involvement in multiple aspects of social comparison processes including the calculation of personal relevance and self-similarity of judgment targets (Moore, Merchant, Kahn, & Pfeifer, 2013). In order to further investigate social influences on reward processing, we are in the process of collecting and analyzing neuroimaging data from a sample of 30 early adolescents (ages 11-13 years). Participants complete a probabilistic decision making task (Cohen et al., 2010) while undergoing fMRI in both a 'private' condition and also in a 'social' condition, during which they are told that an age- and gender-matched peer is observing their performance. Assessment of the relationships between neural responses to reward outcomes and model based decision signals (e.g., decision value and prediction error) will help us to more precisely characterize social influences on reward learning, and results will be discussed in the context of the emergent adolescent self.

# D-57

CORRELATES OF MULTISENSORY NEURAL EMOTION PERCEPTION IN AGING Jamie Klein, the College of William and Mary; Paul Kieffaber, the College of William and Mary - Stimuli are perceived using multiple senses in the phenomenon of multisensory integration (MSI). Behavioral studies have demonstrated that, while older adults suffer deficits in the identification of both emotional faces and voices, they derive greater enhancement from MSI than younger adults. One explanation for this phenomenon is that older adults benefit from the phenomenon of inverse effectiveness, in which less salient stimuli result in increased MSI. Older adults' deficits in hearing and vision may require them to rely on MSI for accurate social perception. In this study, electroencephalography (EEG) was used to identify neural components associated with emotional multisensory perception in younger (M=19.07 years) and older (M=82.73 years) adults. A novel task was used to determine the neural correlates of emotion MSI, which included multisensory stimuli presented simultaneously than consecutive face-voice presentation. rather Significant differences were found between congruent and incongruent emotional stimuli as early as 120 ms after stimulus presentation, with congruent face-voice pairs producing enhanced auditory N1 components. Additionally, multisensory enhancement for auditory N1 was correlated with hearing loss at high frequencies for older adults. These findings suggest that the degree to which older adults utilize MSI for emotion perception is indeed related to sensory deficits.

ADDING INSULT TO INJURY? CHRONIC PEER VICTIMIZATION ACROSS DEVELOPMENT ADOLESCENTS' HEIGHTENS NEURAL SENSITIVITY TO SOCIAL EXCLUSION Michelle E. Miernicki, University of Illinois at Urbana-Champaign; Karen D. Rudolph, University of Illinois at Urbana-Champaign; Wendy Troop-Gordon, North Dakota State University; Eva H. Telzer, University of Illinois at Urbana-Champaign - Peer victimization is a salient and potentially traumatic social stressor that confers significant emotional costs for youth. Yet, we know little about the processes through which peer victimization "gets under the skin." Neuroimaging research in normative samples of adults and adolescents shows social exclusion activates neural regions implicated in the affective component of physical pain (e.g., dorsal anterior cingulate cortex [dACC], anterior insula); we hypothesized exposure to chronic peer victimization during childhood would heighten neural sensitivity to social exclusion during adolescence. This study tracked youths' exposure to victimization across seven years, from mid-childhood through mid-adolescence, examining the implications of a personal history of chronic victimization for neural processing of social exclusion. Thirty-seven female adolescents were recruited from a longitudinal study that followed youth annually from the 2nd-9thgrade. Chronic victimization exposure was determined based on self-reported victimization on the Social Experiences Questionnaire-Revised (e.g., "How often do other kids leave you out on purpose?") assessed annually from 2nd-8th grade. During the summer following 9th grade, we recruited 19 chronically victimized adolescents (i.e., scored > .75 SD above the mean on victimization for at least three years; average number of years victimized=4.47) and 18 non-victimized adolescents (i.e., scored< .75 one standard deviation below the mean on victimization for at least three years; average number of years non-victimized=4.78) to complete a functional brain scan. During the scan, adolescents completed Cyberball, a widely used task that manipulates social exclusion. Youth were told they would be playing an on-line ball-throwing game with two peers (ostensibly in another room). During the game, the ball is thrown between players. In reality, there are no other players and the game is preprogrammed. Participants played two rounds. In the first (inclusion) round, the participant is equally included in the ball tosses. In the second (exclusion) round, the participant is excluded after ten throws. For the rest of the game, the other players only throw the ball amongst themselves. Neuroimaging results indicated adolescent girls with a history of chronic victimization show greater activation than non-victimized girls in the exclusion compared to inclusion condition in brain regions implicated in social pain (insula, dACC), affective arousal (amygdala), and emotion regulation (ventrolateral prefrontal cortex). Chronically victimized girls also showed heightened activation relative to non-victimized girls in the ventral striatum, a region that has previously shown heightened activation during social exclusion among youth (Masten et al., 2011), and has been suggested to be involved in emotion regulation during adolescence (Pfeifer et al., 2011). A history of chronic peer

victimization appears to get under the skin by heightening neural sensitivity to social exclusion during adolescence. Thus, the experience of peer exclusion may be a more emotional (i.e., amygdala activation) and painful (i.e., insula, dACC activation) experience for adolescents who were chronically victimized in their childhood, perhaps necessitating them to engage in greater regulation. This research suggests neural processes may contribute to the long-term costs of early social stressors by sensitizing youth to negative social experiences.

#### D-59

WHY DO BRAIN-TRAINING INTERVENTIONS FAIL? THE DOUBLE-EDGED SWORD OF PROACTIVE CONTROL Elliot T. Berkman, Lauren E. Kahn, Junaid S. Merchant, University of Oregon - A growing and increasingly profitable online industry has recently emerged selling "brain-training" services that promise to increase intelligence and executive function. However, independent studies on these services provide (at best) equivocal support for their effectiveness, particularly in terms of whether the performance gains earned on the training tasks transfer to untrained tasks (so-called "transfer effects"). A major impediment to understanding and predicting transfer effects is a paucity of theoretical accounts of how brain-training interventions are supposed to work. In this talk, we will provide one such account based on an application of Braver's Dual Mechanisms of Control (DMC) model to neurocognitive training, and then present a study that tested the predictions of this updated model in the context of a longitudinal study of self-control training (N=30 per group, each scanned pre- and post-training or active control intervention). The DMC model describes two different modes of control, proactive and reactive, with the former being more effective but more resource intensive and the latter being less effective but less costly, and identifies factors such as motivation and resource availability that determine whether proactive or reactive control is recruited. Our study adds to this theory by showing that training engenders a shift from reactive to proactive control, above and beyond other factors. However, this shift came at a cost: proactive control became associated with specific cues that signaled the upcoming need for control. This result explains why performance gains on training tasks do not always generalize to novel tasks. If training improves performance by forming cue-control associations that trigger proactive control, then proactive control will only engage when training cues are integrated into other tasks. We discuss null results in the training literature in light of our results and describe a path forward for creating theory-based and generalizable brain-training interventions for inhibitory control.

# D-60

**NEUROPHYSIOLOGICAL TRAITS ACROSS COLLEGE DRINKERS AND NON DRINKERS IN RESPONSE TO A TEMPORAL AUDITORY TASK** *Barbara C. Banz - Colorado State University; Alana M.*  Campbell - University of North Carolina; Deana B. Davalos -Colorado State University - Alcohol consumption not only affects outward behavior but is also associated with changes in neurophysiological responses to stimuli in the environment. Differences between alcoholics and controls have been observed in neurophysiological responses to a variety of stimuli using a number of event-related potential paradigms (Pfefferbaum, et al, 1991; Porjesz, et al, 1998). The mismatch negativity (MMN) component reflects sensory gating and is thought to indicate a preparedness to shift attention. MMN has previously been associated with impulse behavior (Franke, Nijs, Van Strein, 2005) which is also associated with alcohol consumption. Alcohol consumption influences MMN amplitude (Jääskeläinen, et al, 1995; Jääskeläinen, et al, 1996; Jääskeläinen, Schröger, Näätänen, 1999; Kähkönen & Martiinen, 2005). Chronic alcohol use has been associated with an increase in MMN amplitude. However, acute intoxication in non-alcoholics has been associated with significant suppression of the MMN amplitude. Though long-term differences in responses are evident in alcoholic populations who have abused alcohol for an extended period of time, college binge drinking has yet to be addressed. Binge drinking is a special circumstance in which a large amount of alcohol is consumed in a short period of time. Thus there are characteristics similar to both long term use as well as acute intoxication. Additionally, binge drinking is prevalent in college populations and carries social pressure. The current study investigated whether college binge drinkers possess a neurocognitive profile more similar to chronic alcohol abusers or to other college aged non drinkers. Further, it sought to examine whether there are electrophysiological signatures in binge drinkers that may suggest possible differences in impulsive behavior and poor executive functioning, as noted in other studies (Townshend & Duka, 2005). The current study measured the neural response to a temporal auditory MMN task. Multiple levels of difficulty were included to manipulate recruitment of prefrontal cortical areas. General MMN differences between groups would suggest overall differences associated with impulsivity, while differences in response to more difficult conditions may reflect both issues in impulsivity and PFC mediated tasks. Thirty-five college students were categorized based on the frequency and patterns of drinking behavior; binge drinkers (10), non-binge drinkers (15), and non-drinker (10). Electrophysiological responses were measured in response to large (310ms) and small (370ms) auditory temporal deviant intervals presented amid a string of standard (400ms) 50 ms 1Hz tones. Results suggested that the 310ms interval elicited a larger response, F(1,31) =6.04, p = 0.02. Non-drinkers showed no difference in MMN amplitude between the two intervals (p = 0.81), binge drinkers showed a marginally significant difference (p = 0.06). Interestingly, a marginal significance was found in the latency of the MMN peaks in response to the two deviant intervals, F(2, 31) = 2.71, p = 0.08, and binge drinkers showed a later response than non-binge drinkers, p = 0.03. While this pattern of results were somewhat unexpected, the MMN differences noted between these groups may suggest possible differences associated with impulsivity and the important role of task

difficulty in distinguishing these groups.

# D-61

WHEN AND HOW DOES THE BRAIN PREDICT **HEALTH BEHAVIOR CHANGE?** Emily Falk, University of Pennsylvania; Matthew Brook O'Donnell, University of Pennsylvania; Christopher Cascio, University of Pennsylvania; Steve Tompson, University of Michigan; Richard Gonzalez, University of Michigan; Sonya Dal Cin, University of Michigan; Matthew Lieberman, University of California, Los Angeles; Victor Strecher, University of Michigan; Lawrence An, University of Michigan; - New evidence for self-related neural predictors of behavior change in response to massmedia health campaigns. We have ample evidence that neural activity can be used to predict the effectiveness of health campaigns. We are lacking, however, a clear understanding of the underlying mechanisms that make the brain an effective predictor and the limits of this predictive ability; how and when does the brain predict health behavior change? Converging evidence demonstrates that neural activity within brain systems associated with self-related processing can predict individual behavior in response to health messages. Preliminary evidence also suggests that neural activity in small groups can forecast population level campaign outcomes. No studies, however, have investigated the psychological processes that underpin the link between neural activity and population level outcomes, or how these predictions are affected by message content. Likewise, investigations of ways to manipulate this activity to achieve better health outcomes have been extremely limited. In this talk, I will review two new studies that examine the links between functionally localized self-related processing and positive responses to communications. The first investigation health demonstrates that neural activity in relatively small groups of smokers (n=50) predicts population level responses to an anti-smoking mass-email campaign (n=800,000). The messages, inspired by FDA's graphic warning labels, promoted tobacco-cessation services offered by the state of New York. Data from this study demonstrate that activity within functionally localized self-related regions of MPFC during health message exposure predicts population level email click-throughrates. This relationship, however, depends on message content-MPFC predicts outcomes in response to strong negative arguments against smoking and not in response to compositionally similar neutral images. The second investigation examines whether it is possible to manipulate self-related processing in MPFC using selfaffirmation. In this randomized, controlled intervention study (n=68), sedentary participants exposed to a selfaffirmation manipulation delivered prior to health messages promoting physical activity significantly increased their physical activity behavior in the month following the intervention, whereas the non-affirmed control group did not. Neural activity in an independent, functionally localized self-related processing region of interest within MPFC predicted this outcome. These results 1) offer support for scalable interventions to improve population health, 2) provide new insight about the underlying psychological and neurocognitive mechanisms linking neural responses to important health behavior change outcomes, and 3) suggest important boundary conditions on prior findings. I will discuss these results in the context of social neuroscience and neuroeconomic models of decision-making as a way of tying together extant findings on decision making with underlying mechanisms that lead health messages to succeed or fail. Taken together, this work provides novel insight about when and how the brain predicts behavior change on small and large scales.

# D-62

WOMEN'S COGNITIVE RESPONSES TO FEMALE-TARGETED ADVERTISING Stephanie Vezich, UCLA Psychology; Ben Gunter, UCLA Psychology; Matthew Lieberman, UCLA Psychology - Portravals of women in advertising generally fall into one of four roles: aspirational, business, domestic, normal/just like me, or sexualized. Campaigns focusing on "normal" depictions of women-those that look like the average woman on the street-have become more commonplace, largely in response to self-report feedback from female consumers who applaud efforts to stray from the narrow range of models typically used in advertising. While these selfreported attitudes seem to paint a clear picture of women's preferences in advertising, evidence that this approach actually drives sales is less clear. To better understand this potential discrepancy, the current study investigates both explicit and implicit responses to female roles in advertising using fMRI. 28 female subjects viewed 120 images of typical female ad portrayals in a randomized block design, with a different role comprising each block: 1) aspirational, 2) business, 3) domestic, 4) normal, 5) sexualized, and 6) control blocks consisting of car images without people. Within each role category block, images reflected various product categories: 1) cars, 2) household items, 3) technology, and 4) control images (images of women without products). Following presentation of each image, participants rated how much they liked the image. Additionally, days prior to their fMRI session, participants completed a survey assessing their explicit attitudes toward traditional gender roles. Finally, directly after their fMRI session, participants were presented with a variety of ads consisting of different role portrayals and were told to advance at their own pace, allowing us to see how much time they spent looking at images in different role categories. In order to compare self-reported explicit attitudes and implicit attitudinal measures, we created two main types of first-level contrasts. One set of contrasts compared each advertising role (aspirational, business, etc.) to control car images. Another contrast directly compared responses to sexualized images to responses to domestic images, as these roles mapped most directly onto our self-report measures on attitudes regarding traditional gender roles. We regressed in traditional gender role attitude scores at the second level to investigate whether neural responses to sexualized ads in particular covaried with explicit attitudes about traditional gender roles. Whole-brain analyses revealed that participants with more traditional explicit attitudes

exhibited stronger activation in ventral striatum, DMPFC, TPJ, and insula compared to those with less traditional attitudes in response to sexualized ads (relative both to control ads and to domestic ads). These results provide preliminary evidence of a disconnect between explicit and implicit attitudes toward sexualized portrayals of women in advertising. In fact, it may be that women with the most traditional explicit attitudes about gender roles-who typically report negative attitudes toward sexualized portrayals-exhibit the most counterintuitive implicit responses.

D-63

HOW ANXIETY AND SENTENCE CONTEXT AFFECT THE PROCESSING OF INSULTS AND **COMPLIMENTS:** INSIGHTS FROM THE EMOTIONAL STROOP PARADIGM Hannah De Mulder (UiL OTS - Utrecht University); Marijn Struiksma (UiL OTS - Utrecht University); Jos van Berkum (UiL OTS - Utrecht University) - In the emotional Stroop paradigm, participants are asked to name the colour of a word that is presented in a coloured font, whilst ignoring its meaning. The typical finding is that participants are slower to name the colour of negative words as compared to non-negative words (McKenna & Sharma, 1995); an effect that is particularly pronounced in anxious individuals (Williams et al., 1996). This finding suggests that the emotional content of words interferes with the allocation of attentional resources. In the current study, a modified version of the emotional Stroop task was used to investigate how participants with high vs. low levels of state anxiety process complimenting and insulting words. These words were presented in a sentence context that was either directed at the participant herself (self-directed context) or at somebody else (other-directed context), e.g. '[participant's name]/Linda is nasty/lovely'. The results showed a typical emotional Stroop effect in that participants took longer to name the colour of the insulting words than the complimenting words, regardless of their anxiety level. This result thus suggests that insults are so salient that they draw attentional resources away from goal-directed processing, even if they are not directed at the participant personally. In addition to this general slow-down when encountering an insult, highly anxious participants also showed a slowdown when they were personally addressed in the stimuli. That is, regardless of whether they were reading an insult or a compliment, stimuli that addressed the participant directly were processed more slowly by the highly anxious participants than by those with lower anxiety levels. As this difference in response time between high and low anxious individuals was specific to the selfdirected context (highly anxious individuals were not significantly slower across the board), it seems that highly

anxious individuals give attentional priority specifically to the processing of self-directed stimuli. Together, these findings thus suggest that in potentially risky situations (i.e. situations involving insults and, for highly anxious participants, situations in which they are personally addressed) attentional resources are diverted away from the task at hand and towards the potential threat, even if the potential threat is read in a contrived and highly 'impersonal' lab setting. THE ROLE OF THE MIRROR SYSTEM IN PROCESSING SEEN AND HEARD EMOTIONAL ACTION Lucy M. McGarry, Ryerson University, Toronto, Canada; Frank A. Russo, Ryerson University, Toronto, Canada; Emily S. Cross, Bangor University, Bangor, Wales -When we see or hear another person execute an action, we tend to automatically simulate the actions of that person. Evidence for this has been found both at the neural level (specifically in the parietal and premotor brain regions, referred to collectively as the mirror system (MS)), and the behavioural level through an observer's tendency to mimic observed movements. It has been suggested that this simulation process plays a key role in socio-emotional understanding. Empirical research supports this premise by demonstrating that the human MS is activated to a greater extent during observation of emotional compared neutral body actions. Emotional vs. neutral vocalizations (perceived via audition) also facilitate MS responses. However, it remains unclear how the mirror system responds during auditory compared to visual perception of emotional vs. neutral non-vocal body actions. The current fMRI study examines emotional facilitation of the MS in auditory and visual modalities using a 2 (Modality: auditory, visual) x 2 (Judgment type: emotional, non-emotional) factorial design. Participants viewed a series of emotional or neutral hand actions. In one condition, they were asked to judge whether the action they observed or heard was emotional or neutral in nature. In another condition, they made non-emotion based judgments of whether the action they just observed or heard was a unimanual or bimanual action. Stimuli were presented in auditory-only and visual-only forms. Planned data analyses involve assessing unimodal effects of emotional content on perceived actions via main effect and interaction analyses within the factorial design, and supramodal effects via conjunction analyses. We predict that making emotional judgments of stimuli will lead to similar patterns of MS facilitation in both auditory-only and visual-only conditions, suggesting that the MS plays a special role in emotion processing in not only visual but also auditory modalities. In addition, we expect that individual differences in empathy scale scores will correlate positively with MS responses in both modalities.

# D-65

NEURAL CORRELATES OF SOCIAL REASONING **REGARDING ATTITUDES: FALSE CONSENSUS** AND SOCIAL INFLUENCE B. Locke Welborn, UCLA; Eva H. Telzer, University of Illinois; Matthew D. Lieberman, UCLA - 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. Using univariate and multivariate methods in two fMRI studies, we explore the neural correlates of consensus estimation and social influence, complementary processes that connect our attitudes to those of others. In assessing the attitudes of our peers, consensus estimation helps us understand when our attitudes may be out of step with those of the group. In shifting our own attitudes to correspond to those of our peers, social influence renders our opinions and judgments malleable to social norms. Using neuroimaging, we investigate some of the neural mechanisms involved in these two essential processes. First, we examine the brain regions whose activity promotes or inhibits the false consensus effect, the pervasive tendency to over-estimate support for our own attitudes (and under-estimate support for those attitudes which we oppose). In a functional imaging study (n=27), bilateral amygdala activity demonstrated a strong, positive relationship with trial-by-trial consensus bias, suggesting detection and evaluation of the social threat implied by holding an unusual or atypical view. participants' Conversely, recruitment of right ventrolateral prefrontal cortex (RVLPFC) was associated with the ability to regulate or attenuate bias, so as to bring consensus estimates in line with the group's actual attitudes. In a second fMRI study (n=20), we elucidate the neural mechanisms supporting social influence from expressed peer attitudes. Mentalizing regions, including the medial prefrontal cortex (MPFC), as well as regulatory regions (RVLPFC) are positively associated with participants' susceptibility to social influence (mean shift in one's attitude in the direction of a peer's attitude). These results may imply that both accurate mental state reasoning and regulatory inhibition of one's own prepotent attitudinal position are essential for reorienting one's attitudes so as to be congruent with those of one's peers. Taken together, this research illuminates the neural mechanisms by which our attitudes both 1) impact our perceptions of the group, and 2) change in response to the pressure of social influence. It is our hope that a thorough investigation of such neural underpinnings will clarify our understanding of these important processes.

#### D-66

SOCIAL REWARDS PROMOTE SAFE BEHAVIOR: MATERNAL PRESENCE FACILITATES ADAPTIVE NEURAL PROCESSING DURING ADOLESCENT RISK TAKING Eva H. Telzer, Nicholas Ichien, Yang Qu; University of Illinois at Urbana Champaign - In adolescence, parents tend to adjust their parenting practices to allow their children to be more independent in their decisionmaking. While decreases in parental supervision are important for developing autonomy and independence, adolescents do not always make optimal decisions on their own and are more likely to engage in risky behaviors during unsupervised time. Although significant work has begun to show the protective role of parental supervision, research examining the mechanisms by which parents impact adolescents' self-regulation and associated risk-taking has been surprisingly scant. Whether parental supervision decreases adolescent risktaking merely by limiting their opportunities to make poor decisions or whether it actually changes the ways in which adolescents think and reason can have significant implications for the development of successful interventions. In the current study, we examined how maternal presence influences adolescents' safe and risky decisions. Twenty-four adolescents were scanned as they completed a simulated driving course (the Stoplight task; Gardner & Steinberg, 2005), in which they encountered 26 intersections with a yellow-light and had to decide whether to "stop" (safe decision) or "go" (risky decision). Adolescents completed one round of the game alone and

one round when their mother was present. Run order was counterbalanced. Results indicate that adolescents made significantly more safe decisions (i.e., stopped at more vellow lights) when their mother was present than when alone. At the neural level, adolescents showed greater activation in regions involved in cognitive regulation (VLPFC) when making safe decisions when their mother was present compared to alone. Following risky decisions, adolescents showed reduced affective-(amygdala) and reward- (ventral striatum) related activation when their mother was present compared to alone. Together, these findings suggest that maternal presence facilitates safe behavior by increasing cognitive regulation and decreasing the affective nature of risktaking. Secondly, we examined neural coupling between affective and cognitive control regions that support safe decisions. Using the ventral striatum as the seed region, we conducted psychophysiological interaction analyses (PPI). Results show that the ventral striatum was significantly positively coupled with the right VLPFC during decisions to stop when mother was present compared to alone. In other words, when adolescents made safe decisions in the presence of their mother, they showed significant functional coupling between the ventral striatum and VLPFC; the ventral striatum was not functionally coupled with the VLPFC when adolescents were alone. Together, our findings suggest that the social context can decrease adolescents' risky decision making by modulating reward- and control-related neural circuitry. Maternal presence facilitated safe behavior through bottom-up processing, whereby mothers elicited a reward-related response (i.e., ventral striatum) that was associated with increased cognitive control (i.e., VLPFC activation). That the striatum was functionally coupled with the VLPFC during safe decisions when adolescents' mother was present provides evidence that social rewards promote safe behavior by increasing motivation to engage in greater cognitive control. Thus, reward-related neural activation may represent an adaptive process, suggesting that the very same neural region that confers risk for adolescent risky decisions may also confer a protective process by facilitating cognitive control.

# Poster Session H

Saturday, April 12, 4:15-5:30pm

H-01 INCREASED STRIATAL ACTIVATION IN

# **RESPONSE TO SYMPATHY-INDUCING STIMULI IN**

**EXTRAORDINARY ALTRUISTS** Brethel-Haurwitz, K. M. 1, Stoycos, S. A. 1, Cardinale, E. M. 1, Lozier, L. M. 2, VanMeter, J. 3, & Marsh, A. A. 1; 1Psychology, Georgetown University, Washington, DC; 2Interdisciplinary Program in Neuroscience; 3Neurology, Georgetown University Medical Center, Washington, DC - 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 "extraordinary altruism." The neural basis of this form of extraordinary altruism is not yet well understood. In the present study, we recruited altruistic living kidney donors and healthy matched controls and compared their neural responses to sympathy-eliciting and neutral scenarios during functional magnetic resonance imaging (fMRI). Scenarios were preceded by either subliminal neutral or fearful facial expression primes, following evidence that altruists may be more sensitive to fearful expressions than controls, and evidence that, following fearful expression primes, sensitivity to these expressions predicts sympathy and a desire to help in the laboratory (Marsh & Ambady, 2007; Marsh, Kozak, & Ambady, 2007). We also assessed altruists' ability to recognize emotional facial expressions in a separate behavioral task. During neuroimaging, subjects read scenarios depicting protagonists in either mildly distressing or neutral situations, each of which was preceded by four backward-masked fearful or neutral facial expressions, each presented for 27 msec and followed by a scrambled mask presented for 80 msec. After reading each scenario, subjects rated how much sympathy they felt for the protagonist via button press. During separate behavioral testing after scanning, subjects explicitly identified facial expressions of anger, disgust, fear, happiness, sadness, and surprise. Brain imaging data were analyzed using AFNI. We first computed whole brain contrasts comparing the effects of fearful versus neutral primes on responses to sympathyinducing scenarios (activation for sympathy-inducing scenarios preceded by a neutral expression was subtracted from activation for sympathy-inducing scenarios preceded by a fearful expression). Results showed that altruists exhibited increased activation in several regions implicated in affective decision-making, including cuneus, cingulate cortex, thalamus, and dorsal striatum (caudate). Supporting the role of dorsal striatum in sympathetic responding, we also found that activation in left caudate in response to sympathy-inducing scenarios preceded by fearful expressions predicted increased self-reported sympathy for the protagonists in these scenarios. In addition, the results of the emotion recognition task conducted outside the scanner indicated that altruists recognized fearful expressions more accurately than did controls, an effect that was specific to fear, and that recognition of fearful expressions in the behavioral task predicted activation in the left caudate in response to sympathy-inducing scenarios preceded by fearful primes during the imaging task. This association held within the altruist group, and was also specific to fear (recognition of other emotions did not predict caudate activation). Previous research has found the ability to recognize fearful expressions to be a significant predictor of sympathy in similar scenarios preceded by a

fearful, but not neutral primes (Marsh & Ambady, 2007). These results suggest that that, in response to stories of individuals in distress, extraordinary altruists may differentially recruit regions involved in reward processing and motivation while engaging in social decision-making. This pattern of results in demonstrated altruists may have important implications for understanding the roots of prosocial motivation and behavior, and for understanding the nature of extraordinary altruism.

#### H-02 \*SANS Poster Award Winner

TEASING APART SOCIAL PERCEPTION AND EPIGENETIC VARIABILITY WITH MULTIVARIATE PATTERN ANALYSES Tyler Santander, Jessica J. Connelly, & James P. Morris (University of Virginia) - Social perception is a complex phenomenon that lies at the heart of all interpersonal interactions-it allows us to infer the thoughts, goals, and beliefs of others; it can promote affiliative behaviors between individuals; and it can ameliorate feelings of isolation and emotional stress. Unlike many other critical aspects of cognition (e.g. memory), successful social perception is often exceedingly effortless, and the advent of noninvasive imaging technologies has now allowed us to begin teasing apart the neural mechanisms that support these behaviors. Toward that end, we employed functional magnetic resonance imaging (fMRI) in an effort to further distinguish between brain systems supporting various facets of social perception. Participants completed three tasks: 1) perception of animacy; 2) perception of biological motion; and 3) perception of emotional faces. Support vector machine (SVM) multivariate pattern classification was then used to probe the processing of social versus nonsocial information across the whole brain. The key strength of a multivariate approach such as SVM is that it is sensitive to spatially-distributed patterns of activation that may not be otherwise distinguishable by mean signal (cf. mass-univariate analyses). Here, classifiers for each task were trained to distinguish between experimental conditions and were tested using an iterative leave-onesubject-per-class-out procedure. Predictive performance was subsequently assessed using an iterative nonparametric permutation test. Across each task, the classifiers were able to significantly discriminate between social and nonsocial processes (balanced accuracies, BAC, all > 80%). While the most discriminative voxels appeared to overlap with areas commonly reported in univariate analyses, there appears to be behaviorally-relevant information across wide swaths of voxels that typically are not discriminable by mean signal. Moreover, a classifier was able to significantly discriminate between perception of animacy and perception of biological motion (BAC = 93.4%), even though peak voxels in univariate analyses demonstrate considerable overlap. Together, these results suggest that multivariate analyses may be an overall more sensitive method for investigating the neural mechanisms that support social perception. Future directions involve additional pattern recognition methods to determine how genetic factors thought to underlie social behavior may be predicted from distributed patterns of activity within an individual's

neural endophenotype. Preliminary findings using relevance vector regression (a sparse Bayesian learning technique for multivariate pattern recognition) indicate that whole brain patterns of activity for emotional face perception are significantly predictive of inter-individual variability in DNA methylation on the oxytocin receptor gene (OXTR). Given that the oxytocin system is wellknown to mediate various aspects of social behavior, these results are a promising first step towards decoding individual differences at the level of genetics from fMRI data.

#### H-03

NEURAL DISSOCIATIONS BETWEEN MEANINGFUL AND MERE INCONSISTENCIES DURING IMPRESSION UPDATING Peter Mende-Siedlecki (Princeton University) and Alex Todorov (Princeton *University*) - Recent work has attempted to characterize the neural bases of updating impressions of other people based on their behavior. Across two previous studies, we have identified a substantial network of regions-including dorsomedial prefrontal cortex (dmPFC), ventrolateral prefrontal cortex (vIPFC), superior temporal sulcus (STS), and temporoparietal junction (TPJ)-which respond preferentially to new information that runs contrary with initial impressions (Mende-Siedlecki, et al., 2013; Mende-Siedlecki, et al., in press). However, it remains unclear whether this activity reflects meaningful changes in impressions in response to attributionally relevant content, or surprise in response to mere inconsistency. We devised an fMRI experiment designed to address this gap in knowledge. Participants learned five consecutive pieces of behavioral information about a series of individuals. For each individual, the content of information on Trials 4 and 5 was inconsistent with the information presented on Trials 1 through 3. Critically, half of these individuals "meaningfully" inconsistent (with behavior were switching in character from either moral to immoral or immoral to moral), while the other half were "merely" inconsistent (with behaviors switching in a surprising, but not trait-relevant manner-for example, an individual previously described as going to bed at 6 P.M. in the evening suddenly going to bed at 3 A.M. in the morning). Left vIPFC and left STS responded preferentially to "meaningful" inconsistency-specifically when behaviors changed in character from moral to immoral, consistent with our prior work. However, bilateral TPJ responded preferentially when behavior changed in a "merely" inconsistent fashion. Within the context of impression updating, these results are potentially suggestive of a dissociation between regions involved in revising person representations in memory (vIPFC, STS) and regions involved in processing intentionality (TPJ). In addition, we combined across the present study and our two previous investigations of impression updating and assessed the degree to which activity associated with "meaningful" updating co-varies with self-reported behavioral tendencies and attitudes, vis-à-vis impression formation. We observed a negative correlation between left vIPFC activity during updating based on immoral behavior and the tolerance of self-reported learning behavior, such that participants who reported more rigid

learning behavior (i.e., "I rarely change my mind about people") recruited left vIPFC more strongly than those who reported more tolerant learning behavior. However, we observed a positive correlation between left vIPFC activity during updating based on moral behavior and endorsement of flexible attitudes regarding personality (i.e., "I believe that people can change"), such participants who endorsed more flexible attitudes recruited left vIPFC more strongly than those who endorsed more fixed attitudes regarding personality. Taken together, these results suggest that real-world differences in updating behavior predict differential activation of regions implicated in updating impressions.

#### H-04

DNA METHYLATION AND GENETIC VARIATION INTERACT AT THE OXYTOCIN RECEPTOR TO MODULATE BRAIN ACTIVITY ASSOCIATED WITH PERCEPTION OF EMOTIONAL FACE EXPRESSIONS Meghan H. Puglia, Department of Psychology, University of Virginia; Allison Jack, Child Study Center, Yale University; Jessica Connelly, School of Medicine, University of Virginia; and James P. Morris, Department of Psychology, University of *Virginia* - Social functioning is dependent upon cognitive and perceptual processes that are necessary for a range of skills, from identifying and reacting to social cues, to establishing and maintaining relationships. These abilities are highly variable across individuals, with some navigating the social world with ease, while others struggle or simply cannot build or maintain social relationships, seen in disorders such as the autism spectrum (ASD). Underlying this variability is a combination of genetic, epigenetic and neurobiological factors that give rise to complex social behavior. The research we describe here examines variability in brain activity as a potential endophenotype linking genetic and epigenetic variation to social behavioral differences. Prior work from our group established that differences in the level of DNA methylation at the oxytocin receptor locus (OXTR) in human typicals predict neural response during social perception. DNA methylation is an epigenetic modification that can result in changes in gene function through changes in gene expression. Here we investigate variability in level of DNA methylation of OXTR in the context of differing genetic background to determine how these genome differences may interact to impact neural systems supporting social behavior. We hypothesized that the effect of OXTR methylation on neural activity during a face perception task would differ depending on the genotype of a common polymorphism (rs53576) known to differentiate typical response to social stimuli. To test this hypothesis, 67 neurotypical volunteers submitted blood samples and were scanned while performing a common emotional face-matching task. DNA from peripheral blood mononuclear cells was bisulfite treated and pyrosequenced, and genotype and percent DNA methylation of our candidate site within OXTR was assessed. Whole-brain analysis revealed that DNA methylation differentially moderates brain response depending on OXTR genotype. Higher degrees of methylation for carriers of a risk allele predicted diminished response within bilateral dorsal anterior

cingulate, while the opposite was true of individuals who do not carry the risk allele. Future work will determine the impact of this novel genetic-epigenetic interaction on behavioral phenotype, potentially highlight the mechanism of its action, and help to further characterize typical and atypical social phenotypes. We suggests that this variability at the genetic and neural level will be predictive of overt behavioral variability.

#### H-05

#### TRAINING AND PREDICTING CHARITABLE **DONATION:** PSYCHOLOGICAL AND PRELIMINARY NEURAL MECHANISMS Yoni K. Ashar, Jessica R. Andrews-Hanna, Tal Yarkoni, Jenifer Sills, Sona Dimidjian, Tor D. Wager; University of Colorado, Boulder - Prosocial behavior is critical to a wellfunctioning society. Here, we describe translational research linking specific psychological motivators of prosocial behavior, operationalized as charitable donation, with a compassion-training intervention acting through those pathways. In Study 1, we used statistical learning to develop a model quantitatively predicting charitable donation from 8 emotions and attributions regarding the potential recipient. The model explained 42% of the variance in donation amounts. In Study 2, we compared a Compassion Meditation (CM) intervention to two active control conditions: a) a placebo Oxytocin spray, controlling for expectations of increased compassion and demand characteristics, and b) a familiarity training group. CM led to increased charitable donation relative to combined controls, and the model of emotions and attributions developed in Study 1 mediated this effect. We will additionally present preliminary analyses on the neural correlates of donation and on the effect of CM on brain function. We conclude that a translational approach integrating interventions with their underlying psychological and neural mechanisms holds promise for advancing our knowledge of prosocial motivation, behavior, and training.

#### H-06

PHYSIOLOGICAL RESPONSES TO FEEDBACK DIFFERENTIATE SOCIAL AND MONETARY **REWARDS** Victoria K. Lee1, Chaydaa R. Mohammed2, & Lasana T. Harris1,2; 1Department of Psychology & Neuroscience; 2Institute of Brain Sciences - Growing evidence suggests social and monetary reward processing are similar-social rewards (e.g. being labeled trustworthy, donating money to charity in the presence of others, and viewing smiling faces) engage brain regions that are also engaged for monetary reward (Izuma et al., 2008; 2010; Lin et al., 2012). However, social rewards are often preferred to nonsocial rewards, suggesting behaviorally these two types of reward are not the same. This disconnect may result from the simplified social context that can often result when studying social processes in the lab (Zaki & Ochsner, 2009). Here we study reactions to

social and monetary reward using a truly social rewardgroup membership in an esteemed social group. Using facial EMG, we measure reactions to positive and negative feedback in the zygomaticus major, orbicular oculi, and corrugator supercili muscles when receiving positive or negative social or monetary feedback. Participants were asked to decide which of three abstract paintings is most expensive in the money condition or is preferred by members of an esteemed social group, MENSA, in the social condition. Correct responses in the money condition implied the participant has a good eye for art and resulted in bonus money awarded at the end of the experiment. Correct responses in the social condition implied the participant had similar preferences as MENSA members, and perhaps deserving of membership in the group themselves. We observed valence dependent differences for the social and monetary conditions in the zygomaticus and corrugator muscles. These results suggest reactions to social and monetary reward differ and highlight the importance of the social context in studying reward.

# H-07

PERIPHERAL OXYTOCIN PREDICTS INDIVIDUAL VARIABILITY IN PERCEPTION OF ANIMACY Katie Lancaster1, C. Sue Carter2, Hossein P. Nazarloo2, Allison Jack3, Jessica Connelly4, and James P. Morris1; 1Department of Psychology, University of Virginia, Charlottesville, VA; 2Department of Psychiatry, University of North Carolina, Chapel Hill, NC; 3Child Study Center, Yale University, New Haven, CT; 4Department of Medicine, University of Virginia, *Charlottesville, VA* - Social perception is key to all human interaction; however, the neurobiology supporting social perceptual processes is poorly understood. One neuropeptide in particular- oxytocin-has generated significant recent interest due to its role in bonding and affiliative processes in mammals. Oxytocin has also been shown to influence perception in a prosocial manner when administered intranasally; however, the relationship between endogenous oxytocin and perception remains unknown. Accordingly, we sought to examine whether individual differences in peripheral (plasma) oxytocin could account for variability in neural activity underlying social perception. In the current study, we assessed fMRI BOLD response to perceptions of animacy of anthropomorphized shapes. Thirty-seven male participants underwent scanning and provided a blood sample for hormonal analysis. Across all participants, perception of animacy generated robust activations in superior temporal sulcus extending into lateral occipital cortex, inferior frontal gyrus, and medial prefrontal cortex (mPFC). Further, individual levels of peripheral oxytocin were significantly related to activation in areas of medial temporal gyrus, lateral occipital cortex, middle frontal gyrus, ventral mPFC and dorsal mPFC. Together these results suggest that peripheral oxytocin may be an important contributor to the neurobiological basis of social perception.

# H-08

# ELECTROENCEPHALOGRAPHIC CORRELATES OF

EMPATHIC ACCURACY Brett Velez, Northern Arizona University; Brandon Nelson, Northern Arizona University; Kimberly Anderson, Northern Arizona University; Chad Woodruff, Northern Arizona University - Research using neuroimaging techniques propose that the human mirror neuron system (hMNS) plays a role in empathic Mu-suppression processing. using electroencephalography (EEG) is suggested to be the activation of mirror neurons in the sensorimotor cortices. Previous work also shows that the ability to discriminate the self from other is critical in the role of empathizing with another person. Functional MRI results of empathic accuracy experiments suggest the hMNS may play a role in empathic processes (Zaki, Bolger, Oschner, 2008). The current experiment adapts the paradigm used by Zaki and seeks to support and extend the results with a different neuroimaging measure, EEG. We predict to see a relationship between self-other discrimination and empathic accuracy along with emotional expressivity, perspective-taking abilities, and affective empathy. Similar to Zaki's earlier research, preliminary results show a relationship between the targets' emotional expressivity and the perceivers' accuracy ratings.

# H-09

PERCEIVED WARMTH AFFECTS SOCIAL COGNITION DURING GAME PLAY R. McKell Carter(1,2\*), Micah Johnson (2), Sarah Danehower (2), and Michele T. Diaz (2); 1 - Psychology and Neuroscience, Duke University; 2 - Brain Imaging and Analysis Center, Duke University; \*Correspondence at: mckell.carter@gmail.com -Whether or not someone considers another person's thoughts and feelings depends on how they relate to them. Warmth is one particularly important dimension of personality that determines how we relate to other individuals. Previous work has shown that people are more likely to consider the thoughts and feelings of another person if they perceive that individual as warm. Here we seek to extend that work to a competitive domain by showing that creating a view of another as either warm or cold changes the extent to which we consider their mental processes. We also hypothesize that brain regions underlying these interactions, like the temporal parietal junction, will be modulated by the perceived warmth of the opponent. We asked participants to play a simplified poker game during function magnetic resonance imaging (fMRI) against two opponents, characterized as either a warm or cold person by statements that appear below their picture. We used combinatorial pattern classification techniques to identify portions of the brain that differentiated bluffing from folding, contrasting patterns of activation elicited by the warm and cold opponents. Participants bluffed a significant portion of the time against both opponents. Regions of the brain thought to be involved modeling others mental processes predicted bluffing, including the medial and dorsolateral prefrontal cortices as well as a region in the temporal parietal junction. Combinatorial analysis shows that these regions did not equally contribute to bluffing. The perceived warmth of the opponent also modulated bluff prediction. The perceived warmth of the opponent modulated competitive interaction and the engagement of social cognitive regions of the brain. This work was supported by NIMH R01-070685, NIA R01-034138 and by NINDS P01-41328.

# H-10

DIFFERENCES IN THE EARLY VISUAL ELECTROPHYSIOLOGICAL RESPONSE TO FACES DURING TRUST APPRAISALS IN HIGH VS. LOW **BPD-TRAIT GROUPS** *Bibi, R.\*,\*\*, Melara, R.\*,\*\*, Sullivan, K.\*\*, Mitchell, P.\*, Shevorykin, A.\*\*, Skiba, R.\*\*, John, G.\*\*,* Kodra, A.\*\*, Edelman, J.\*,\*\*, & Fertuck, E.\*,\*\*; \* The Graduate Center, CUNY; \*\* The City College of New York, CUNY- As a fundamental emotional stimulus, facial expression conveys important information in social exchange. Individuals who suffer with Borderline Personality Disorder (BPD) have shown difficulty interpreting emotions in speeded tasks (Dyck et al., 2009). They are also more likely to be biased to interpret neutral faces as negative and exhibit longer response times to ambiguous faces (Fertuck, Grinband, & Stanley, 2013). The present study investigates the neural substrates underlying negative biasing and difficulties in interpreting facial trait expressions in individuals with BPD features using eventrelated potentials (ERPs). A novel EEG paradigm we developed for trait appraisal research that incorporates implicit social learning of trust was employed. The paradigm includes trait appraisals to faces parametrically varied along a trust dimension before and after learning ambiguous, negative, positive, and mixture of positive and negative traits associated with a particular Identity (face). We used this paradigm to compare trust appraisals in a non-clinical sample of undergraduate students grouped with "high BPD traits" (n=10,PAI-BPD M= 38.4, SD =3.9) vs. "low BPD traits' (n=9, PAI-BPD M=12.3, SD =8.1). The high BPD trait group exhibited a response bias to rate the untrustworthiness of facial stimuli higher, F(1,17) = 8.1, p<. 01 compared to the low BPD trait group. We found ERP evidence for differences in early cortical visual perception in the high vs. low BPD trait groups. In line with previous studies that show subtle deficits in visual perception might be related to impairment in interpersonal communication and negative biases in BPD.

# H-11

THE IMPACT OF CHILDHOOD EXPERIENCE ON AMYGDALA RESPONSES TO PERCEPTUALLY FAMILIAR BLACK AND WHITE FACES Tianyi Li, University of Chicago;; Jasmin Cloutier, University of Chicago;; Joshua Correll, University of Colorado Boulder.-Given the well-documented involvement of the amygdala on race perception (Kubota et al., 2012), the current study aimed to investigate how interracial contact during childhood shapes amygdala responses to racial out-group members in adulthood. Given the dearth of research directly examining the impact of familiarity on race perception, the current study also aims to directly explore the role of perceptual familiarity. Of particular interest was the impact of childhood experience on responses to perceptually familiar, compared to novel, Black faces. More generally, the current study has the potential to inform how perceiving others in terms of unique

characteristics (i.e., differentiating individuals based on idiosyncratic features beyond those associated with a particular social category) may contribute to effective prejudice reduction. White participants between the ages of 19 and 34 years (N=45; Mean Age=24.2 years; 24 female) went through an individuation task that familiarized them with 10 Black and 10 White faces (see Lebrecht et al., 2009). Participants took part in an eventrelated fMRI session while viewing forty unique faces (10 familiar Black, 10 familiar White, 10 novel Black, and 10 novel White). Consistent with the long-standing idea that individuation, rather than categorically construing individuals based on their social group of belonging, minimizes prejudice (Brewer, 1988; Fiske and Neuberg, 1990), the obtained results suggest that perceptual familiarity diminishes amygdala activity when perceiving Black faces. More interestingly, this reduction in amygdala responses to familiar Black faces is magnified by childhood interracial contact. Specifically, controlling for a number of well-established individual difference measures related to interracial attitudes (e.g., implicit and explicit prejudice, internal and external motivation to respond without prejudice, etc.), White perceivers with more childhood exposure to racial out-group members (i.e., Black adults and peers) display greater relative reduction in amygdala responses to familiar Black faces, as compared to novel Black faces. Notably, including the extensive measures of racial attitudes as covariates in the model, the association between interracial contact and reduced amygdala responses to familiar Black faces cannot easily be accounted for by attitudes or motivational processes. A similar pattern is not found for White faces. These results suggest that interracial contact during childhood enhances the efficiency of perceptual familiarity training in prejudice reduction. The implications of such findings are discussed in the context of previous investigations into the neural substrates of race perception and in consideration of potential mechanisms by which childhood experience may shape race perception. Nonetheless, being the first study attempting to examine the impact of childhood experience on race perception in adulthood, further investigations are required to understand how childhood exposure and familiarity interact during race perception.

# H-12

# FORMING IMPRESSIONS OF OTHERS VARYING ON FINANCIAL AND MORAL STATUS Ivo Gyurovski (University of Chicago); Jasmin Cloutier (University of Chicago)- Status-based Person Evaluation Social hierarchies are the basis of many non-human and human

societies. Asymmetries in social status typically underlie these hierarchies and individuals with higher social status have been suggested to elicit positive evaluations from conspecifics (Fiske 2010; Magee & Galinsky, 2008). Following up on our previous findings suggesting that the human ventromedial prefrontal cortex [VMPFC] is preferentially recruited when forming impressions of targets with vocational occupations indicative of high moral status (Cloutier et al., 2012), we were interested to further examine how distinct dimensions of social status impact the neural substrates of person perception.

Existing evidence suggests that while wealth may confer high status, it can also lead to negative evaluations (Fiske et al., 2002; Ribstein, 2009). In contrast, high moral status, which habitually confers respect (Boehm, 2012; Yzerbyt & Demoulin, 2010), consistently leads to positive evaluations. Thus, the current study was designed to further test the hypothesis that evaluative responses to targets varying in social status are dependent upon the social dimensions along which status is inferred (Cloutier et al., 2012). To do so, we focused on VMPFC activity during impression formation of individuals varying on distinct dimensions of social status. In an fMRI experiment, participants were presented with faces associated with either a low, average, or high financial status, or a low, average, or high moral status. Participants were asked to form an impression of each target, but were not instructed to explicitly evaluate them based on their social status. The obtained results indicate greater VMPFC activity to targets with higher compared to lower moral status and greater response to targets with lower compared to higher financial status. Given that the VMPFC has been previously implicated in person evaluation and the generation of affective meaning (Mende-Siedlecki, Said, & Todorov, 2013; Roy, Shohamy, & Wager, 2012), such findings further suggest that high status does not necessarily lead to positive evaluations and that the dimension from which status is inferred influences how perceivers evaluate others (Cloutier et al., 2012). The implications of these results are discussed with an emphasis towards better understanding the impact of social status on social cognition and uncovering the neural substrates of person evaluation. In conjunction with additional research on the topic (Chiao et al., 2009; Cloutier & Gyurovski, 2013; Yamakawa et al., 2009), these findings suggest the existence of a possible network of brain regions (including the IPS) involved in assessing the relative positions of conspecifics varying in social status.

# H-13

AMYGDALA ACTIVATION DURING SYMPATHIZING AS A FUNCTION OF CALLOUS-**UNEMOTIONAL TRAITS** Elise M. Cardinale, Leah M. Lozier, Sarah A. Stoycos, Abigail A. Marsh; Georgetown University - Callous-unemotional (CU) traits represent the emotional and interpersonal traits characteristic of adult psychopathy including lack of guilt, shallow affect, lack of concern for the wellbeing of others and deficits in responding to fear-related stimuli. Research examining the neural correlates of CU traits has consistently found evidence for amygdala hypoactivity in response to emotionally evocative stimuli such as fearful facial expressions. Until recently, studies have conflated the effects of conduct problems and CU traits. Recent evidence suggests that callous-unemotional traits may moderate the relationship between conduct problems and amygdala activity with high CU traits and conduct problems resulting in hypoactivation while low CU traits and conduct problems result in hyperactivation of the amygdala in response to fearful expressions. The present study examined the effects of subliminal fear priming on sympathizing in children, ages 10-17, with varying

degrees of externalizing conduct problems and CU traits as assessed by the Inventory of Callous and Unemotional Traits (ICU). Previous research has found that priming individuals with fearful facial expressions increases sympathy for others. We aimed to examine whether this same effect could be observed in adolescence with behavior problems and varying degrees of CU traits and if differences in sensitivity to fear primes as well as differences in underlying neural correlates predict sympathizing or aggressive behavior. Each participant completed an fMRI scan during which they read scenarios describing characters in either distressing or neutral scenarios. Before each scenario, participants were subliminally primed with either fearful or neutral faces. Participants were instructed to indicate how much sympathy they felt for the character described in each. We found that children with conduct problems and high levels of CU traits showed amygdala hypoactivity during sympathizing when primed with fear facial expressions while children with conduct problems but low CU traits showed amygdala hyperactivity in comparison to controls. Furthermore, amygdala activity was negatively associated with self-reported proactive aggression, aggression for the sake of achieving a goal, but not reactive aggression, aggression in response to threat or provocation. We also found that the Uncaring subscale of the ICU was strongly predictive of amygdala activity, while neither the Unemotional nor Callous subscales were. Additionally, children with low CU traits and conduct problems responded with the highest levels of sympathy for the character when primed with fear expressions. Other significant brain regions that were revealed through an interaction between group and condition in a whole brain analysis were the inferior parietal lobule, cingulate gyrus, precuneus and middle frontal gyrus. These findings indicate that in a sample of adolescents with serious conduct problems, CU traits are associated with amygdala activity during sympathizing following fear priming supporting the link between CU traits, fear processing deficits and amygdala hypoactivity. Amygdala hyperactivation and increased sympathizing following fear priming in children with conduct problems and low CU traits indicate a possible area for behavioral rehabilitation. Furthermore, our findings suggest that hypoactivity of the amygdala during sympathizing is predictive of increased instrumental aggression in adolescence.

# H-14

THE NEURAL ORGANIZATION OF PERSON KNOWLEDGE Mark A. Thornton, Harvard University; Jason P. Mitchell, Harvard University - Understanding the enduring characteristics of individual people plays a crucial role in human social life. Social and personality psychology have suggested several dimensions along which knowledge about others might be organized. These include basic social categories, personality, egocentrism, relationships, and stereotyping. However, do real-world perceivers actually use all of these dimensions to characterize others? The current study employed functional magnetic resonance imaging (fMRI) and multivoxel pattern analysis to discover whether and

where different types of person knowledge are represented in the brain. Participants first provided a list of 40 people who they knew personally and rated each person on 16 scales falling into the five models of the social world described above. Basic social categories included age, race, and sex; personality was assessed on the Big Five dimensions; egocentrism was measured in terms of similarity, familiarity, and liking; relationships types were based on relational models theory constructs of equity, sharing and authority; and stereotypes were measured on warmth and competence, the dimensions of the stereotype content model; and similarity was measured on the basis of a behavioral task in which participants indicated which of two targets was more similar to a third. A subset of 20 people was selected by an algorithm designed to maximize interpersonal variance across all five models. Finally, during fMRI scanning participants engaged in an episodic simulation task in which they imagined each of the 20 people in six common scenarios (e.g. buying groceries). Patterns of brain activity corresponding to each of the people were generated using the general linear model. A searchlight analysis was used to generate neural similarity matrices between people for each voxel in the brain. These similarity matrices were then compared to matrices based on the aggregate theoretical models described above and their individual dimensions. A wide array of brain regions were associated with individual dimensions, suggesting that different dimensions of person knowledge are indeed coded throughout the brains of perceivers.

# H-15

INDIVIDUAL DIFFERENCES IN ESCAPE/AVOIDANCE BEHAVIOR IN HUMANS: EMPIRICAL FINDINGS AND A COMPUTATIONAL MODEL J. Sheynin 1,2,3, K.D. Beck 1,2,3, K.C.H. Pang 1,2,3, R.J. Servatius 1,2,3, C.E. Myers 2,3; 1 Joint Biomedical Engineering Program, New Jersey Institute of Technology and Graduate School of Biomedical Sciences, Rutgers, The State University of New Jersey, Newark, NJ; 2 Department of Veterans Affairs, VA New Jersey Health Care System, East Orange, NJ; 3 Stress & Motivated Behavior Institute, Department of Neurology and Neurosciences, New Jersey Medical School, Rutgers, The State University of New Jersey, *Newark*, *NJ* - Normally, avoidance behavior is an adaptive behavior, which can protect individuals from aversive events. However, exaggerated avoidance can be detrimental and can result in the development of psychopathologies such as anxiety disorders. Crucially, individual differences, including those associated with anxiety vulnerability, might affect individuals' propensity to acquire and express avoidance behavior. In the present project, we evaluated the relationship between personal characteristics and avoidance learning in undergraduate students. In the first study, students (N=102) were tested on a computer-based task in which they could learn to escape or avoid an on-screen aversive event. Warning signals that were predictive of the aversive events, as well as other non-threat signals were included. Subjects were also given the Tridimensional Personality Questionnaire (TPQ), which assesses several aspects of personality, and includes an assessment of harm avoidance (HA), a

tendency to respond intensely to signals of aversive stimuli. Results demonstrated that HA was associated with higher rates of avoidance responses (AR) in the current paradigm. Furthermore, while males and females avoided at the same rate, females showed longer AR durations. In a second study, we tested whether manipulating the saliency of the non-threat signal, would affect escape-avoidance acquisition. Students were randomly assigned to a testing condition with or without a salient non-threat signal (n=61 per group). Results showed that while the addition of a salient non-threat signal eliminated the sex difference on AR durations, it is only the condition with the non-threat signal that showed HA differences on AR rates. Taken together, findings suggest that sex differences on AR durations are sensitive to the saliency of non-threat signals (and disappear when saliency is high), while HA differences on AR rates are dependent on the presence of non-threat signals (regardless of saliency). These results were further investigated using a reinforcement learning model with an actor-critic architecture. Several model parameters (e.g., exploration/exploitation tendencies) were found to potentially account for the described empirical data. Overall, this work sheds light on the mechanisms underlying avoidance behavior in humans, which in turn may suggest new methods to facilitate the prevention, diagnosis and treatment of pathological avoidance.

#### H-16

HEURISTIC DECISION MAKING: A MEMORY-BASED PROCESS MODEL INCORPORATING **RECOGNITION AND FLUENCY** Shane R. Schwikert, Tim Curran; University of Colorado-Boulder - Simple heuristics have been shown to facilitate the interplay between memory and judgment processes by exploiting fundamental cognitive abilities. The recognition heuristic states that, when choosing between a recognized item and an unrecognized item, choose the recognized item. Relatedly, the fluency heuristic states that when two items are recognized; choose the item that is recognized more quickly (retrieved more fluently). Both these heuristics are prime examples of shortcuts that make the most of an automatic by-product of retrieval from memory in order to make guick decisions. In an initial experiment, we used a modified city-size and country-size comparison task (known collectively as 'regions') while recording eventrelated potentials (ERPs) to investigate the potential contributions of familiarity and recollection to the two heuristics. ERPs were markedly different for recognition heuristic-based decisions and fluency heuristic-based decisions, suggesting a distinct role for familiarity in the recognition heuristic and a distinct role for recollection in the fluency heuristic. In a follow-up behavioral experiment, we coupled a remember-know procedure with a region-size comparison task to obtain more accurate measures of perceived memory for each region in the task. Although current literature suggests the fluency heuristic relies on retrieval fluency (recognition speed) in isolation, our results suggested retrieval fluency is confounded with recollection of further information. Furthermore, multi-level modeling suggested that both

sources of information contribute differentially to fluency heuristic-based decisions. We conclude that there is no need for the two separate heuristics as they are traditionally defined, and instead an all-encompassing heuristic based on perceived memory differences between two items would be more practical. By our theory, when two items differ greatly in their perceived memory (an unknown item vs. a well-remembered item) individuals can utilize an early and more coarse familiarity signal to make a decision. Conversely, when two items are similar in their perceived memory, familiarity differences are not robust enough to make a reliable decision, and individuals must resort to more effortful recollection processes in order to make a decision.

#### H-17

THE NEURAL MECHANISMS OF FREEZE AND THE FREEZE-FIGHT TRANSITION Thomas Gladwin, Donders Institute for Brain, Cognition and Behaviour, Radboud University Nijmegen.; Vanessa van Ast, Donders Institute for Brain, Cognition and Behaviour, Radboud University Nijmegen.; Mahur Hashemi, Donders Institute for Brain, Cognition and Behaviour, Radboud University Nijmegen.; Erno Hermans, Donders Institute for Brain, Cognition and Behaviour, Radboud University Nijmegen.; Karin Roelofs, Donders Institute for Brain, Cognition and Behaviour, Radboud University Nijmegen.; - When confronted with a threat, humans and other animals may show a cluster of behavioral and physiological changes termed freeze. Freeze is associated with immobility and parasympathetic activation, expressed for instance as heart rate deceleration and a reduction in body sway. However, underlying this immobility is an attentive, prepared readiness to execute fight or flight responses. Relatively few investigations of the neural mechanisms of freeze have been performed in humans. An important first study used a passive viewing paradigm to demonstrate the of amygdala-periaqueductal involvement gray connectivity in threat-related heart rate deceleration. We aim to build on this work, first, by controlling the ability to actively prepare to avoid threat. We expect that freeze will be found most strongly in the active condition, compared to a helpless state of threat anticipation. Second, we aim to study the transition from freeze to the execution of a fight response. To these aims, we developed a Freeze-Fight task in which subjects were confronted with risky versus safe opponents, and in which they were armed or unarmed. Both types of opponent could draw a gun and attempt to shoot the subject, or take out a mobile phone. If the subject was armed, they could attempt to shoot the opponent after he had drawn a gun. With risky opponents, being shot in the game was associated with an actual aversive stimulus (electric shock). The task was performed during fMRI scanning. We will present results concerning the effects of the task conditions on freeze, and on the neural activity and connectivity associated with freezing and the freeze to fight transition.

#### H-18 \*SANS Poster Award Winner

SOCIAL NETWORKS AND SOCIAL SHARING:

NEURAL, LINGUISTIC AND ONLINE SOCIAL NETWORK MEASURES HELP US UNDERSTAND THE PSYCHOLOGY OF RECOMMENDATIONS AND **INFORMATION DIFFUSION** Matthew Brook O'Donnell (University of Pennsylvania); Chris Cascio (University of Pennsylvania); Joe Bayer (University of Michigan); Emily B. Falk (University of Pennsylvania) - What makes people want to share particular ideas? What makes some people more effective at persuading others about an idea and thereby contributes to the broader propagation of the idea? How does the broader social environment affect how people make recommendations? The new media environment has increased our daily exposure to novel ideas and provided greater opportunities for sharing these ideas with others. It has also offered unprecedented access to a written record of social network ties and linguistic patterns of sharing that can now be leveraged to understand the social and psychological processes involved in making recommendations and successful idea propagation. In this talk, we describe results from a series of studies that illustrate how computational tools from social network analysis and linguistics can complement neural measures in answering core questions in social and affective neuroscience and psychology. Social network analysis (SNA) provides measures for quantifying the social and psychological components of individuals' broader social environments (e.g., their connections to others and opportunities to exert social influence). As one example of how SNA can complement neuroscience data, we examined how social network position (the extent to which an individual is a hub in their social network) relates to neural processes involved in making effective recommendations. Using 54 ego-networks scraped from adolescent male Facebook users' online accounts we quantified the extent to which they serve to connect the groups of friends in their network. In this study, teens who connect more different groups of friends show increased activity in the mentalizing system when making recommendations and receiving social feedback about their recommendations. The mentalizing system is also associated with successful message propagation and being a good "idea salesperson". Taken together, these results suggest one possible pathway through which social position produces and/or is produced by interactions at the individual level. To further understand the content of these interaction, we turn to computational linguistics. As examples, we made use of two kinds of quantitative linguistic analysis, 1. categorical word counts (i.e., Pennebaker's LWIC) and 2. supervised machine learning sentiment analysis. We found that exposure to ideas containing more social words produced greater activity in mentalizing regions, specifically the right temporal parietal junction (rTPJ), during initial exposure. Next, neural activity extracted from a functional ROI network including rTPJ, MPFC and PC/PCC, predicted (using a multilevel logistic regression) the type of language that participants subsequently used to describe stimuli. More specifically, increased activity in these regions was associated with using more positive language, as classified by the automatic sentiment analysis of the language produced by subjects describing and recommending the stimuli. Taken together, these results suggest linguistic pathways that may link initial

neural activity associated with being a good idea salesperson to actually bringing another person on board with one's preferred ideas. In this talk, new insights regarding the psychological and neurocognitive mechanisms of social influence will be used to illustrate the broader opportunities that these methods afford to the field.

# H-19

FREEZING AND VISUAL PERCEPTION Maria Lojowska1,2, Thomas Gladwin1,2, Erno Hermans2,3, Karin Roelofs1,2; Maria Lojowska(1,2), Thomas Gladwin(1,2), Erno Hermans (2,3), Karin Roelofs (1,2); (1)Behavioural Science Institute, Radboud University Nijmegen, The Netherlands ; (2) Donders Institute for Brain, Cognition and Behaviour, The Netherlands; (3)Radboud University Nijmegen Medical Centre, The Netherlands- On encountering a threat, humans tend to show an evolutionarily preserved freeze reaction characterized by immobility and heart rate deceleration. Freezing has been conceptually framed as a mechanism to prevent from being spotted by a predator, thereby to increase chances of survival(1). Because freezing usually takes place in situations where a threat is ambiguous, one of its evolutionary benefits should be the modulation of visual processes in such a way that features important for threat detection can be detected better. Given that discrimination of coarse visual features is particularly relevant for fast threat detection, we predict that freezing facilitates visual sensitivity for low-spatial frequency targets (LSF) as compared to high-spatial frequency targets (HSF) containing detailed visual information. To test this hypothesis, we used a visual discrimination task in which participants had to determine the orientation of presented LSF and HSF gratings (i.e. Gabor patches) under threat of shock vs. no shock condition. Threat of shock was used to induce freeze reactions assessed through decelerations of heart rate. The orientation of gratings on each condition was adjusted by an adaptive staircase procedure(3). Perceptual performance was measured by an angular threshold required to perform at 75% accuracy for each condition. Our pilot data confirmed that heart rate deceleration can be reliably induced using threat of electric shock. The results of the complete study will be presented.

# H-20

THE ROLE OF THE MEDIAL FRONTAL CORTEX IN THE MAINTENANCE OF EMOTIONAL STATES Christian E Waugh, Wake Forest University; Maria G. Lemus, Stanford University; Ian H. Gotlib, Stanford University -Although people are able to maintain emotions well beyond the duration of the eliciting stimulus, the mechanisms that underlie this maintenance of emotions have not been elucidated. In two studies, we examined whether people maintain emotional states 'actively,' with explicit elaboration of the emotion, or 'passively', without elaboration. In the first, behavioral, study, 40 participants completed an emotional working memory task in which they were presented with pairs of pictures (either positive or negative) and were instructed either to maintain the emotional intensity from the first picture to compare to that of the second picture ('maintain' condition), or to only rate the emotional intensity of their response to the second picture ('non-maintain' condition). After the task, participants viewed the pictures again and rated them with respect to emotional intensity. In support of the 'active' maintenance hypothesis, participants recalled their emotional responses on the maintenance trials as being of higher intensity than their emotional responses on non-maintenance trials. In the second, fMRI, study, 24 participants completed the same affective maintenance task while their BOLD signal was assessed. We used inverse logit analyses to extract the duration and magnitude of participants' BOLD responses to the first picture of each set. Supporting the 'active' maintenance hypothesis, when maintaining vs. not maintaining emotion, participants exhibited increased height and width of activation in the dorsal medial frontal cortex (MFC) and lateral prefrontal cortex, regions associated with explicit emotion generation and manipulation of contents in working memory, respectively. Supporting the 'passive' maintenance hypothesis, however, when viewing negative emotional pictures (vs. neutral pictures) that were not explicitly maintained, participants exhibited greater duration of activity in the rostral MFC, a region associated with implicit emotion generation. Supported by behavioral findings, this evidence that people maintain emotional states both naturally in the rMFC and strategically in the dMFC may be critical for understanding normal as well as disordered emotion regulation.

# H-21

# THE EFFECT OF THREAT ON VISUAL SELECTION M. Mulckhuyse, Experimental Psychology, Helmholtz Institute, Utrecht University, Utrecht, The Netherlands; E.S. Dalmaijer, Experimental Psychology, Helmholtz Institute, Utrecht University, Utrecht, The Netherlands; L. Kenemans, Experimental Psychology, Helmholtz Institute, Utrecht University, Utrecht, The Netherlands- Emotional stimuli, such as threatening stimuli, are known to influence visual selection. However, how and when these stimuli modulate visual selection is not yet clear. For example, one theory argues that threatening stimuli are processed automatically and affect visual selection very rapidly via a subcortical pathway, whereas another theory argues the opposite. This theory states that threatening stimuli are not processed automatically or faster than other visual salient stimuli and affect visual selection via cortical connections. In the current study we measured eye movement behavior to index the time-course of emotional modulation of distractors on visual selection. Observers made a speeded saccade to a neutral target stimulus while visually salient distractor stimuli were presented. We used a differential fear-conditioning procedure to present a threatening (CS+) or a non-threatening distractor (CS-). The results showed that the threatening distractor affected the oculomotor system and modulated the timecourse of correct saccades: short saccades latencies were not modulated by threat whereas longer saccade latencies were. That is, saccade latency increased in the presence of threat suggesting delayed disengagement from the threatening distractor. In addition, the threatening

distractor captured the eyes more often than the nonthreatening distractor indicating stronger competition of the threatening distractor. However, threat did not affect latency of these automatically driven error saccades. The present findings reveal the modulation of threatening distractors on visual selection and suggest that threatening stimuli are prioritized in visual selection, although they are not processed faster than nonthreatening visually salient stimuli.

# H-22

EXERCISING SELF-CONTROL **INCREASES** RELATIVE LEFT FRONTAL CORTICAL **ACTIVATION** Adrienne Crowell ; Texas A&M University; Brandon J. Schmeichel ; Texas A&M University; Eddie Harmon-Jones ; The University of New South Wales - The current research assessed patterns of electrical activity in the frontal lobes following an effortful self-control task to illuminate the motivational consequences of exercising self-control. We considered competing predictions. One prediction is that exercising self-control increases relative right frontal activation and is consistent with research based on revised reinforcement sensitivity theory (Corr, 2008; Gray & McNaughton, 2000), which proposes that behavior is under the guidance of three underlying neurobiological systems. One system (BIS) is sensitive to response conflict, enables response inhibition, and has been linked to relative right cortical activation (Shackman et al., 2009; Sutton & Davidson, 1997; cf. Coan & Allen, 2003; Hewig et al., 2006). Insofar as BIS contributes to selfcontrol, exercising self-control should increase relative right-frontal cortical activation. The other prediction is that exercising self-control increases relative left frontal activation and is consistent with the limited resource model of self-control (Muraven & Baumeister, 2000), which proposes that exercising self-control consumes and temporarily depletes a limited inner resource. Accordingly, as the capacity for self-control becomes depleted, activity in brain regions that underlie selfcontrol (i.e., right ventrolateral prefrontal cortex) should be reduced. Evidence further suggests that a reduction in the capacity for self-control is associated with a concomitant increase in approach motivation (e.g., Schmeichel, Harmon-Jones, & Harmon-Jones, 2010), which portends a temporary increase in relative left frontal activation following self-control. In the current experiment, we assessed resting EEG activity before and after participants wrote a story that did (controlled writing condition) versus did not (free writing condition) require them to exercise self-control. We also examined potential moderating effects of self-reported BIS and BAS sensitivity, respectively. An average frontal index (AF3/4, F1/2, F3/4, F5/6, F7/8) was created for each resting period, and pre-manipulation and post-manipulation asymmetry indices were calculated (natural log right minus natural log left). To gauge the effect of the writing manipulation on prefrontal cortical activity, we computed the residual value of post-manipulation asymmetric activity from a regression including pre-manipulation asymmetric activity as a predictor. A regression analysis of the residual asymmetry score on BIS, BAS, writing condition and their interactions revealed a significant interaction between BIS and writing condition. Specifically, among participants lower in BIS, completing the self-controlled writing task increased relative left frontal cortical activity compared to completing the free writing task. The effect of writing condition was not significant among participants higher in BIS. These results support the prediction that exercising self-control leads to an increase in left frontal cortical activity, especially for those lower in BIS, who are lower in punishment expectancies. One possibility is that people high in BIS may not spontaneously engage left frontal resources after depletion because they expect and worry about ensuing punishments. Insofar as greater left than right frontal activity is related to increased approach motivation, the results could help to explain why people who have exercised self-control on one task more often fail at subsequent self-control tasks. The increase in approach motivation could be leading people to forgo control in favor of salient approach-related rewards.

# H-23

EMPATHY LEVELS MODULATE PSTS ACTIVITY DURING HUMOR PROCESSING OF PAINFUL STIMULI Carlos Cardenas-Iniguez, Department of Psychology, University of Chicago; Jasmin Cloutier, Department of Psychology, University of Chicago; William M. Kelly, Department of Psychological and Brain Sciences, Dartmouth College; Todd F. Heatherton, Department of Psychological and Brain Sciences, Dartmouth College- The current study investigated the neural correlates of humor processing, particularly when accompanied by perception of pain, also known as 'proto-humor' (Gervais & Wilson, 2005; Vrticka et al., 2013). Forty-five participants (22 women, mean age: 22 years) took part in an event-related fMRI session during which they passively watched video clips depicting humorous events of a painful nature. After the scanning session, participants rated how funny they perceived the videos to be, and these ratings were used in a parametric random-effects analysis. To investigate the mediating role of empathy in processing humor in the presence of physical pain, participants also completed the Empathy Quotient scale (EQ ; Baron-Cohen and Wheelwright, 2004). Converging with previous findings, parametric analyses of functional imaging data showed increased activity in right posterior superior temporal sulcus (pSTS) with increasing judgments of humor, a region previously shown to be involved in humor comprehension (Hutcherson et al., 2005; Franklin & Adams, 2011). In addition, individual differences in empathy level significantly predicted increased right pSTS activity associated with perceived humor. We also present preliminary functional connectivity results between right STS and other regions associated with humor processing. The results provide additional evidence for the involvement of the right posterior STS in humor processing and offers some insights into the differential impact of empathy on some of the neural processes underlying the processing of humor and physical pain.

# H-24

DEALING WITH DISTRESSING THOUGHTS:

NEURAL CORRELATES OF REGULATING THE INTERNAL IMPACT OF EMOTIONAL **DISTRACTION ON WORKING MEMORY** Alexandru D. Iordan, Gina Giase, Yuta Katsumi, Sanda Dolcos, & Florin Dolcos; University of Illinois at Urbana-Champaign Previous investigations of the impact of task-irrelevant emotions on cognitive processing have used external distractors, such as negative (unpleasant) pictures. However, it is not clear how internal emotional distraction, such as recollection of negative autobiographical memories (AMs), which resemble distressing thoughts that occur during rumination in depression, produces similar effects on ongoing cognition. Specifically, it is not clear whether recollection of taskirrelevant negative AMs impairs cognitive performance in healthy behavior, and what the neural correlates of the response to, and coping with, such internal distraction are. These issues were investigated using a dual WM maintenance-AM recollection task, which also included manipulation of attentional focus during AM recollection (Context versus Emotion), as an emotion regulation strategy, in conjunction with fMRI recordings. Preliminary behavioral results show that focusing on nonemotional contextual aspects of AMs, compared to focusing on emotion, is associated with reduced experience of emotion and increased WM performance. Preliminary fMRI results show that focusing on nonemotional contextual aspects is associated with sustained dorsolateral prefrontal cortex activation and reduced amygdala activity. Collectively, these results suggest that focusing away from emotion during the recollection negative events may be an effective regulation strategy that reduces the impact of distressing thoughts on ongoing cognition. These findings from healthy participants have relevance for clinical research, as rumination on negative thoughts has been linked to emotional dysregulation and susceptibility to affective disorders, whereas the ability to resist distressing thoughts has been linked to resilience to emotional disorders.

# H-25

SEX DIFFERENCES IN OXYTOCIN EFFECTS ON FEAR-CONDITIONING Vanessa A. van Ast 1,2, Anna E. Kunze 3, Nik Papaloukas 3, Karin Roelofs 1,2, Merel Kindt 3; 1 Behavioural Science Institute, Radboud University Nijmegen, Nijmegen, The Netherlands; 2 Donders Institute for Brain, Cognition and Behaviour, Radboud University Nijmegen, Nijmegen, The Netherlands; 3 Department of Clinical Psychology, University of Amsterdam, Amsterdam, The Netherlands - Animal research has implicated oxytocin in the down-regulation of fear expression. If so, oxytocin may be used as an adjunct to treatment of anxiety disorders in humans. However, no studies so far have investigated effects of oxytocin on the expression of fear in emotional learning and memory. Models of the pathogenesis of anxiety disorders further incorporate sex as an important vulnerability factor, but the majority of oxytocin studies tested only male participants. Taken together, in humans, it is presently unknown whether 1) oxytocin affects the expression of fear, 2) if possible effects are subsequently maintained, and 3) whether sex possibly

plays a moderating role in these relationships. In a between-subjects, double-blind, placebo-controlled study, we examined acute and long-term effects of oxytocin on the physiological expression of fear by administering oxytocin prior to differential fear conditioning. The next day, retention of the fear-conditioned responses was assessed by means of extinction and reinstatement procedures. Physiological expression of fear was measured by fear-potentiated startle, skin conductance, and heart rate. Our findings indicate that oxytocin administered before fear acquisition attenuated fearpotentiated startle responses and deceleration heart rate during fear acquisition, but did not abolish fear learning. These effects were specific for female participants. No long-term effects of oxytocin were observed whatsoever. The results of the present study imply that oxytocin could indeed be used to attenuate immediate, but not long-term, physiological fear responses in women.

# H-26

INDIVIDUAL DIFFERENCES IN BODILY FREEZING PREDICT EMOTIONAL BIASES IN DECISION MAKING Verena Ly 1,2, Quentin Huys 4,5, John F. Stins 6, Roshan Cools\* 2,3 and Karin Roelofs\* 1,2; 1 Radboud University Nijmegen, Behavioural Science Institute, Nijmegen, The Netherlands; 2 Radboud University Nijmegen, Donders Institute for Brain, Cognition, and Behaviour, Centre for Cognitive Neuroimaging, Nijmegen, The Netherlands-Instrumental decision making has long been argued to be vulnerable to emotional responses. Yet the precise nature of these emotional influences remains unclear. Theories based on multiple behavioral control systems suggest that emotional biasing of action selection might reflect effects of a system that regulates innately specified, evolutionary preprogrammed responses. To test this hypothesis directly, we investigated whether effects of emotional faces on instrumental approach and avoidance responses can be predicted by effects of emotional faces on bodily freezing, an innately specified response to aversive relative to appetitive cues. We tested forty-four women using a novel socioemotional decision making task combined with posturography, which involves a force platform to detect small oscillations of the body to accurately quantify postural control in upright stance. On the platform, participants learned whole body approachavoidance actions based on monetary reward or punishment, while being primed by emotional faces (angry/happy). Using posturography, it has previously been shown that angry faces elicit reductions in spontaneous postural sway, reminiscent of bodily freezing, a defensive reaction to threat. The combined setup in the current study, allowed us to quantify an innately specified response to the emotional face, i.e. bodily freezing, as well as its predictive value for the subsequent instrumental response. Our results show that the effects of the emotional faces on the instrumental response are action-specific. Thus, angry relative to happy faces speeded instrumental avoidance relative to approach responses. Critically, individual differences in this emotional effect were predicted by individual differences in bodily freezing. This finding strengthens the hypothesis that emotional biasing of instrumental

action involves interaction with a system that controls innately specified responses.

# H-27

PERSONALITY TRAITS CORRELATE WITH NEURAL ACTIVATIONS DURING FOOD **DECISION-**MAKING J. Bradley C. Cherry, Department of Psychology, University of Missouri-Kansas City; John M. Crespi, Department of Agricultural Economics, Kansas State University; Jayson L. Lusk, Department of Agricultural Economics, Oklahoma State University; Laura E. Martin, Hoglund Brain Imaging Center, University of Kansas Medical Center; Amanda S. Bruce, Department of Psychology, University of Missouri-Kansas City - Little is known about the relationship between personality and food decisionmaking where foods produced using controversial biotechnologies are concerned. We examined the relationship between consumers' neuroticism and extraversion and their neural activations in two food decision-making contexts involving foods produced using controversial biotechnologies. When neural activations in these contexts were contrasted and analyzed, we hypothesized activation in anterior cingulate cortex would correlate positively with neuroticism, and activation in lateral prefrontal cortex would correlate positively with extraversion. Methods: We recruited 47 healthy participants (23 females; aged 18-55 years; M = 31.9 years) to complete the NEO-Five-Factor Inventory-3 (NEO-FFI-3) and undergo two event-related functional magnetic resonance imaging (fMRI) scans. During these scans, participants performed a food decision-making task, making 84 binary decisions between two types of milk. The two options presented in each decision differed according to three conditions: a "price" condition, in which the options' prices differed, but the technologies used to produce them did not; a "technology" condition, in which the technologies used to produce the options differed, but their prices did not; and a "combination" condition, in which the prices of the options and the technologies used to produce them both differed. We used BrainVoyager QX to conduct a whole-brain analysis of participants' neural activations during combination versus price decisions, followed by a whole-brain correlation of those neural activations and participants' neuroticism and extraversion T scores. Results: Neural activations correlated negatively (p < .01, cluster threshold = 16 voxels) with neuroticism, with correlations observed in right medial frontal gyrus (Brodmann Area [BA] 10; x = 8, y = 52, z = 12; r = -0.55) and left insula (BA) 13; x = -34, y = 25, z = 9; r = -0.53). Neural activations correlated positively (p < .01, cluster threshold = 16 voxels) with extraversion, with correlations observed in right middle frontal gyrus (BA 10; x = 29, y = 49, z = 9; r = 0.58), right inferior frontal gyrus (BA 45; x = 38, y = 25, z = 3; r = 0.51), and left anterior cingulate (BA 32; x = -22, y =49, z = 9; r = 0.58). Discussion: Inconsistent with our hypothesis, we did not observe a significant relationship between activation in anterior cingulate cortex and neuroticism, which could be due to the very specific nature of the food decision-making task. However, consistent with our hypothesis, we observed activation in several regions of prefrontal cortex to be significantly

associated with extraversion scores. Limitations to this study include the use of a single food product and, according to eight participants, the use of somewhat unrealistically high prices. However, participants' reactions to the high prices seemed consistent with the hypothesis of loss aversion, though this was not explicitly tested. Future food studies should examine this issue further, and perhaps use a wider variety of both food and non-food products.

#### H-28

EFFECT OF PARTIAL SLEEP DEPRIVATION ON EMPATHY FOR PAIN IN AN FMRI EXPERIMENT Gustav Nilsonne, Sandra Tamm, Paolo d'Onofrio, Hanna Thuné, Johanna Schwarz, Predrag Petrovic, Håkan Fischer, Göran Kecklund, Torbjörn Åkerstedt, and Mats Lekander; Stockholm University and Karolinska Institutet- Disturbed sleep affects emotional responding. It is however unknown whether disturbed sleep also affects empathy for pain. We have investigated the effect of partial sleep deprivation on empathic responding. Predefined regions of interest were the bilateral anterior insulae and the medial cingulate cortex, which is postulated to form a core network for empathy. Healthy volunteers (n = 21, mean age 24, SD 3, 10 female) participated in a trial of partial sleep deprivation (3h sleep) using a cross-over design, monitored by polysomnography at home. During fMRI, participants viewed pictures of hands being stung by needles or poked with a Q-tip. Across sleep conditions, pain stimuli caused significantly increased activity in the anterior insulae (p < 0.005) and medial cingulate cortex (p< 0.001), using region-of-interest analyses. In addition, whole-brain analyses showed significant activation in the left inferior parietal (p < 0.001) and left primary sensorimotor cortices (p < 0.001). Partial sleep deprivation caused participants to report increased levels of unpleasantness (p < 0.01) when viewing pain stimuli. No significant effects of sleep deprivation were however detected in fMRI analyses. Self-rated empathy using the Interpersonal Reactivity Index subscale Empathic Concern was not significantly related to activation in insulae nor in cingulate cortex in the pain vs no pain contrast. These data do not support a major effect of sleep deprivation on empathic processing in the brain.

#### H-29

THE ROLE OF CORTICOSTEROIDS IN DOWN **REGULATING THE RESPONSE TO** ACUTE STRESSORS Erno Hermans; Donders Institute for Brain, Cognition and Behaviour and Department for Cognitive Neuroscience, Radboud University Nijmegen Medical Centre, Nijmegen, The Netherlands - Corticosteroids are released through activation of the hypothalamic-pituitary-adrenal in response to acute stressors. (HPA) axis Accumulating evidence suggests that corticosteroids play a key role in the return to homeostasis following stress exposure. For instance, corticosteroids exert negative feedback on the HPA axis itself, a mechanism that is hippocampally dependent. Recent findings in humans

moreover demonstrate that corticosteroid administration has anxiolytic-like effects and down regulates the neural circuitry involved in generating emotional arousal, including the amygdala, suggesting that corticosteroid release during stressful experiences serves to limit responsiveness to stressors. However, no study to date has demonstrated that blockade of corticosteroid release during acute stress indeed leads to excessive or prolonged emotional arousal. We therefore administered metyrapone (750 mg twice) or placebo in healthy induction. Metyrapone volunteers before stress suppresses adrenal 11ß-steroid hydroxylase and thereby blocks corticosteroid production. Stress was induced by exposure to four highly aversive movie clips. Participants moreover received two electrical shocks and were under continuous threat of shock. In between movie clips, participants viewed three blocks of negatively arousing photographs (approx. 10, 20, and 30 min post-stressor onset). All procedures took place inside an MRI scanner. We recorded BOLD-fMRI and pupil dilation responses (measure of sympathetic arousal) to photographs, and measured salivary cortisol before and after stress. Around testing, cortisol levels were substantially lower after metvrapone (3.8 nmol/L) than placebo (9.3 nmol/L, P<.001), and cortisol levels increased after stress only after placebo (P<.05). Pupil dilation responses to photographs were stronger in the metyrapone group (P<.05), but did not differ between blocks. This effect was accompanied by an increased BOLD response in a cluster at the amygdala-hippocampal junction (peak: [30, -16, -16], t=4.42, P=.006, SVC). Thus, in line with expectations, we found that cortisol blockade increased responsiveness to negatively arousing stimuli both at a neural level and in a measure of sympathetic arousal. We found no evidence of a time-dependency of this effect (stronger effect in later blocks), which may be due to the fact that cortisol levels were already lowered prior to the onset of the stressor in the metyrapone group. In conclusion, these findings suggest that blockade of endogenous cortisol leads to a disinhibition of emotional arousal during acute stress through a reduced inhibition of amygdalahippocampal circuits.

#### H-30

THE AMGYDALA'S ROLE IN PROCESSING THE TRUSTWORTHINESS OF UNSEEN FACES Ryan M. Stolier, Dartmouth College; Eric A. Hehman, Dartmouth College; Zachary A. Ingbretsen, Dartmouth College; Jonathan B. Freeman, Dartmouth College - The amygdala has been implicated in the processing of facial trustworthiness when a face is clearly visible. However, it remains an open question whether the amygdala is responsive to high-level facial information such as trustworthiness without perceptual awareness. In both blocked and eventrelated designs, we used a backward masking paradigm to test amygdala responsivity to the trustworthiness of subjectively unseen faces. Both computer-generated and real faces varying in trustworthiness were presented subliminally, masked by faces neutral in trustworthiness. Regions in the amygdala tracked both how untrustworthy a face appeared (i.e., negative-linear responses) as well as the overall strength of a face's trustworthiness signal (i.e.,

nonlinear responses), despite faces not being subjectively seen. The findings demonstrate that the amygdala can be influenced by even high-level facial information before that information is consciously perceived, and bolster existing evidence for the amygdala's role in automatic and rapid social evaluation.

#### H-31

THE **PSYCHONEUROENDOCRINOLOGICAL** EFFECTS OF SOCIAL STRESS AND LEADERSHIP: ALTERED HYPOTHALAMIC-PITUITARY-ADRENAL (HPA) REACTIVITY IN PEOPLE WITH INHIBITED TEMPERAMENTS Kostek, John A. 12, VanMeenen, Kirsten M. 12, Janke, Kellie 23, Beck, Kevin D. 12, Myers, Catherine E. 12, Pang, Kevin C.H. 12, Servatius, Richard J. 12; 1 VA New Jersey Health Care System, East Orange, NJ; 2 Stress and Motivated Behavior Institute, New Jersey Medical School, Rutgers, Newark, NJ ; 3 Graduate School of Biomedical Sciences, Rutgers, The State University of New Jersey, Newark, NJ - Introduction: Stress is often studied under artificial laboratory conditions (e.g. Trier Social Stress Test) or in extreme naturalistic settings (e.g. skydiving). However, the stress of everyday stimulation such as leading a group or performing before coworkers is often overlooked. Importantly, the strength and duration of stress responses can vary widely between people due to differences in experiences, personality, and biological predispositions. These individual variations in stress reactivity may have implications for the etiology of affective disorders (e.g. anxiety disorders, depression). One known risk factor for the development of anxiety disorders is Behavioral Inhibition (BI). Inhibited people tend to avoid and withdraw from novel social and nonsocial stimuli. However, the extent to which inhibited people have altered stress reactivity is unknown. The present research was designed to investigate stress reactivity in response to social stress and leading in inhibited people as well as to examine the lasting effects of occupational training on self-confidence. Method: 84 healthy adults participated in a week-long occupational training course to familiarize them with military life and routine. On the first day of training, volunteers completed a battery of questionnaires including the Adult Measure of Behavioral Inhibition (AMBI), and Leadership and Personal Self-Efficacy scales (LSE, PSE). Follow-up questionnaires were sent to participants the Monday after training. To assess the acute stress effects of training, saliva was collected proximal to two field exercises: 1) Drill & Ceremony: learning to march and give commands during drill and ceremony maneuvers; and 2) Building Entry: leading a squad during a force-on-force exercise using laser tag equipment. For Building Entry, squad participants were matched for BI and randomly assigned to the roles of squad leader or follower. Saliva samples were assayed for α-amylase (sAA), cortisol and DHEA. Results: Basal concentrations of neurosteroids and sAA were unrelated to questionnaire scores. However, examination of HPA (hypothalamic-pituitary-adrenal) activation revealed that inhibited people exhibited blunted cortisol reactivity, and no differences in DHEA or sAA, compared to uninhibited

people during Drill & Ceremony. Additionally, participants that were assigned to lead their squad during Building Entry had large cortisol elevations and reported decreased PSE and LSE scores while followers had relatively smaller cortisol responses and reported increases in PSE and LSE scores after training. Discussion: One explanation of blunted cortisol reactivity in BI is that inhibited people are more sensitive to stress and thus have more frequent HPA activation. Over time, the HPA negative feedback system down regulates to accommodate higher concentrations of circulating cortisol. This habituation would present as blunted reactivity in response to normal activation. In Building Entry, leaders and followers had similar physical exertion. Thus, the observed cortisol elevations in leaders reflect the social stress associated with leading a group and the stress of leading may have been the driving force in the decreased PSE and LSE scores. Leading may not always be associated with lower cortisol as previous literature would suggest. Overall, accounting for personality in the assessment of stress offers a distinct advantage: a priori prediction of reactivity and its attendant neurobiology.

# H-32

INTEGRATING PERSONALITY AND FUNCTIONAL BRAIN IMAGING TO EXPLAIN RISKY CHOICES Claudia Civai, Department of Economics, University of Minnesota -TC; Daniel R. Hawes, Department of Psychology, Stanford University; Colin G. DeYoung, Department of Psychology, University of Minnesota -TC; Aldo Rustichini, Department of Economics, University of Minnesota -TC- We investigate risky decision-making by testing how preferences, personality traits, IQ and neural activations are correlated. Seventy-five subjects performed a lottery task while in a 3T MRI scanner: they were required to choose between two either winning (Gain) or losing (Loss) lotteries, equal in their expected value but different in their variance. Variance is defined as the average deviation between the possible outcomes of the lottery and its expected value, and it is considered a measure of riskiness. Personality and IQ were assessed using the Personality Inventory for DSM-5 (PID-5), the Big Five Aspect Scale (BFAS) and the Wechsler Adult Intelligence Scale (WAIS-IV). Risk acceptance (RA) was measured as the percentage of chosen risky lotteries. RA\_Gain and RA\_Loss choices were not correlated. Participants made more risky choices in Gain with respect to Loss (t (74)=3.841; p<0.001). A strong positive correlation was found between RA and IQ, but only for Gain choices (β=.375, p<.01); interestingly, for both Gain and Loss, a positive correlation was found between RA and Grandiosity, a PID-5 scale related to risk sensitivity and overestimation of one's own abilities (β=.313; p<0.05 and  $\times \leq =.231$ ; p=0.091, respectively). Neural activations were analyzed by fitting a model with 14 parametric regressors, to define areas whose activation increased together with either the variance or the expected value of each lottery presented. Here, we discuss main results for variance-related activity at the moment of the presentation of the lotteries. Ventromedial prefrontal cortex (vmPFC), dorsal anterior cingulate (dACC) and amygdala, bilaterally, increased their activations with the increase of Gain variance; interestingly, these activations were negatively correlated with both RA\_Gain and Grandiosity. Moreover, increased amygdala activation was also positively correlated with Withdrawal, a facet of Neuroticism (BFAS trait) associated with passive avoidance of negative stimuli. As far as the Loss choices are concerned, the activations in bilateral amygdala, putamen and pallidus positively correlated also with Loss variance, and, although no significant correlation was found between these activations and RA\_Loss, Withdrawal was positively associated with the amygdala activation. Bilateral dorsolateral prefrontal cortex and parietal cortex, in particular anterior and posterior supramarginal gyrus, were also positively associated with the increase in both Gain and Loss variance, but no other significant correlations were found, suggesting that the involvement of these areas was associated with the elaboration of the riskiness, but not with the selection of the response. These results suggest that when rewardsensitive and emotional areas (vmPFC, dACC, amygdala) are more activated by the riskiness of the choice, the RA is reduced, as far as Gain condition is concerned; moreover, these activations are modulated by personality traits such as Grandiosity and Neuroticism, which are linked to sensitivity to risk and punishment. More broadly, these findings highlight the importance of considering personality traits as an important factor for explaining individual preferences and the neuro-cognitive mechanisms that underpin the perception of risk.

# H-33

REDUCED AMYGDALA VOLUME IS ASSOCIATED WITH DEFICITS IN INHIBITORY CONTROL: A VOXEL AND SURFACE-BASED MORPHOMETRIC ANALYSIS OF COMORBID PTSD/mTBI Depue, B.E. 1,2, Olson-Madden, J. 3,4, Smolker, H.R. 1, Rajamani, M. 3, Brenner, L.A. 3,4 & Banich, M.T. 1,2; University of Colorado at Boulder, Institute of Cognitive Science1; University of Colorado at Boulder, Department of Psychology and Neuroscience2; VISN 19 Mental Illness Research Education and Clinical Center3; University of Colorado Denver, Anschutz Medical Campus4 - A significant portion of previously deployed combat Veterans from Operation Enduring Freedom and Operation Iraqi Freedom/Operation New Dawn (OEF/OIF/OND) are affected by comorbid posttraumatic stress disorder (PTSD) and mild traumatic brain injury (mTBI). Despite this fact, neuroimaging studies investigating the neural correlates of cognitive dysfunction within this population are almost nonexistent. Nonetheless, а large number of neuroimaging studies have investigated the neural correlates associated with the diagnosis of PTSD and TBI in isolation, rather than co-morbidly. Prior studies among each cohort (PTSD or TBI) have revealed alterations in the structure and function of the hippocampus, amygdala, and ventro-medial PFC and/or sub-genual anterior cingulate cortex. In both populations dysfunction in these brain regions has been linked to deficits in inhibitory control. The current study used both voxel-based and surface-based morphometery to determine whether comorbid PTSD/mTBI is characterized by altered brain structure in the same regions as observed in singular diagnostic PTSD or TBI. Furthermore, we assessed whether alterations in brain structures in these regions were associated with behavioral measures related to inhibitory control, as assessed by the Go/No-go task, selfreports of impulsivity, and/or PTSD or mTBI symptoms. Results indicate volumetric reductions in the bilateral anterior amygdala in our comorbid PTSD/mTBI sample as compared to a control sample of OEF/OIF veterans with no history of mTBI and/or PTSD. Moreover, increased volume reduction in the amygdala predicted poorer inhibitory control as measured by performance on the Go/No-go task, increased self-reported impulsivity, and greater symptoms associated with PTSD. These findings suggest that alterations in brain anatomy in OEF/OIF veterans with co-morbid PTSD/mTBI are associated with both cognitive deficits and trauma symptoms related to PTSD.

# H-34

ACTIVITY IN VENTROMEDIAL PREFRONTAL CORTEX IS RELATED TO SIGNIFICANCE OF OWNING OBJECTS FROM DIFFERENT SOCIAL **SOURCES** Kyungmi Kim, Marcia K. Johnson; Department of Psychology, Yale University - Well-being and subjective experience of a coherent world depend on our sense of "self" and relations between the self and the environment (e.g., people, objects). As noted by William James (1890/1983), individuals place a "unique kind of interest" on aspects of the world that one can call 'me or mine' compared to those that are 'not me or not mine' (James, 1890/1983). When people contemplate the 'me or mine' aspects of the world (i.e., self-related processing), the ventromedial prefrontal cortex (vMPFC) reliably activates (Lieberman, 2010). Altered vMPFC activity during selfrelated processing is one of the characteristic features of patients with disorders in emotional/social processing (e.g., depression, autism). Yet, despite substantial evidence implicating vMPFC in self-related processing, the function of this region in such processing is poorly understood. Across various domains, vMPFC activity has been associated with the "positivity" of experiences (e.g., fear extinction, positive reappraisal success) and in particular, vMPFC reflects subjective value of various types of stimuli ranging from food to social reward (Rangel & Hare, 2010). Thus, one possibility is that vMPFC represents positive subjective value of self-related information or assigns positive subjective value to information by virtue of its self-relatedness. An alternative is that vMPFC assigns personal significance to self-related information bv evaluating its meaning/function for the self (D'Argembeau, 2013). In this case, vMPFC activity would not be necessarily always associated with positive value of self-related information. We tested these two alternatives (i.e., positive subjective valuation vs. assignment of personal significance) by contrasting contexts in which self-relevance of stimuli is likely to yield positive vs. negative subjective values. During functional magnetic resonance imaging (fMRI), participants imagined owning objects associated with either their perceived ingroup or outgroup. Ownershipinduced attitudinal changes (i.e., mere ownership effect)

were measured by having participants rate their preference for objects before and after imagining owning the objects. If vMPFC activity primarily reflects positive subjective valuation, post-ownership preference increases should be related to greater vMPFC activity during ownership imagination regardless of an object's association with one's ingroup or outgroup. Alternatively, if vMPFC activity primarily reflects assignment of personal significance, the personal significance of assimilating with one's ingroup should be reflected in greater vMPFC activity associated with preference increases from pre- to post-ownership whereas the personal significance of differentiating from one's outgroup should be reflected in greater vMPFC activity associated with preference decreases from pre- to postownership. We found that for ingroup-associated objects, vMPFC showed greater activity for objects with increased than decreased post-ownership preference. In contrast, for outgroup-associated objects, vMPFC showed greater activity for objects with decreased than increased postownership preference. Our findings suggest that the function vMPFC in self-related processing may not be to represent/evaluate the "positivity" or absolute preference of self-related information but to assign personal significance to it based on its meaning/function for the self.

# H-35

SCARILY COMING TO THE CENTRE: POLITICAL CENTRISM AS AN EFFECT OF MORTALITY SALIENCE AND A NEED FOR CLOSURE Carlos Alberto Rivera García; University of Essex - Three studies assessed the relationship between need for closure (NFC; Kruglanski, Webster, & Klem, 1993) and evaluations of political ideology changes, as a function of mortality salience (MS). Based on terror management theory (Greenberg, Pyszczynski, & Solomon, 1986) and previous research (e.g., Cozzolino, 2006; Jost et al., 2003), we hypothesized that abstract reminders of death would activate the facet of NFC that seeks group consensus and stability (as opposed to deviation and persuasion). Following an MS or control induction, 156 participants evaluated politicians who switched political ideologies (moved from the left to the right). In line with recent research (Fu et al., 2007), results indicate that MS induced people high in NFC to express greater support for politicians seeking consensus in the political centre, compared to politicians endorsing liberal or conservative ideologies, an effect consistent with research linking NFC to desires for group centrism and collective closure. A second study (N= 170) clarified this issue further with participants evaluating political parties (rather than individual politicians) depicted as moving from their traditional left/right positions toward the political centre in one condition, or parties that remained true to their traditional ideologies in a second condition. Results revealed that participants high in NFC exposed to MS expressed significantly higher levels of support for parties moving from the extreme right to the centre, than for parties moving from the extreme left to the centre. A third study (N=276) explored how the activation of specific needs for cognitive closure via MS would result in an

increased support for a centrist political party described as uniform in thought and enjoying an internal (vs. split) mandate for the party's manifesto. The results further indicate that reminders of mortality amplify demands for consensus and clarity more than signaling a demand for ideological clarity. Results and implications are discussed.

# H-36

TRAIT OPTIMISM MEDIATES THE RELATIONSHIP BETWEEN GREY MATTER VOLUME IN THE ORBITOFRONTAL CORTEX AND RESILIENCE TO AFFECTIVE DYSREGULATION Yifan Hu, University of Illinois at Urbana-Champaign (IL), USA; Matthew Moore, University of Illinois at Urbana-Champaign (IL), USA; Alexandru D. Iordan, University of Illinois at Urbana-Champaign (IL), USA; Sanda Dolcos, University of Illinois at Urbana-Champaign (IL), USA- Trait optimism, reflected in individuals' tendency to maintain positive expectations even in the face of adversities, plays a strong protective role against symptoms of affective dysregulation (i.e., depression and anxiety symptoms). Lateral orbitofrontal cortex (IOFC), a region involved in higher-level emotional integration, emotion-cognition interactions, and emotion control, has been linked in functional neuroimaging studies to cognitive processes that are highly relevant to the thinking and behavior patterns entailed by optimism, such as the ability to evaluate negative events and to adapt to the changing environment. Furthermore, research employing volumetric analyses has consistently reported a reduction in the volume of IOFC in patients with depression and those with anxiety disorders, compared to healthy subjects. However, an open question concerns the role of optimism in the relationship between the OFC volumes and symptoms of anxiety and depression in healthy participants. Here, we investigated this issue in 55 subjects who completed measures of optimism (Life Orientation Test), depression (Beck Depression Inventory), and trait anxiety (State-Trait Anxiety Inventory-Trait), and underwent MRI scanning. Analyses focused on IOFC volumes extracted using automatic parcellation, and mediation analyses were performed with optimism being the mediator. Results showed that optimism was positively associated with the IOFC volume and negatively associated with both anxiety and depression symptoms. Moreover, optimism had a negative mediating effect on the relationships between grey matter volume in the lOFC and symptoms of anxiety and depression, suggesting that reduced volume of this region predicts vulnerability, whereas increased volume predicts resilience to these symptoms. Taken together, these results suggest that personality traits indexing positive affect mediate the protective role of grey matter volume in emotion regulation regions against symptoms of affective dysregulation. These results provide novel insights into the relationship between personality and brain structure, and have significance for developing therapeutic and preventive interventions aimed to reduce susceptibility and increase resilience to affective dysregulation.
INHIBITORY CONTROL TRAINING EFFECTS ON TIMING AND NEURAL OVERLAP OF INHIBITORY **CONTROL AND AFFECT REGULATION** Kathryn S. Gilliam, Lauren E. Kahn, Rebecca D. Calcott, Junaid S. Merchant, Elliot T. Berkman ; Affiliation: University of Oregon - A domain-general model of self-control posits that different domains of self-control share a common neural substrate and that training in one domain (e.g., inhibitory control) will transfer to another (e.g., affect regulation). Previous behavioral and neuroimaging have supported the existence of this common neural substrate in the right inferior frontal gyrus (rIFG). Evidence also exists for the involvement of rIFG in the successful training of inhibitory control. Yet, transfer effects (i.e., generalization of training-related improvements to untrained tasks) have been harder to demonstrate. What are the neural changes associated with inhibitory control training? How can these be used to predict transfer effects? To answer these questions, we conducted a functional neuroimaging study on eighty healthy college-aged participants. These participants were randomly assigned to one of three groups: an inhibitory control training group, a sham training group, or a passive control group. All groups completed pre and post-training fMRI scans during which they performed the Stop Signal Task (SST) and an affect regulation task involving both cognitive reappraisal and affect labeling. The SST required the participants to establish a prepotent "go" response and then to selectively inhibit this response after hearing an auditory "stop" cue. The affect regulation task directed participants either to decrease their emotional response to distressing images (using cognitive reappraisal or affect labeling) or to simply observe the images. During the three-week period between scans, the training group returned to the lab to complete ten 7-minute training sessions on the SST. The sham training group also returned to the lab ten times and completed a non-inhibition control task. The passive control group only completed the pre and post scans. Results reveal that inhibitory control and affect regulation recruit similar regions, including rIFG, across groups at baseline. Preliminary analyses suggest that the degree of neural overlap across tasks varies by experimental group following the training period. Additionally, preliminary analyses also suggest that the timecourse of regulation across tasks varies by experimental group. Results will be discussed in the context of domain-general self-control and potential mechanisms by which inhibitory control might be most likely to generalize.

## H-38

WHAT IS EGO **DEPLETION?** A NEURAL-MECHANISTIC **EXPLORATION** OF SELF-**REGULATION AND SELF-AFFIRMATION** Jordan L. Livingston, University of Oregon; Rose E. Jeffries, University of Oregon; Elliot T. Berkman, University of Oregon; - Over one hundred studies have now demonstrated that performance on sequential self-control tasks declines as self-regulation demands increase (Hagger et al., 2010). However, the mechanism of this "ego depletion" effect remains elusive. As a result, there are now several mechanistic theories under investigation, and it has been proposed that neuroscience can inform this debate

(Berkman & Miller-Ziegler, 2013). One particularly promising model suggests that ego depletion is caused by reorientation of attention and motivation vis-v<sup>+</sup>-vis gratifications, such that attention and motivation shift towards gratification as self-regulation demands increase (Inzlicht & Schmeichel 2012). However, no study has directly tested this theory. We used a dot probe to index attentional biases towards rewarding, neutral, and threatrelated words in a repeated-measures design at baseline, after depletion, and after self-affirmation, which has been shown to reverse depletion (Schmeichel & Vohs, 2009). Contrary to the theory, behavioral results suggest that depletion eliminates initial biases toward rewards (vs. threats). However, self-affirmation following depletion does enhance attention to self-relevant threats. These results suggest that the effects of depletion and affirmation may, in fact, operate via shifts in attention, though not necessarily by increasing attention to rewards. In order to further tease apart these results, we are currently collecting pilot fMRI data to directly test the attention-motivation theory of ego depletion, and will have a full sample well ahead of the conference in April. Using Neurosynth to generate a priori ROIs related to "attention," we expect shifts in depletion to be associated with changes in the dorsal frontoparietal network such that depletion will be associated with less activity (i.e., less directed attention) compared to control conditions. Furthermore, because the attention-motivation model hypothesizes that shifts in attention are a result of changing needs for gratification, we expect that depletion will likely be associated with changes in reward areas such that, for example, self-affirmation will be associated with increased activity in the nucleus accumbens and the ventral tegmental area (Tamir & Mitchell, 2012). Such results will serve as a prime example of neuroscience informing psychological theory as we expect that the results will help to illuminate the long held debate regarding the mechanisms of ego depletion.

### H-39

INSULTS HURT AND THEY KEEP HURTING, ESPECIALLY WHEN THEY ARE ABOUT YOU! EVIDENCE FROM EEG AND SKIN CONDUCTANCE MEASURES Marijn Struiksma, UiL OTS, Utrecht University; Hannah De Mulder, UiL OTS, Utrecht University; Nicola Spotorno, University of Pennsylvania; Jana Basnakova, Slovak Academy of Sciences; Jos van Berkum, UiL OTS, Utrecht University - Research on emotion in language has mainly focused on the processing of emotion words in isolation (Citron, 2012). Using EEG and skin conductance measures, we investigated how compliments and insults are processed in a sentence that either directly addressed the participant or targeted somebody else (e.g. '[participant's name]/Jane is ugly/beautiful'). Our main questions were whether the sentence context is rapidly integrated into processing and whether participants differentially adapt to insults and complements. Relative to compliments, insults elicited a stronger P2 response (150-250ms), regardless of who was addressed. This suggests that a generic negativity bias is already present during early perceptual processing, possibly reflecting rapid detection of, and focus on, the taboo nature of

insulting words. In the 350-500ms latency range the negativity bias was modulated by who was addressed. Relative to compliments, insults elicited a strong Late Positive Potential (LPP) response. However, the effect was strongest when the insults were directed at the participant in contrast to when they were directed at somebody else. These personal insults also elicited the strongest skin conductance response, suggesting that sympathetic activation is not only driven by the occurrence of a negative word, but is also sensitive to the sentence context. Interestingly, multiple repetitions of our stimuli did not modulate the early and late effects, which suggests that both the initial generic response to insults and the following specific response to personal insults do not readily adapt. Together, our findings indicate that even in a contrived and highly 'impersonal' lab setting, insults affect participants' physiological and neural responses especially when they directly address the participant. And at the neural level they continue to do so over repetition.

#### H-40

**JAILBREAKING COGNITIVE REAPPRAISAL: A SELF VS. OTHER PERSPECTIVE** Ana Draghici, Erik Knight Wing, Kateri McRae; University of Denver, Denver, Colorado -Cognitive reappraisal, an emotion regulation strategy that involves purposefully reinterpreting an emotion-eliciting event in order to change the duration, intensity, or type of emotion one is experiencing (Gross, 1998), has been shown to be one of the most effective ways to alter an emotional response (Goldin et al., 2008; McRae et al., 2010). There is, however, significant variation across people and situations in how well cognitive reappraisal works (John & Gross, 2007), and new research is beginning to shed light on the notion that some types of reappraising are more successful than others (McRae, Ciesielski, & Gross, 2012). We compared the behavioral and neural outcomes of two different types of reappraisal: reinterpreting an emotional event in order to change one's own emotional response vs. reinterpreting in order to change someone else's emotional response. In Study 1, we used a well-validated picture reappraisal task (Gross, 1998) to compare 62 participants' responses to neutral and negative IAPS pictures (Lang, Bradley, & Cuthbert, 2008), paired with different types of reappraisal instructions. The experiment used a  $2 \times 3$  mixed repeated measures design with Instruction Target (Self vs. Other) varied between participants, and Trial Type (Look Neutral, vs. Look Negative, vs. Change Negative) varied within participants, 40 trials for each within condition. Participants in the Self condition received the typical reappraisal training and were told that they'd see a variety of pictures preceded by an instruction to either allow themselves to react naturally (Look) or think about ways of reinterpreting the events depicted so they feel less negative (Change). Participants in the Other condition were told to imagine throughout that a friend is viewing the pictures at the same time, and either let themselves and their friend react naturally (Look) or think about ways of reinterpreting the events depicted so their friend feels less negative (Change). We collected selfreport measures of negative affect after each experimental

trial and, at the end of the experiment, measures of overall task difficulty, motivation, and perceived task success for the Look Neutral, Look Negative, and Change Negative trials, respectively. In Study 2, we used a withinparticipants variation of the same design in a functional magnetic resonance imaging (fMRI) experiment to compare whole-brain blood oxygen level-dependent (BOLD) responses for each Trial Type (Look Neutral, Look Negative, Change Negative) and Target (Self vs. Other). 18 participants alternated between randomized event-related Look Neutral, Look Negative, and Change Negative trials (36 each) grouped in 4 counterbalanced blocks where the Instruction Target alternated between Self and Other. Along with the same self-report measures from Study 1, we used measures of brain structure and function to compare and contrast the effects of the two different Instruction Target conditions on the neural markers of Reactivity (Look Negative > Look Neutral) and Regulation (Change Negative > Look Negative). Results of the two studies are discussed in terms of effectiveness and efficiency of each emotion regulation strategy, as well as the common and distinct brain areas that the two strategies rely on.

## H-41

MOVIE TRAILERS: THE NEURAL BASIS OF **INTUITIVE CONSUMER CHOICE** Vincent Schoots (1,2), Maarten Boksem (1,2), Alan Sanfey (2,3), Ale Smidts (1); 1 Erasmus University Rotterdam, Rotterdam School of Management; 2 Radboud University Nijmegen, Donders Institute for Brain, Cognition & Behaviour; 3Radboud University Nijmegen; Behavioural Science Institute - In daily life, we face decisions of widely different nature. While enormous progress has been made explaining choice with economic models, there is still a lack of understanding of non-reasoned choice processes. The choice to watch a particular movie, for instance, generally evolves while watching its trailer, without much deliberation. Which mental processes underlie this preference formation? Studying this process is valuable for theory building, but also has a practical application for marketers if we can predict individual or out-of-sample choice using neuroimaging. We set out to study movie choice in detail using functional magnetic resonance imaging (fMRI), eye tracker and heart rate measurements. Our aim is twofold: 1) to provide insight into the mental processes underlying consumer choice in a non-reasoned, intuitive decision setting, and 2) to assess how we can predict consumer choice using fMRI. 30 participants watch the cinematic trailers of 18 recent movies which they have not seen yet, while lying in the scanner. We collect a number of stated (e.g. willingness to pay) and revealed (choose three DVD's to take home) preference measures for these movies. In addition, we obtained US box office revenue for the 18 movies from the internet movie database (IMDb), as a measure of real-world commercial success. We will use an ROI-based approach to track neural activity for a preferred versus non-preferred trailer in key nodes in the neural decision network. We will also assess how much variance in choice can be predicted by fMRI over and above classic behavioral preference measures. Later, we will compare this with the predictive value of heart rate

and eye tracker data, and use multivariate analyses on our neuroimaging data to elucidate preference formation and predict choice.

#### H-42

### **INCENTIVIZING INHIBITORY CONTROL WITH REWARD** *Lauren E. Kahn, Casey Magis-Agosta, & Elliot T. Berkman (University of Oregon)-* According to dual process models of cognition, "cold" top-down processes (e.g., control) operate in opposition to "hot" bottom-up processes (e.g., reward) at both the behavioral and neural

processes (e.g., reward) at both the behavioral and neural levels (Heatherton & Wagner, 2011). According to these models, behavior is driven by a competition between the two systems in a given situation. A alternative model describes behavior instead as being guided by a single subjective value computation which in turn is influenced by multiple factors including ongoing goals and temptations (Hare, Camerer, & Rangel, 2009). Critically, if value is the primary determinant of action, then a manipulation of value should alter behavior, even when a "hot" incentive is used to produce a "cold" result (controlled behavior). In our study, we tested whether one component of self-control, response inhibition, could be incentivized using explicit rewards. If so, this could pose a problem for dual process models, since they generally consider response inhibition part of the "cold" system, while rewarding processes are considered as part of the "hot" system. Identifying the neural underpinnings of incentivized self-control in this way will illuminate how systems previously thought to act in opposition may instead work together to produce "controlled" behavior. Response inhibition was measured using the stop-signal task, which induces a prepotent motor response that must be inhibited on one-quarter of the trials when a beep (the "stop-signal") is presented. Participants completed two non-incentivized runs of the task for a baseline, and then completed three runs of the task at three different incentive levels counterbalanced for order. Participants were paid twenty, forty, or sixty cents for successfully inhibiting their motor response during "stop" trials, and five cents for pressing the correct arrow during "go" trials. A control group completed five non-incentivized runs of the task so that practice and depletion effects could be taken into account. Behavioral results demonstrated a linear effect of incentive on stopping times, where higher incentives induced faster (more efficient) stopping times (p < .05). Preliminary neuroimaging results show that the stopping network (including inferior frontal gyrus, anterior cingulate, and pre-supplementary motor area) is recruited during "stop" versus "go" trials, and with additional data currently being collected, we will determine how this brain activity changes as a function of incentive. These results support the idea that reward is not always opposed to self-control, and in fact can improve it under some conditions. This finding is difficult to reconcile with dual process models, which describe reward and self-control as being in opposition. This instead suggests that explicit rewards may upregulate the "value" of self-control. Additional functional magnetic resonance imaging data are currently being collected to test this hypothesis further, and these neuroimaging results will be discussed.

### H-43 \*SANS Poster Award Winner

NEURAL MARKERS OF DAILY SELF-CONTROL FAILURE IN CHRONIC DIETERS Richard B. Lopez\*, Wilhelm Hofmann\*\*, Dylan D. Wagner\*, William M. Kelley\*, and Todd F. Heatherton\*; \*Department of Psychological & Brain Sciences, Dartmouth College, Hanover, NH 03755, USA.; \*\*Department of Psychology, University of Cologne, Germany - Prior studies have consistently shown that selfregulatory depletion increases the likelihood of subsequent self-control failure. Recent imaging work has proposed that these depletion effects may arise from increased activity in the brain's reward systems (e.g., ventral striatum; orbitofrontal cortex, or OFC), demonstrating that chronic dieters, when depleted, exhibit such activity in response to appetizing food cues. In the current study, our objective was to determine if food cue related activity following depletion is predictive of self-control failure in everyday life. To this end, we combined functional neuroimaging and experience sampling methods. Thirty-nine, right-handed female dieters first participated in a functional MRI (fMRI) session, which consisted of an attentional control task (previously shown to deplete self-regulatory capacity), followed by a food cue reactivity task that used a rapid, event-related design. After the fMRI session, participants carried mobile devices for a one-week long sampling of their daily eating behaviors. Several times a day and at random, non-overlapping intervals, participants were signaled to report their desires for food, whether or not they had given in to their desires and already ate, and if so, the quantity of the desired food they consumed. Regression analyses revealed that post-depletion activity in the left OFC during exposure to appetizing food cues predicted food desire strength, enactment of desires, and amount eaten in the subsequent week. Additionally, region of ventral activity in а anterior cingulate/ventromedial prefrontal cortex positively tracked with enactment of desires and amount eaten. These findings provide preliminary evidence of neural markers of real world self-control failure in chronic dieters. They are also suggestive of individual differences in food specific reward signals, which may account for why some dieters are less likely to resist temptations to eat and restrain their eating behavior.

## H-44

THE MODERATING ROLE OF CULTURE IN THE RELATIONSHIP BETWEEN THE DOPAMINE RECEPTOR GENE (DRD4) AND NOVELTY SEEKING Sarah Huff, Anthony King, Carolyn Yoon, Steven Tompson, Israel Liberzon, Shinobu Kitayama; All authors are affiliated with the University of Michigan, Ann Arbor, MI. - Although considerable research has focused on the hypothesis that carriers of a 7-repeat allele of the dopamine receptor gene (DRD4) are higher in novelty seeking compared to noncarriers, supportive evidence for the hypothesis is surprisingly weak. In the present study, we examined the relationship by investigating ethnicity and gender as potential moderators. We administered the Novelty Seeking subscale of the Temperament and Character Inventory (TCI) to 194 European American and 204 East Asian college students. European American students had to have been born in and spent their entire lives in the United States. East Asian participants had to have been born in East Asia and spent less than ten years in the United States. Upon completion of surveys, individuals provided saliva samples to be genotyped. They were subsequently grouped based on presence or absence of the 7- or 2-repeat alleles of DRD4 (both of which are associated with higher dopamine signaling capacity relative to 4-repeat alleles). Across all participants, there was a significant relationship between presence of the 7or 2-repeat alleles and lower novelty seeking. In addition, we found a moderating effect of social orientation in the relationship between DRD4 and novelty seeking. These findings suggest that ethnicity and cultural orientation may help to explain some of the inconsistencies in previous research. Future directions include a polygenic approach to studying the relationship between dopamine seeking. Implications for cultural and novelty neuroscience are discussed.

## H-45

**OXYTOCIN ENHANCES HUMAN OPTIMISM** Yina Ma (1,2), Yi Liu (1), Chenbo Wang (1), Shihui Han (1); Department of Psychology, PKU-IDG/McGovern Institute for Brain Research, Peking University, Beijing, China, 100871; Lieber Institute for Brain Development, Johns Hopkins University School of Medicine, 855 North Wolfe Street, Baltimore, MD 21205, USA - People are often optimistic when making predictions about their future as they update beliefs about their future to a greater extent in response to desirable information than to undesirable information (i. e., an optimistic bias). The present study examined the role of oxytocin in generation of optimistic beliefs by testing its effects on updating desirable and undesirable information. In a double blind, placebocontrolled between-subjects design, 60 male participants received intranasal administration of placebo or oxytocin and estimated their personal probability of experiencing 80 different adverse life events. Participants were then informed of the average probability of each event and were asked to estimate their probability of encountering these 80 events again. We assessed whether participants used the desirable (i.e. average probability better than expected) or undesirable (i.e. average probability worse than expected) information to update their predictions. We first found an optimistic bias in belief updating across the place and oxytocin groups, i.e., participants changed their beliefs more toward desirable than undesirable information. Interestingly, oxytocin treatment enhanced the optimistic bias compared to placebo treatment. This provides the first evidence that oxytocin affects belief formation by increasing the optimistic tendency. Moreover, we showed that the oxytocin effect on belief updating was induced by the increased belief updating in response to desirable information whereas oxytocin treatment did not influence belief updating towards undesirable information. Our findings reveal a functional role of oxytocin in the optimistic bias, which is different from dopamine that increases optimistic bias by impairing the ability to update belief in response to undesirable information. Thus oxytocin and dopamine modulate the generation of the optimistic beliefs through differential mechanisms.

## H-46

FACTORS LEADING TO ATTITUDE-BEHAVIOR DIVERGENCE IN ADVERTISING AMONG WOMEN Benjamin C. Gunter, UCLA; Stephanie Vezich, UCLA; Matthew D. Lieberman, UCLA - Self-reported attitudes are often unreliable predictors of behavior. Although attitudes about contentious social and political issues may be well informed and strongly held, numerous environmental and biological complexities can lead to discrepant behavior. We explored this phenomenon in the domain of advertising. Advertisers portray women in various roles in their campaigns in order to appeal to specific demographics. The industry is diversifying its campaigns in response to changing attitudes about hypersexualized portrayals of women, but conventionally successful strategies continue to be met with success. In order to explain the mixed results of such strategies, we used fMRI to examine the neural responses of 28 female adults to five common portravals of women in advertising (aspirational beauty, businesswomen, normal, traditional roles, and hypersexualized) against a common, non-human baseline of car images. Following each image presentation, participants reported how much they liked the image on a scale ranging from 1 (dislike) to 4 (like). We contrasted each of the portrayals to the car baseline and directly contrasted two portrayals (hypersexualized and traditional/domestic) against each other, in line with our hypotheses and participants' self-reported attitudes about gender roles. Activation from these contrasts was extracted in regions of interest related to valuative processing, including ventral striatum and orbitofrontal cortex. Although a strong majority of participants (82%) identified the hypersexualized portrayals as their least favorite (mean liking 2.09), these images were the only portravals that reliably elicited activation in the reward network. In addition, participants were slowest to respond to questions about the hypersexualized portrayals. The degree to which participants hesitated when reporting their dislike for the hypersexualized images was significantly positively correlated with reward network activation. This slowing was further correlated with progressive and egalitarian attitudes about women's roles in society. These results suggest that, in the case of women's responses to advertising strategies, a mismatch between neural activation and explicit attitudes can cause uncertainty when the time comes to make a decision about a product or service. Further analyses are pending to explore this phenomenon and construct a mediation model.

# H-47

EVENT-RELATED POTENTIALS FOR IMPLICIT, EXPLICIT, AND EMPATHIC PROCESSING OF EMOTIONAL FACIAL EXPRESSIONS Taylor J. Groth, Tien T. Tong, Jason S. Nomi, Stephanie Bastidas, Lucy J. Troup; Colorado State University - The current study examined how implicit, explicit, and empathic responses to emotional facial expressions influence event-related potentials (ERPs). Non-depressed and non-anxious human participants viewed happy, sad, and neutral emotional facial expressions while attempting to either identify the gender (implicit), identify the emotional expression (explicit), or empathize with the emotional expression (empathic). EEG data were recorded from 19 electrodes set according to the international 10-20 system with analysis focusing on mean amplitudes for midline and bilateral frontal, central, and parietal electrodes. Midline analysis showed that the vertex positive potential (VPP; 140-200ms) amplitude was largest for sad faces across all electrodes regardless of condition. Global analysis showed that P3 (200-400ms) amplitudes in the expression recognition condition differed by hemisphere and electrode for sad and happy faces but not for neutral faces. Finally, the global analysis also showed that P3 amplitudes for all three emotional expressions in the empathize condition differed by hemisphere and electrode. The results suggest that the early perception of emotional expression across all manipulations is represented by increased midline amplitude of the VPP while processes such as expression recognition and empathizing with expressions are represented by differences in P3 amplitudes across hemispheres and electrodes.

#### H-48

PREDICTED QUALITY OF LIFE IS CORRELATED WITH ALPHA ASYMMETRIES IN FRONTAL AND PARIETAL REGIONS OF THE HUMAN BRAIN Jeff Davis, California State University Long Beach; Kristen Damron, California State University Long Beach; Mary Beal, California State University Long Beach - Prediction is one of the central elements of behavioral control. Current theories suggest predictive learning evolved as a mechanism of early detection of threats to life and, simultaneously, as a mechanism to optimally manage a body's use of finite energy resources. Researchers have found that prediction (or predictive processing) is extensively connected with a range of cognitive and motor processes. Given its importance, this study examines how a prediction about one's future quality of life might be correlated with neural responses to negative and positive information. Data for this study come from the Midlife Development in the United States survey (MIDUS). The MIDUS survey is a longitudinal panel study based on a representative sample of n= 7,108 U.S. residents that was begun in 1995-1996. The second wave of the study was conducted between 2002 and 2005 (MIDUS II). The MIDUS II study consists of 5 sub-studies, one of which includes an electroencephalography (EEG) study of n = 331 participants randomly drawn from the core sample. The age range of the sample is 36 to 84 with a mean of 55.41 and a standard deviation of 11.12. The EEG study measured alpha asymmetries using a 128 channel net. Participants were shown negative, positive and neutral images on a 17 inch computer monitor. Before the EEG study, participants were asked three questions

about their perceived quality of life (1) ten years prior to the study, (2) currently, and (3) ten years into the future. Participants recorded their responses using an 11-point scale where 0 = worst possible overall life and 10 = best possible overall life. Results show that evaluations of quality of life in the past, present and future are correlated with alpha asymmetries in frontal and motor cortices. Scores on each question are positively related to asymmetry measures indicating that participants who rated their quality of life favorably have higher activity in the left hemisphere. Evaluations of life in the past and present are associated with higher brain activity concentrated in regions that control motor planning and processing of emotional information (P3), respectively. By contrast, a favorable prediction about future quality of life is correlated with higher activity in the same areas and, in addition, areas controlling sensorimotor integration and social perception. Surprisingly, prediction of future life has no significant connection with activity in areas such as the prefrontal cortex. In conclusion, prediction about future quality of life might have a greater impact on brain functioning than perspectives on past and present life. This finding accords well with arguments proposing that prediction is fundamentally driven by motor processes.

### H-49

SELF-CONSCIOUSNESS **MODULATES** MPFC CONSISTENCY UNDERLYING IMPLICIT AND **EXPLICIT SELF-REFERENTIAL PROCESSING** Pin-Hao A. Chen 1, Dylan D. Wagner 1, Joseph M. Moran 2,3, William W. Kelley 1, Todd F. Heatherton 1; 1 Department of Psychological and Brain Sciences, Dartmouth College, Hanover, NH.; 2 Center for Brain Science, Harvard University, Cambridge, MA.; 3 U.S. Army Natick Soldier Research, Development, and Engineering Center, Natick, MA.; - The medial prefrontal cortex (MPFC) engages robustly in selfreferential processing tasks (Kelley et al., 2002; Mitchell et al., 2006; Moran et al., 2013), and also activates when participants process self-relevant information implicitly (Moran et al., 2009). This finding suggests the possibility that similar brain mechanisms subserve both explicit and implicit self-referential processing. We therefore examined whether MPFC activity is consistent for explicit and implicit self-referential processing within the same individuals. Moreover, individual differences in private self-consciousness are associated with differences in processing speed in self-reflection tasks (Hull et al., 1988), suggesting that individual differences in selfconsciousness might modulate the consistency of MPFC activity. However, to date, no study has directly tested these hypotheses. Twenty-seven native Chinesespeaking participants, who were also fluent in English, were recruited for the study. In an event-related fMRI study conducted within two months of their arrival in the USA, participants made explicit SELF, MOTHER, and FONT-based judgments in both English and Chinese. The self-consciousness scale was administrated after scanning. Six months after the initial scan, the same participants performed an implicit self-referential task in which they passively viewed Chinese and English words that were SELF-relevant, NEUTRAL, or ODDBALL items (presented in green font). Participants were instructed to

press a button only when words appeared in green font (ODDBALL). We compared MPFC activation during explicit self judgments (extracted from SELF > MOTHER contrast during scan 1) to MPFC activation during implicit self judgments (extracted from SELF > NEUTRAL contrast during scan 2). The results showed that the correlation between explicit and implicit self-referential processing in the native language was statistically significant (r = 0.40, p < 0.05) whereas the correlation in the second language was not significant (r = 0.25, p = 0.19). The participants were split into two groups based on the median of their self-consciousness scores. Individuals who were high in private self-consciousness showed a stronger correlation in the native language (r = 0.72, p < 0.01) between explicit and implicit self-referential processing than individuals who were low in selfconsciousness (r = 0.09, p = 0.76). These findings suggested that MPFC activity is highly consistent across both explicit and implicit self-referential processing, and also across time. Self-consciousness might be a moderating variable influencing the stability of selfreflection across time.

## H-50

FMRI STUDY OF THE ROLE OF EMPATHY AND EMOTIONS IN MORAL JUDGMENT OF REAL-WORLD SITUATIONS Vanessa Singh 1,2; Mary Helen Immordino-Yang 2,3; Jonas Kaplan 2; Hanna Damasio 2; Antonio Damasio 2; Dept. of Psychology, University of Southern California; Brain and Creativity Institute, University of Southern California; Rossier School of Education, University of Southern California- Neuorimaging studies consistently find that moral judgment engages brain structures involved in emotion processing and perspective taking, and recent work in psychology has demonstrated an influence of emotions such as compassion, anger and disgust on the level of punishment levied on a moral transgressor (DeSteno et al., 2010; Ugazio et al., 2011). However, the neural mechanisms underlying the influence of emotion on moral judgment have not been investigated. Moreoever, most studies employ abstract moral dilemmas that cannot serve as a proxy for the dynamic contextual influences on moral judgment of everyday life situations. To fill this gap in both psychological and neuroscience literature, we produced video clips depicting everyday life moral transgressions to investigate the neural correlates of: (1) moral judgments in the context of situations commonly encountered in everyday life, and (2) interactions among: the level of severity an observer attributes to an immoral act; the moral transgressor's display of emotion during the act; and the observer's own proneness for empathic reactions. While inside the fMRI scanner, subjects rated the severity of moral transgression committed by the transgressor who displayed a happy, sad or no emotion. Subjects rated more severely those transgressions where the transgressor benefitted from the immoral act and displayed a happy emotion. Transgressors who displayed a sad emotion were judged as displaying most guilt. As hypothesized, videos where the transgressor displayed a happy emotion were significantly more likely to engage brain regions involved the emotion processing, decision making and perspective taking, and were associated with greater increase in galvanic skin conductance. Our results suggest that emotion and empathic tendencies can critically influence our moral judgments.

# H-51

TO ERR IS... SOCIAL: THE EFFECTS OF OXYTOCIN ON PERFORMANCE MONITORING IN A SOCIAL **CONTEXT** Ellen R.A. de Bruijn; Leiden University, Institute of Psychology, Unit of Clinical Psychology and Leiden Institute for Brain and Cognition, Leiden, the Netherlands; Margit I. Ruissen; Leiden University, Institute of Psychology, Unit of Clinical Psychology and Leiden Institute for Brain and Cognition, Leiden, *the Netherlands;* Sina Radke: Universitätsklinikum Aachen, Aachen, Germany - The majority of human behavior takes place in some sort of social context. As a result, others' behavior affects ours and our actions may also affect the people around us. Mistakes are a good example of actions that often have negative consequences not only for ourselves, but also for the people we are interacting with. In a previous fRMI study, we demonstrated that the mentalizing network (including medial frontal cortex and posterior parietal cortex) is more activated when we make mistakes that have consequences for another person compared to mistakes that only affect ourselves. I will present data from a recent ERP study in which we investigated whether the electrophysiological correlate of error detection - the so-called error-related negativity (ERN) - is differently involved in these two types of errors and whether the hormone oxytocin modulates the performance-monitoring processes involved. Healthy male volunteers (N=24) participated in a double-blind placebo-controlled cross-over study where they performed two versions of a flanker task. Participants were seated next to each other while EEG measurements were obtained. In the Solo version, participants performed the flanker task simultaneously and were told that any errors they made only affected their own individual bonus. In the Duo version, participants performed the same task but were now told that errors had negative consequences for both their own bonus and the bonus of their co-actor. I will discuss both the behavioral and the ERP results from this study and relate them to existing theories on performance monitoring and the role of oxytocin.

# H-52

AUTOMATIC APPROACH IN INTERTEMPORAL CHOICE Woyke, I. C.(1), Roelofs, K. (1,2), Monterosso, J. R.(3,4), & Figner, B. (1,2,5); (1) Behavioural Science Institute, Radboud University Nijmegen, The Netherlands; (2) Donders Institute for Brain, Cognition, and Behaviour, Radboud University Nijmegen, The Netherlands; (3) Department of Psychology, University of Southern California, USA; (4) Brain and Creativity Institute, University of Southern California, USA; (5) Center for the Decision Sciences, Columbia University, USA - Intertemporal choices between a smaller-sooner (SS) versus a larger-later (LL) reward require tradeoffs between reward magnitude and time of delivery. Humans often exhibit substantial impatience in such decisions, choosing the SS even when the LL is substantially larger. Such impulsivity is particularly pronounced when the SS is an immediate reward (compared to when both SS and LL are future rewards). Behavioral and neuroscience research has shown that immediate rewards can be characterized as being particularly tempting and (lateral prefrontal) self-control can be relevant to resist such temptation and choose the LL. Currently, however, it is not yet well understood what makes immediate rewards so attractive, i.e., which processes are responsible for their outsized impact on intertemporal choice. Our project investigates the role of automatic approach associations (AAA) in impulsivity in intertemporal choice: The main hypothesis is that immediate rewards are associated with AAA, and can be understood within the framework of Pavlovian vs. instrumental conflict. To investigate AAA's role in intertemporal choice, we combined an intertemporal choice task with a standard paradigm previously successfully used to study automatic approach and avoidance in many domains, including problematic behaviors such as substance abuse and anxiety disorders. In our task, participants make intertemporal choices either via pulling a joystick towards themselves or pushing it away from themselves. Disambiguated using a "zooming" feature, pulling the joystick is an approach movement (the stimulus increases in size), while pushing it away is an avoidance movement (the stimulus decreases in size). Based on previous AAA research, we thus predicted that if immediate reward is associated with AAA, participants should be more likely (and faster) to choose an immediate SS in the "pull-to-choose" condition than the "push-to-choose" condition: If our hypothesis about AAA towards immediate SSs is correct, the pull-tochoose condition is a congruent condition (AAA towards SS congruent with approach movement), whereas the push-to-choose condition is an incongruent condition (increasing required response time and likelihood of LL choice). Further, the difference between pull-to-choose versus push-to-choose should be larger if the SS is an immediate reward compared to when both SS and LL are future rewards. Thus, our task allows us to test not only a more general approach bias in intertemporal choice, but also gives insights into the specificity and boundary conditions of this effect. In a pilot study (N = 51) with a preliminary task version, we found results supporting our hypothesis: Participants significantly more often (and more quickly) chose the immediate SS in the pull-tochoose compared to the push-to-choose condition. Currently, we are collecting data in a larger sample and with an improved task that contains also a neutral (left/right) condition and gives additional insights into potential mediators such as relative differences in SS/LL amounts, and time difference between SS and LL. Individual-differences variables such as self-reported impulsivity and reward and punishment sensitivity are being collected to investigate the role of person-related moderators.

## H-53

#### DECISION WITHOUT DELIBERATION: A ROLE FOR AFFECT IN COMPLEX DECISION MAKING Pareezad

Zarolia, University of Denver ; Kateri McRae, University of Denver - Affect plays a crucial role in decision-making and recent research has made important progress towards understanding the nature of that role (Bechara & Damsio, 2005). The purpose of the present research was to examine the role of affect in a non-deliberative form of decisionmaking. We modified a commonly used paradigm to compare deliberative and non-deliberative decisionmaking (Dijksterhuis, 2004) in which participants are presented with four options each comprised of twelve attributes, they are then instructed to either think about the attributes or are distracted for four minutes, finally they are asked to choose one option. In previous studies, participants in the distraction condition choose the objectively best option a greater percentage of the time than those in the deliberation condition. For our modification we introduced an Affective Deliberation condition during which participants are instructed to reflect on how they feel about the options rather than critically think about them, and an Affective Distraction condition during which participants were asked to solve affectively evocative rather than neutral anagrams. Using behavioral and psychophysiological measures, we tested the hypotheses that 1) if affect plays a critical role in optimal decision making, then emphasizing affect during deliberation should improve quality of choice, and 2) if affect conveys critical choice information, then interrupting or introducing unrelated affective signals during distraction should decrease the quality of choice. Preliminary results replicate previous findings demonstrating that a greater percentage of participants in the Neutral Distraction condition chose the objectively best choice (76.9%) as compared to the Neutral Deliberation condition (42.9%). The results also support the second hypothesis, with fewer participants choosing the objectively best choice in the Affective Distraction (53.8%) condition as compared to the Neutral Distraction condition (76.9%). These results suggest that one role for affect in complex decision-making is its ability to communicate evaluations of choice-relevant attributes; importantly, when the choice-relevant evaluations are diluted by irrelevant affect, the quality of choice decreases.

## H-54

APPETITE FOR CONFORMITY: AN PEER PREFERENCES SHIFT BEHAVIORAL AND NEURAL **RESPONSES TO FOODS** Erik C. Nook, Jamil Zaki; Stanford University - Conformity constitutes a "strong force" in social behavior, as it powerfully shifts people's endorsed beliefs and preferences. However, it is unclear just how "deeply" social norms penetrate when exerting these effects. Here, we investigated the extent to which social influence shifts behavioral and neural indices of preferences for a very basic stimulus: food. Twenty-five Stanford undergraduates were scanned with fMRI while they rated how much they liked 150 foods. After each trial, participants saw ratings ostensibly made by their peers about each food. In actuality, these ratings were manipulated to be higher than, equal to or lower than participants' own ratings. After a delay, participants rerated each food in the absence of information about peer preferences. Controlling for their initial ratings, participants' second ratings exhibited social influence: they were higher for foods initially liked, as opposed to disliked, by their peers. Further, learning that one's ratings disagreed with those of the group was associated with increased activity in regions associated with cognitive control (e.g. anterior cingulate cortex) and social cognition (e.g. precuneus). By contrast, learning that one had agreed with the group produced activity in the ventral striatum, an area typically associated with value processing. Further, individual differences in agreementrelated striatal activity tracked individuals' tendency to conform by shifting their ratings to match those of their peers. Finally, during their second ratings, participants engaged ventromedial prefrontal cortex (vMPFC) more strongly when viewing foods rated highly, as opposed to less highly, by their peers. Together, these results provide insights into two key mechanisms underlying social influence. First, agreement between individual and group preferences engaged the ventral striatum, and activity in this region predicted behavioral conformity. This finding supports a reinforcement learning model of conformity under which individuals value the experience of consensus and seek it out by "tuning" their opinion to match those of a group. Second, peer preferences influenced vMPFC responses to foods. Given that vMPFC is commonly associated with value computation, this suggests that group norms modulate subjective preferences for food via basic reward processing mechanisms. In all, the present studies extend recent demonstrations that social influence can modulate preferences at both behavioral and neural levels. Furthermore, they reveal that social influence is powerful enough to affect food desirability. Future research should explore how interventions aimed at promoting healthy eating could harness the power of social norms.

### H-55

WHY CLARITY OF THE LOOKING-GLASS SELF **DEPENDS ON POPULARITY** Noam Zerubavel, Columbia University; Jochen Weber, Columbia University; Niall Bolger, Columbia University; Peter Bearman, Columbia University; Kevin Ochsner, Columbia University - Neural mechanisms linking social network position to accuracy of reflected self-appraisals It is entirely human to contemplate how others perceive us, but what factors explain individual differences in the accuracy of these reflected self-appraisals? We hypothesized that popular members of real-world social networks would more accurately understand how their peers perceived them, and that this relationship would be mediated by the efficiency of neural mechanisms underlying reflected self-appraisals. To test these predictions, we recruited two student organizations, each comprised of 13 well-acquainted group members. Utilizing a round-robin design, we obtained participants' predictions about how each of their group members would rate them on a series of traits and those group members' actual ratings. By correlating predicted and actual trait ratings, we computed each group member's reflected self-appraisal accuracy. We also utilized social network analysis to measure individuals' popularity. Confirming our first hypothesis, popularity

was positively correlated with accuracy of reflected selfappraisals. We then used functional magnetic resonance imaging to scan these same participants while they made reflected (other-about-you) and direct (you-about-you) self-appraisals. The other-about-you > you-about-you contrast identified brain regions uniquely recruited for reflected self-appraisals: middle temporal gyrus, precuneus, and temporo-parietal junction. Mediation analyses revealed that decreased activation in these brain regions during reflected self-appraisals fully mediated the link between popularity and reflected self-appraisal accuracy, suggesting that popular individuals' enhanced accuracy results from greater efficiency of neural mechanisms underlying reflected self-appraisals. More broadly, we provide a theoretical framework and experimental methodology for integrating functional neuroimaging with social network analysis to understand individual differences in neurocognitive processes and their interpersonal consequences.

## H-56

THE HEALTH IMPACT OF SOCIAL AND AFFECTIVE **NEUROSCIENCE: NIH'S POINT OF VIEW** *Janine M.* Simmons, National Institute of Mental Health SANS brings together scientists dedicated to studying the neural bases of affective and social processes. The National Institutes of Health (NIH) seeks to apply scientific findings to "enhance health, lengthen life, and reduce illness and disability." The goals of this presentation are to articulate how social and affective neuroscience fits within this NIH mission, how investigators can best utilize the expertise of NIH program officers to navigate the system, and how NIH can help foster the career development of rising social and affective neuroscientists. The presentation will focus on the National Institute of Mental Health (NIMH) and the potential for social and affective neuroscience to impact our understanding of mental health and our treatments for mental illness. I will discuss NIMH's commitment to support both basic and translational neuroscience, discuss gaps and opportunities for funding within the Affect, Social Behavior, & Social Cognition Program, and provide an introduction to NIMH's Research Domain Criteria (RDoC) project. The presentation will also include information regarding overlapping and distinct interests at several other NIH institutes, including the National Cancer Institute, National Institute on Aging, and National Institute of General Medical Sciences.

## FUNCTIONAL CONNECTIVITY OF SELF-PROTECTION: NEW INSIGHTS INTO THE ROLE OF MOFC IN MOTIVATED SELF-EVALUATIONS

Taru Flagan; Jennifer S. Beer; Department of Psychology, University of Texas at Austin, Austin, TX, USA - In contrast to research linking MPFC to self-evaluation, research now finds that medial orbitofrontal cortex (MOFC) is important for motivated self-evaluations such as selfevaluations that flatter the self. One puzzle is why MOFC shows different associations with flattering selfevaluations (Flagan & Beer, 2013). MOFC activity is consistently associated with flattering self-evaluations but sometimes activation is increased and other times it is decreased (e.g., Beer et al., 2003; 2006; Beer, Lombardo, & Bhanji, 2010; Beer & Hughes, 2010; Hughes & Beer, 2012; 2013). Flattering self-evaluations may arise because people want to protect self-esteem but they may also arise simply because people use incomplete information when evaluating themselves (e.g., Chambers & Windschitl, 2004; Taylor & Brown, 1988). Do the neural mechanisms of flattering self-evaluations depend on whether the evaluations are driven by self-protective mechanisms? To address this question, the functional connectivity of MOFC was examined in order to determine if the different associations between MOFC and flattering selfevaluations arise in predictable but distinct networks depending on whether they are used to protect selfesteem. Methods. Psychophysiological interaction (PPI) analyses were conducted on previously published datasets to investigate the functional connectivity of MOFC activation associated with (a) self-evaluations made in response to self-esteem threat (Hughes & Beer, 2012; 2013) and (b) self-evaluations made in the absence of threat (Beer & Hughes, 2010). Two of the datasets used the exact same measure of flattering self-evaluations but only one introduced the need for self-protection. The third dataset was included for comparison with the other two because of its precision in identifying the cognitive mechanism underlying self-evaluations that was associated with MOFC activation. This study combined Signal Detection Theory with fMRI and found that MOFC mediates the decision threshold for attributing things to the self (Hughes & Beer, 2012). MOFC seed regions were created as 5mm radius spheres around the peak found in group analyses of each dataset. PPI regressors were contrasted in a GLM and mixed effects analyses were performed for each dataset. Results. The analyses supported the prediction that MOFC activation underlying self-evaluations arises from different neural networks depending on whether the self-evaluations are used to achieve self-protection. When self-esteem is under attack, MOFC activation shows less positive covariation with middle frontal gyrus and more positive covariation with different regions of the striatum depending on whether self-protection requires flattery (e.g., caudate) or modesty (putamen). In contrast, functional connectivity of MOFC activation associated with self-evaluations that are flattering but not used for self-protection shows covariation with a completely distinct set of neural regions. Conclusions. Although people most often report flattering self-evaluations, the underlying neural systems differ depending on the motivation underlying the flattery. Functional connectivity between MOFC, striatum, and middle frontal gyrus may support selfevaluations used to protect self-esteem in the face of threat. Furthermore, functional connectivity between MOFC and striatal subregions may reflect whether a shift to a more conservative or liberal decision threshold for self-evaluations will be most rewarding in the presence of threat.

### H-58

## ETHICS OR EMPATHY? FOCUSING ON DIFFERENT MOTIVATIONS FOR ALTRUISM ACTIVATES DISTINCT COMPONENTS OF THE SOCIAL COGNITIVE NETWORK

Cendri Hutcherson, Division of Humanities and Social Sciences, Caltech; Antonio Rangel, Computational and Neural Systems & Division of Humanities and Social Sciences, Caltech - The psychological and neural mechanisms underlying generosity (sacrificing for others' benefit in the absence of strategic or selfish motives) remain poorly understood. Do people act generously because they care about conforming to social norms that promote generosity (i.e. ethics), because they care about others' happiness (i.e. empathy), or both? How does the brain represent these different considerations? To investigate the behavioral and neural correlates of ethical and empathic motives for generosity, participants made a series of choices about different monetary tradeoffs between themselves and an anonymous partner under three instructional conditions: respond naturally, focus on ethical/moral considerations, or focus on their partner's feelings. After completing the choice task, participants made two different subjective ratings of the choices they had seen in the choice task: 1) the ethical obligation to accept or reject each tradeoff, and 2) how their partner would feel if they accepted or rejected each tradeoff. These ratings allowed us to examine neural representations of the subjective perception of each attribute during choice. Behaviorally, focusing on ethical and empathic reasons for choice both increased generosity, with empathy instructions inducing significantly greater generosity overall. Neurally, we found distinct patterns of activation during each condition. Compared to natural response, focusing on ethics increased the correlation between behaviorally expressed preferences and regions of the dorsomedial prefrontal cortex and temporoparietal junction. In contrast, focusing on one's partner's feelings increased the representation of the partner's payoff in regions of the superior temporal gyrus and insula. The association between these same regions and subjective preferences also increased. Finally, instructions to focus on ethics or empathy both decreased neural evidence of conflict and self-control during generous behavior compared to natural response trials. Taken together, these findings suggest that generosity may result from a mixture of different motives, supported by computations in distinct brain regions. Moreover, although activation of either motive decreases the need for self-control to choose generously, empathic motives may be more effective

## H-59

#### NEURAL CORRELATES OF PERSPECTIVE TAKING IN EVALUATING SOCIAL INTERACTIONS

Sanda Dolcos, Yuta Katsumi, Gina Giase, Suhkyung Kim, & Florin Dolcos; University of Illinois at Urbana-Champaign -Effective social interactions require the ability to evaluate other people's actions and intentions, and subtle nonverbal cues conveyed through body language or physical touch, such as a handshake or a gentle touch on the shoulder, can play an important role in these evaluations. In everyday life people typically evaluate others' actions and intentions while directly engaged in social interactions, but also while watching social interactions between other people. Such evaluative judgments may be performed either from the own (ME) or another (OTHER) person's perspective. However, little is known about the impact of these perspectives on evaluative responses in social settings, and the associated neural correlates. In the present study, fMRI data were recorded while 20 participants (10 females) viewed and rated videos of guest-host interactions in a business setting, taking either the ME (for same-sex guest) or the OTHER (for other-sex guest) perspective. The host displayed behaviors that either encouraged (Approach condition) or discouraged (Avoid condition) further social interactions. Half of the trials were preceded by a handshake initiated by the host as part of the initial greeting. Watching social interactions from the ME perspective was associated with increased activity in a host of brain regions from the self-referential processing network, including prefrontal and temporal areas, insula, dorsal and ventral striatum, anterior cingulate, and the amygdala. Watching Approach interactions from the ME perspective was associated with increased activity in the superior frontal and parietal areas, while watching Avoid interactions was associated with increased activity in medial and lateral prefrontal areas and anterior cingulate. Moreover, watching social interactions preceded by Handshake from the ME perspective was associated with increased activity in the left amygdala and nucleus accumbens, suggesting a more positive evaluation of handshake from the ME than the OTHER perspective. Overall, these findings have relevance for understanding the neural correlates of perspective taking in social interactions, and for understanding alterations associated with clinical conditions in which interpretation of affective social clues is dysfunctional (e.g., autism and social phobia).

### H-60

**NEGATIVE MOOD DIMINISHES REAPPRAISAL SUCCESS** Seth Kallman, Noam Zerubavel, Kevin Ochsner; (All of the above are members of the Psychology Department at Columbia University) - The connection between negative affect and increased alcohol consumption has been well established both in popular culture and the scientific literature. This dysregulated behavior, sometimes referred to as 'drinking to cope,' might occur for several reasons. On one hand, negative affect may increase the bottom-up incentive salience of alcohol cues. Alternatively, it may decrease peoples' ability to exercise effective top-down self-regulation. To shed light on these possibilities, we had healthy college students view pictures of alcohol and rate their urge to drink the depicted beverages. They were asked to do this while either looking naturally or using cognitive reappraisal to reinterpret the stimuli in terms of their negative consequences. Critically, they made these judgments following either a neutral or a negative mood induction. This design allowed us to examine the effects of negative mood on natural responses, regulated and the difference responses, between them (operationalized as 'regulation success'). The results showed that participants were able to successfully use reappraisal to reduce their reported desire to drink the alcoholic beverages. However, there was a significant interaction with mood, such that regulation success significantly declined in the negative mood condition. Interestingly, the majority of participants held the metacognitive belief that the negative mood increased their ability to think of negative consequences. While this could have conceivably aided reappraisal, our results suggested otherwise. Overall, this study provides experimental evidence that negative affect can impair cognitive reappraisal.

### H-61

SWEET-CHEEKS VS. PEA-BRAIN: EMBODIMENT, VALENCE AND TASK ALL INFLUENCE THE TIME COURSE OF THE LPP IN EMOTIONAL LANGUAGE Benau, E.M. (1), Johnson, E.K. (1), Siakaluk, P. (2), O'Hare, A. (3), Gregerson, S. (1), Fennel, A. (1), Jamison, A (1). & Atchley, R.A (1).; University of Kansas, Lawrence, KS, USA; University of Northern British Columbia, Prince George, BC, Canada; University of Massachusetts Dartmouth, Dartmouth, MA, USA - Extant studies have established that, in healthy individuals, compliments are processed faster and more reliably than insults. However, it is not fully established what can enhance or hinder the processing of this information. Words that are embodied, or refer to the human body, have demonstrated more rapid and accurate processing than words that are unembodied, but these studies have been largely compared insults to neutral stimuli. The present study synthesizes and extends this research to examine the role of embodiment in insults, compliments, and neutral stimuli using event-related potentials (ERP). While electroencephalographic activity was recorded, undergraduate volunteers completed two tasks: one in which they determined if a visually presented word was an insult and one in which they determined if a presented word was a compliment. Our ERP analyses focused on the late positive potential (LPP) component. Consistent with past research, we trisected the LPP into an early (400-500ms), middle (500-600ms), and late (600-700ms) component, and then ran a 2 (task) X 3 (time window) X 3 (stimulus type) X 2 (embodiment) ANOVA. The results showed that compliments and insults generated a significantly larger LPP than neutral stimuli, indicating a reliable LPP response was elicited. There was both a time window X stimulus type and a time window X embodiment interaction such that, in the

early time window only, compliments generated larger LPPs than insults and embodied words generated a larger LPP than unembodied words. Finally, there was a significant time window X stimulus type X task interaction. In the compliment detection task, the LPP for compliments was significantly larger than the LPP for insults in the early time window but did not differ from insults in the middle or late time windows; the LPP to neutral stimuli remained significantly smaller in each time window. This was not entirely consistent in the insult detection task: the LPP to compliments generated a significantly larger LPP in the early time window, but did not differ from insults in the middle window, and were significantly smaller than the LPP to insults in the late time window. Concurrently, neutral stimuli did not differ from insults in the early time window, were smaller than both insults and neutral stimuli in the middle time window, and did not differ from compliments in the late time window. In sum, when insults were the target of focus for the experiment, they generated a larger LPP later while compliments generated larger LPPs in the early time window regardless of task; compliments were processed faster and more reliably than insults as were embodied words compared to unembodied words. The present findings indicate that the time course for processing compliments and insults may be influenced by task instruction, but it is not yet clear why or how. Further research is needed to better understand the function of the time course of the LPP, the processing of insults and compliments, and what role embodiment may play in both.

### H-62

AFFIRMING CORE VALUES PREVENTS OVER-CLAIMING SELF-KNOWLEDGE John Lurquin -University of Colorado Boulder; Laura Shiley - University of Colorado Boulder; Joanna K. Hubbard - University of Colorado Boulder - When we receive a threat to our self-esteem, we respond in various ways. One way we appear to bolster our self-esteem is by claiming and believing we possess knowledge that we do not. In the current research we measured this over-claiming bias after participants received bogus negative feedback about their intelligence. Results show that working memory capacity predicts this over-claiming tendency such that those with low working memory capacities over-claimed more following the negative feedback. This was especially true for participants who experienced negative mood from the feedback. However, these patterns did not occur among participants who were exposed to a self-affirmation intervention prior to the bogus intelligence feedback. These participants were asked to affirm two core values by choosing from a list which were most important to them (e.g., relationships with family) and writing about them for five minutes. In past research, this intervention has protected participants from gender and racial stereotype threat. In the current study, we show that affirming core values can protect participants from threats to their self-esteem that typically lead to negative mood and over-claiming self-knowledge

### H-63

PREDICTION ERROR **GOVERNS** PHARMACOLOGICALLY INDUCED AMNESIA FOR LEARNED FEAR Dieuwke Sevenster 1, Tom Beckers 1,2, Merel Kindt 1; 1 University of Amsterdam, 2 University of Leuven - Retrieval of a consolidated memory returns it to a plastic state, during which the memory is prone to modification. This process of reconsolidation does not necessarily occur when a memory is reactivated. Recently, it has been proposed that reconsolidation is triggered only when learning takes place, in order to integrate new information in the initial memory presentation (memory updating). According to general associative learning models, learning takes place when there is a discrepancy between actual and expected events (prediction error; PE). Even though it has frequently been suggested, there is no experimental evidence that PE is a necessary condition for reconsolidation. So far, PE could only be inferred from effective reconsolidation without an independent assessment of PE driven learning. In a human fear conditioning paradigm we investigated the role of PE in reconsolidation. Fear acquisition took place on day 1, memory reactivation followed by propranolol (40 mg) administration on day 2, and extinction learning and reinstatement test on day 3. PE was assessed by means of a change in threat expectancy ratings, while fear expression was measured with the fear-potentiated startle. Reinforcement schedules of acquisition and reactivation were manipulated such that reactivation resulted in a negative PE (omission of a predicted reinforcement), no PE, or a positive PE (unpredicted reinforcement). Propranolol eliminated the startle fear response 24 h after reactivation only when either a Negative PE or a Positive PE was present during memory retrieval. PE serves as a marker of memory destabilization, independent from the process of reconsolidation itself.

### H-64

A TRAIT AND AGENT MEMORY CODE IS REPRESENTED IN THE MEDIAL PREFRONTAL **CORTEX** Frank Van Overwalle, Ning Ma, Elien Heleven, Laurens Van Der Cruyssen - Vrije Universiteit Brussel - The medial Prefrontal Cortex (mPFC) is critically involved in inference about the traits of the self and others. We investigated whether the mPFC also represents the neural code for traits and the agents (or social groups) that possess these traits. To localize these codes, we used fMRI-adaptation, which is a rapid suppression of neuronal responses upon repeated presentation of the same underlying stimulus, in this case, the implied trait or agent. Participants had to infer an agent's trait from brief trait-implying behavioral descriptions. In each trial, the critical (target) sentence was preceded by a sentence (prime) that implied the same trait or no trait at all, and which involved the same agent or not. The results revealed robust adaptation in the ventral mPFC only. More importantly, the mPFC areas representing the memory code of agents and traits were adjacent to each other, but did not overlap. An additional fMRI study further demonstrated that this trait code was independent

from valence, as positively and negatively valenced object descriptions did not show this adaptation pattern.

#### H-65

IMAGINING EMOTIONAL AN **FUTURE:** AMYGDALA LESIONS IMPAIR AFFECTIVE **PROSPECTION** Elizabeth Race (VA Boston Healthcare System and Boston University School of Medicine); Margaret Keane (Wellesley College and VA Boston Healthcare System); Mieke Verfaellie (VA Boston Healthcare System and Boston University School of Medicine) - Many imagined events have emotional content and elicit emotional responses. Despite the centrality of emotion to prospection, limited work has examined how emotion is integrated into simulations of the future or what neural mechanisms support affective prospection. One possibility is that the amygdala supports emotional aspects of prospection in a similar manner as it supports emotional aspects of memory. Indeed, a recent neuroimaging study reported amygdala activity when participants imagined positive future events (Sharot et al., 2007). In the current study, we adopt a lesion-deficit approach to test the hypothesis that the amygdala plays a critical role in affective prospection. We first re-analyzed data collected in a recent future-thinking study by Race et al. (2012) to examine the ability of amnesic patients with medial temporal lobe (MTL) damage that either included the amygdala or spared the amygdala to produce detailed descriptions of past and future events (e.g., a visit from a close friend). The richness of patients' descriptions was measured using an objective scoring of the number and nature of narrative details. Patients with amygdala damage produced fewer emotional details when projecting themselves into the future and the past compared to amnesic patients without amygdala damage, even though both groups produced similar numbers of non-emotional details. We then examined whether the amygdala is particularly important for imagining emotionally-charged scenarios (e.g., winning the lottery) by examining the ability of the two patients groups to describe positive events situated in the future and the past. Patients with amygdala damage produced sparser descriptions of positive past and future events compared to patients without amygdala damage, and their descriptions contained fewer emotional and nonemotional details. These results suggest that the amygdala plays a critical role in the emotional aspects of mental simulation.

H-66	
11-00	

ON THE NEURAL PROCESSES INSTANTIATED BY INGROUP-ASSOCIATED PRODUCT MARKETING: THE CASE OF ALCOHOL ADVERTISING Chris Loersch, University of Colorado; Tiffany A. Ito, University of Colorado; Bruce D. Bartholow, University of Missouri - One prevalent marketing strategy is to create a "brand community" in which a product's consumers feel as

though they form a cohesive group with the product's manufacturer and the other individuals who use the brand. Because of the efficacy of this strategy, many companies actively work to associate their products with existing social groups, attempting to join the group and "convince" its members that it is normative for them to use and enjoy the product. Although prevalent across companies and product types, this strategy may present a number of problems when used by alcohol manufactures. In the current studies, we utilized event-related brain potentials (ERPs) to examine the underlying attentional processes instantiated by this marketing strategy and their relation to real-world drinking behavior. ERPs were measured during an oddball task (using beer, water, ingroup, and outgroup-related images as the oddballs) and recent drinking behavior was assessed both at this initial experimental session and one-month later during an online follow-up. Using ERPs, we obtained both deliberate (P3) and spontaneous (N1) measures of attentional processing. Across studies, we found that participants' neural responses to alcohol (P3) and ingroup-associated alcohol (N1) were related to past drinking behavior. Strikingly, these attentional biases were also able to predict drinking behavior one month later; and could account for the change in drinking that occurred between the lab session and the one-month follow-up. Together, these studies demonstrate that associating alcohol with an important ingroup instantiates a variety of attentional biases. In combination with our previous behavioral work, this suggests that the advertised product takes on many of the characteristics of the ingroup, changing alcohol-related attitudes and beliefs and automatically attracting heightened attentional processing. Although innocuous for some products, these effects have a number of disturbing ramifications for dangerous products like alcohol.